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THE JOURNAL OF MENTAL SCIENCE

(THE BRITISH JOURNAL OF PSYCHIATRY)



BY AUTHORITY OF
THE ROYAL MEDICO-PSYCHOLOGICAL ASSOCIATION

EDITOR-IN-CHIEF
G. W. T. H. FLEMING

CO-EDITORS
Alexander Walk and P. K. McCowan

AND WITH THE ASSISTANCE OF

Sir E. D. Adrian	E. G. Holmes
F. C. Bartlett	C. J. McCarthy
S. M. Coleman	Alfred Meyer
C. J. C. Earl	Lionel S. Penrose
Sir A. Fleming	A. A. W. Petrie
F. L. Golla	E. T. O. Slater
W. Stephenson	

VOL. XCII

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" In adopting our title of the *Journal of Mental Science*, published by authority of the *Medico-Psychological Association*, we profess that we cultivate in our pages mental science of a particular kind, namely, such mental science as appertains to medical men who are engaged in the treatment of the insane. But it has been objected that the term mental science is inapplicable, and that the term mental physiology or mental pathology, or psychology, or psychiatry (a term much affected by our German brethren), would have been more correct and appropriate ; and that, moreover, we do not deal in mental science, which is properly the sphere of the aspiring metaphysical intellect. If mental science is strictly synonymous with metaphysics, these objections are certainly valid ; for although we do not eschew metaphysical discussion, the aim of this JOURNAL is certainly bent upon more attainable objects than the pursuit of those recondite inquiries which have occupied the most ambitious intellects from the time of Plato to the present, with so much labour and so little result. But while we admit that metaphysics may be called one department of mental science, we maintain that mental physiology and mental pathology are also mental science under a different aspect. While metaphysics may be called speculative mental science, mental physiology and pathology, with their vast range of inquiry into insanity, education, crime, and all things which tend to preserve mental health, or to produce mental disease, are not less questions of mental science in its practical, that is in its sociological point of view. If it were not unjust to high mathematics to compare it in any way with abstruse metaphysics, it would illustrate our meaning to say that our practical mental science would fairly bear the same relation to the mental science of the metaphysicians as applied mathematics bears to the pure science. In both instances the aim of the pure science is the attainment of abstract truth ; its utility, however, frequently going no further than to serve as a gymnasium for the intellect. In both instances the mixed science aims at, and, to a certain extent, attains immediate practical results of the greatest utility to the welfare of mankind ; we therefore maintain that our JOURNAL is not inaptly called the *Journal of Mental Science*, although the science may only attempt to deal with sociological and medical inquiries, relating either to the preservation of the health of the mind or to the amelioration or cure of its diseases ; and although not soaring to the height of abstruse metaphysics, we only aim at such metaphysical knowledge as may be available to our purposes, as the mechanician uses the formularies of mathematics. This is our view of the kind of mental science which physicians engaged in the grave responsibility of caring for the mental health of their fellow-men may, in all modesty, pretend to cultivate ; and while we cannot doubt that all additions to our certain knowledge in the speculative department of the science will be great gain, the necessities of duty and of danger must ever compel us to pursue that knowledge which is to be obtained in the practical departments of science with the earnestness of real workmen. The captain of a ship would be none the worse for being well acquainted with the higher branches of astronomical science, but it is the practical part of that science as it is applicable to navigation which he is compelled to study."—*Sir J. C. Bucknill, M.D., F.R.S. (Journ. Ment. Sci., vol. vii, 1861, p. 137).*

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(THE BRITISH JOURNAL OF PSYCHIATRY)

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LATE EFFECTS OF CLOSED HEAD INJURIES: PSYCHIATRIC
OBSERVATIONS.*

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By E. GUTTMANN, M.D. Munich.

From the Maudsley Hospital, Denmark Hill, S.E. 5.

IN discussing the late stage of head injuries, it is necessary first to define the clinical stages in the treatment of these conditions. With Donald Munroe, it is considered expedient to classify cases of head injury in general into—

(a) Operative and (b) Non-operative cases.

This distinction is more important in the first, or acute, stage than later, but the differences in treatment, nursing, location within the hospital, and disposal, are often reflected in the later stages, and should, therefore, not be forgotten when considering the chronic stage. It is suggested that the acute stage should be defined as follows :

(a1) In operative cases, from the injury to the conclusion of the local surgical treatment.

(b1) In non-operative cases, from the injury to the disappearance of the initial disturbance of consciousness.

The former group will include all " open " injuries, such as gunshot wounds and compound fractures, the latter group most cases of closed injury ; but closed injuries remain surgical risks as long as their consciousness is impaired. The patient in this stage will, therefore, be the responsibility of the surgeon.

The second, or subacute stage, begins at the conclusion of the first. In the operative cases, the end of the second, subacute or convalescent stage is difficult to define generally, since the amount of cerebral damage, condition of the wound, and often concomitant injuries or infections, cause wide variation in the course of recovery. Cases in this stage will still be the surgeon's responsibility, even

* Paper read before the Clinical Psychiatry Sub-Committee of the Royal Medico-Psychological Association.

if their treatment or rehabilitation will not differ much from closed injuries. I do not consider it practicable to define the second stage in those cases other than—

(a2)—the discharge from hospital.

In the non-operative cases a more exact definition can be given, based on the severity of the injury. Discharge from hospital is no suitable criterion, since many of these cases are discharged from hospital while still convalescent.

From the study of Cairns and others* a fair estimate of the expected time of recovery can be made. It is therefore suggested that the end of the second stage should be assumed—

- | | |
|--|-----------------------------|
| (b2) A. In mild cases | 1 month after injury. |
| B. In moderately severe cases | 2 months " " |
| C. In severe cases | 3 " " " |
| D. In exceptionally severe cases | 4 to 5 months after injury. |

The late, or chronic stage begins at the conclusion of the second stage, as just defined.

ASSESSMENT OF SEVERITY.

In this clinical classification the assessment of the severity of the injury is of primary importance and, therefore, some agreement should be reached on the assessment of the severity of (non-operative) head injuries. It is common usage, medical and lay, to describe the severity of an injury in terms of the duration of unconsciousness, but everybody who has experience in taking histories from cases of head injury or studying clinical records will agree that this method is unsatisfactory. Assessment of consciousness is difficult, in particular if one includes states of disturbed consciousness. The recovery of consciousness is rarely observed and recorded accurately. The difficulties increase if one has to assess the clinical state in retrospect. One of the characteristics of disturbed consciousness is the amnesia it leaves behind, and Ritchie Russell was the first to draw the conclusion—which now seems so obvious—that this psychological symptom might be employed as indicator of the severity of "concussion," i.e. of such head injuries which caused un-

* Cairns expected, in Service patients, return to duty in cases with—

Post-traumatic amnesia of 5 mins. to 1 hour after	4-6 weeks.
" " of 1 to 24 hours	" 6-8 "
" " of 1 to 7 days	" 2-4 months.
" " of over 7 days	" 4-8 "

Guttman found, in civilians, absence from work, in the average, in cases with—

Post-traumatic amnesia of up to 1 hour	4.5 weeks (± 2.08).
" " " 1 day	5.6 " (± 2.46).
" " " 7 days	8.85 " (± 5.34).
" " of over 7 "	13.75 " (± 4.65).

Botterell and Wilson, in soldier patients actively treated, found the average time off duty in cases with—

Post-traumatic amnesia of up to 24 hours	36 days.
" " of 1 to 7 days	54 "
" " over 7 days	59 "

consciousness (or, in mild cases, a disturbance of consciousness). His example has been followed widely since and its usefulness has been proved in many investigations, predominantly in those which were concerned with large numbers of cases where statistical treatment permitted one to disregard minor fallacies. Like all psychological methods, this has its fallacies, with which the investigator has to be familiar, and in this psychiatric analysis it may be worth while considering these in more detail.

A common mistake is to attempt to assess the traumatic amnesia (both retrograde and post-traumatic) too early, or, to describe the same mistake from another angle, not to distinguish clearly between the assessment of disturbed consciousness and its signs and that of amnesia. Amnesia is a gap in the patient's past memory which cannot be properly assessed while he is in a state of disturbed consciousness in which his grasp, his recall, his thinking are still impaired. If one keeps this common psychiatric definition in mind, many pseudo-problems, such as the study of extremely long amnesias, simply vanish. Some general psychiatric considerations also simplify the problem of the "lucid interval." We know that states of clouded consciousness do not leave behind a complete amnesia, but patchy recollections, nor does it surprise us to hear that a patient in a state of clouded consciousness can carry out simple actions without appearing grossly disturbed to others.

J. P.—, aged 25, a corporal in the R.A.F., was knocked down by a vehicle when cycling during the blackout. Found by the police. Got up and walked with them to the police station, waited there, sitting, until an ambulance arrived to take him to hospital. He was kept there for ten days. His injury was obviously considered trivial, and he was returned to duty (as switch-board operator) without any rehabilitation. He developed headaches, nightmares, and noticed a falling off in his work owing to poor concentration.

After admission here he gave a consistent story. He could describe the spot on the road (well known to him) where the accident happened; his last recollection was hearing the lorry; his first recollection after the accident was waking up in the hospital and asking for place and time. His post-traumatic amnesia was seven hours, and the injury obviously not as trivial as it appeared from an estimate of the initial, complete unconsciousness.

Whereas these difficulties are avoidable by using a correct technique of examination and assessment, drug medication during the acute stage falsifies the clinical picture, and makes the amnesia unsuitable as a measure of the severity of the injury. An anaesthetic may have been given in non-operative head injuries, where concomitant injuries required surgical treatment. Morphine is still too often given to any case of "shock" or surgical injury, disregarding the cerebral condition. There is finally alcoholic intoxication to be mentioned, which tends to prolong the disturbance of consciousness and the subsequent amnesia. Hysterical manifestations may complicate the picture; it is not uncommon to find minor abrasions or other signs of head injury in patients admitted in hysterical twilight states. Hypno-narcosis makes it often possible to demonstrate the hysterical nature of the disturbance, but failure to remove the disturbance of consciousness at the time, or the amnesia subsequently, does not prove the organic nature of the condition. A patient may conceal his real experiences or inhibitions, even under sodium amytal. One also meets falsifications of memory, conscious or unconscious,

when assessing amnesias, but on the whole, histories taken by different people at different stages, but employing the same technique and conventions, are remarkably consistent. This is probably due to the fact that the patient, once he has verbalized his experiences, remembers the verbal formula rather than the actual experience of driving, waking up, etc. Real difficulties arise only when the patient has no real "landmarks" by which to determine the beginning and the end of his amnesia.

CLASSIFICATION OF CHRONIC STAGE.

I propose to classify the signs and symptoms of the chronic stage into five syndromes, which may occur separately or combined. These syndromes are :

I. *Largely objective : Defect conditions.*

- (i) Sensory-motor defects, peripheral or central.
- (ii) Ideo-motor defects (e.g. aphasia, vestibular disturbance).
- (iii) Disturbance of intellectual efficiency (memory, concentration, fluency).
Impairment of reasoning (intelligence in the strict sense of the word).
Change of character (i.e. emotional and volitional disposition).

II. *The Epileptic syndrome.*

Minor, major fits, twilight states, deterioration, fugues, automatism.

III. *Largely subjective.*

The post-concussional or post-contusional syndrome in the strict sense, headaches, giddiness, fatigue, insomnia, irritability, disturbed memory and concentration.

IV. *Psychogenic reactions.*

V. *Precipitated psychoses (of endogenous type).*

The following paper, which is based on experiences in a Neurosis Centre, will not deal with defect conditions. It will attempt to show that the "subjective syndrome" and psychogenic reactions are hard, if not impossible, to distinguish, since the physiological and psychological factors causing them are inextricably mixed, and that there is not much point in keeping them separate.

The literature was recently reviewed by H. H. Merritt and E. Guttmann, and I will only quote a few recent investigations into the frequency and causation of the chronic after-effects. All increase in our knowledge is due to follow-up examinations of unselected head injuries (as opposed to studies of patients who come under observation and treatment on account of chronic symptoms). The latter obviously present a selection of cases with poor outcome, and the clinical impression based on such cases has largely (and unduly) influenced the popular picture of the late effects of head injuries.

FREQUENCY OF LATE STAGE.

C. P. Symonds and W. Ritchie Russell published their observations on 242 consecutive cases of acute head injuries in Service personnel, all accidental, i.e. not due to gunshot wounds and similar war injuries. Five patients died ;

of the remainder, 91 per cent. were returned to duty. A follow-up showed that a further 11 per cent. were invalidated later. Thus 80 per cent. became fit for military duties, though not necessarily free from symptoms.

E. Guttmann studied an unselected group of civilian head injuries in the acute stage, and kept them under out-patient observation for at least six months after discharge. The time of recovery in his cases, as well as those of Symonds and Russell, showed a close relationship to the duration of the amnesia and was below the figures suggested above (see footnote, p. 2).

A special study of headaches, the most frequent subjective symptom, showed that, with short treatment and active rehabilitation, nearly 80 per cent. of the patients could be discharged free from headaches (and other symptoms), and this rate was the same after six months, though, shortly after discharge, the frequency of symptoms increased up to 40 per cent. Cases with short amnesia suffered more frequently from headaches than severer cases. Denny-Brown and a team of collaborators investigated a consecutive series of 430 cases of head injuries admitted to Boston City Hospital, but by excluding patients under 15 and over 55, and alcoholics and vagrants, the group was reduced to 200. 110 patients (55 per cent.) complained of symptoms in convalescence, headache and giddiness being the most frequent. The typical "post-concussional syndrome" occurred in 30 patients only.

Of the whole group, 138 complained of headache at some stage. In 59 patients the headache did not persist beyond the hospital stay. In 63 patients it lasted longer than two months, and in 11 cases the headache only started after discharge from hospital.

All the evidence goes to show that a considerable proportion of cases with head injury (between 40 per cent. and 50 per cent.) never suffer from headache; that out of those who develop headaches, a considerable proportion lose them during the convalescent period, so that only a small proportion enters a chronic stage. From the data quoted, this proportion can be estimated at between 20 per cent. and 30 per cent.

The following small investigation confirms the infrequency of post-traumatic headache, in particular when seen against the background of the "normal" occurrence of headaches:

At the Officers' Board of the N.F.S. a health questionnaire was a part of the routine procedure, in which the following questions were included:

What accidents did you have (a) up to the age of 14?
(b) after the age of 14?

If you were unconscious, state for how long.

Describe the after-effects, if any.

And, in another context:

Are you subject to headaches?

The analysis of 550 questionnaires yielded the following table:

	Head Injury.	Yes.	No.
Headaches	Yes	5	70
	No	10	465
$\chi^2 = 4.930.$ P between .05 and .01. $Y = .29 \pm .129.$			

In other words the occurrence of headaches in men with head injuries in their history is only just significantly higher than in those who never had a head injury. One of the head injuries included was a trivial fall at the age of five; another one a cycle accident with unconsciousness of ten minutes at the age of twelve. If one excludes these obviously trivial cases, one arrives again at a frequency of 20 per cent. similar to the frequency estimated before.

AETIOLOGY OF CHRONIC STAGE.

Our views on the aetiology of the post-concussional symptoms have changed gradually during the last few years. Before that there were two schools of thought, the organic and the psychological, but recently the psychiatric approach has conquered even the strictest neurologist, so that they speak about aetiological factors of various description rather than of one cause or one pathology. When reviewing the evidence one has to distinguish again between investigations which were based on consecutive admissions or unselected samples, and those which are based on the examination of bad risks.

In my analysis of 300 unselected cases of civilian head injuries, I came to the conclusion that in most cases which complained of headaches six months after the injury, the symptom was either precipitated by psychological causes, or the patient's attitude towards it was determined by such factors. Denny-Brown in his survey of admissions to the Boston City Hospital summarized his findings :

The symptoms associated with prolonged disability, whether the injury had been severe or mild, were predominantly anxiety symptoms. Intellectual disorder played no significant part. Environmental factors of the injury were in total effect more important in accounting for disability than were the factors indicative of the severity of injury, and psychiatric factors indicate the possibility for lessening disability by psychiatric treatment.

This association between head injury and psychiatric factors was analysed in some detail by the same team of workers. As regards the post-traumatic headache, they were able to demonstrate the high incidence of prolonged headaches among those patients who were considered to have been nervous or neurotic prior to the accident, among those with complicating environmental factors (including compensation) likely to produce emotional stress, and among those with symptoms of a marked immediate emotional reaction to injury.

These relationships, the authors conclude, suggest the importance of both psychological and physical factors in the production of prolonged post-traumatic headaches in the majority of cases. Even with headaches localized to the region of known damage to scalp or skull, psychological factors had high correlation.

With regard to dizziness, they found that dizziness for longer than two months was characteristically associated with pre-traumatic nervousness, complicating environmental factors during convalescence and, to a lesser degree, with immediate abnormal emotional reaction to injury. These relationships point to the importance of psychological factors in the production or continuation of post-traumatic dizziness.

As mentioned before, all these conclusions are based on the investigations of *unselected* cases of head injuries. Investigations of *selected* cases tend to confirm the picture. Symonds and Russell, in the investigation quoted, also investigated chronic cases, i.e. cases transferred to the head injury centre at a late stage, because their progress was unsatisfactory. Their analysis showed that the invaliding rate in the severe cases (P.T.A. more than seven days) was the same as in the acute cases, but that the percentages invalided in the groups with shorter P.T.A. was in each instance much higher for the chronic than the acute cases. They therefore sought factors other than the severity of the injury to determine the prognosis, and they found the predisposition to mental disorder of decisive importance.

The invaliding rate of those who showed signs of mental instability in their personal history, or a family history of serious mental disorder, was twice as high as that of those who showed no such history. On the other hand, the recovery rate of flying personnel was much higher, and the authors suggest that the main reason for this good prognosis was that they are a highly selected group in respect of absence of predisposition to mental disorder.

COMPARISON BETWEEN THE CHRONIC STAGE OF HEAD INJURY AND COMMON NEUROSES.

We can now finally compare the clinical picture of chronic after-effects of head injury with that of common neurotic states. A. J. Lewis was the first to carry out such an investigation. He matched 64 post-traumatic neurotic patients with an equal number of other neurotics.

The points at which the two groups differed significantly (i.e. statistically so) were remarkably few: More men in the control group were discharged Category E; had as adults shown signs of predisposition to mental disturbance; had been unsociable, weak and dependent, lacking in initiative, over-anxious, hypochondriacal or obsessional. More of them complained of pain (apart from headache) and of anxiety symptoms, whereas the head injury cases included, as would be expected, more people who had been of stable, well-organized personality before their illness, and severe headache. Fainting and irritability were commoner among them. But the differences in these respects were only on the margin of statistical significance, and it was evident that the head injury series was made upon very much the same sort of people (in family and personal history, intelligence, symptoms, response to treatment, and outcome) as the non-organic group.

I made similar investigations in a somewhat larger material; 350 cases (all male Forces patients)* were collected, in which a head injury, mild or

* All the cases admitted to Mill Hill had been seen by psychiatrists, and many by neurologists before admission, and were sent there, as a rule, only "if no organic causes for their complaints had been found." A few cases in which this statement was proved not to be correct were excluded from this study. They included two patients who, two or three months after a severe head injury, were still in Korsakoff states, a man whose mental symptoms following operation on a post-traumatic abscess were considered largely organic and indicated re-operation, two epileptics, and some cases of localized cerebral injury sent for rehabilitation to Mill Hill on special grounds.

severe, was considered part of the illness for which they were admitted to Mill Hill, and I compared them with 700 cases (used by Eysenck in his study of "Types of Personality") which had no history of head injury, organic illness or other complications, and with an analysis of 5,300 unselected male service neurotics. The data were taken from the statistical cards which are kept for every patient at Mill Hill. The following points were compared :

Social Data.

There was no significant difference in age or marital state between the head injury and the control group ; in the distribution of skilled and unskilled occupations ; in the frequency of job changes ; in the amount of unemployment.

History.

A family history of psychosis, neurosis, or psychopathy was insignificantly less frequent among the head injuries (53.5 per cent.) than in the control group (56.4 per cent.) (C.R. 1.05). An unsatisfactory home atmosphere was less frequent in the head injuries (23.7 per cent.) than in the controls (32.3 per cent.) (C.R. 2.9). A history of mental breakdowns or neurotic symptoms clearly indicating predisposition was less frequent in head injuries (53.6 per cent.) than in the controls (65.3 per cent.) (C.R. 4.3).

Personality.

The head injuries are insignificantly less intelligent than the controls ; they are significantly less unstable, less dependent, less inert, less cyclothymic, and less hypochondriacal ; they are insignificantly less schizoid, and show no difference in obsessional traits.

Symptoms.

Headaches are more frequent among the head injuries (83 per cent.) than in the controls (60.1 per cent.) (C.R. 10.8). More frequent are also irritability, apathy and fainting attacks ($P < .01$).

Less frequent are anxiety, somatic anxiety, depression, dyspepsia, sexual anomalies (including impotence), pain (other than headache), and hysterical conversion symptoms.

Aetiology.

Among the chief psychological factors the stress of exposure to bombardment, etc., was equally frequent in head injuries and in the controls ; the same is true of the stress of domestic problems ; whereas the stress of wartime separation and regimentation was significantly less among the head injuries than among the controls ($P < .01$).

Outcome.

The invaliding-out rate of the head injuries (51.4 per cent.) was insignificantly lower than in the controls (54.2 per cent.) (C.R. 1.0).

The following table compares the subsequent history of the men returned to duty with that of 1,124 control cases :

	Invalided out during first 3 months.	Next 3 months.	Next 6 months.	Within 12 months of discharge.	During second year after discharge.
170 head injuries	14	23	13	50	12
1,124 controls	123	79	109	311	107

In other words, the invaliding-out rate of the head injuries during the first year after return to duty is insignificantly higher than that of the controls, so that the total result can be considered much the same in both groups.

There is no doubt that these results could be further improved by intensified individual treatment.

On the first 50 consecutive admissions treated by myself at Mill Hill, 32 were returned to duty, 17 invalided, and 1 (an acute case) was transferred to another hospital and subsequently invalided. Three of those returned to duty could not be followed up. Of the remaining 29, the following numbers were ascertained as still giving satisfactory service :

At the end of 3 months	28
" " 6 " 	24
" " 12 " 	18
" " 24 " 	8

The losses include not only those invalided out subsequently, but also those not accessible after an increasingly long period of service with the usual drafting overseas and postings from unit to unit.

When conclusions are drawn from the comparisons of history and clinical picture, allowance must be made for the possibility that the physician in charge, concentrating his attention on the head injury, may not have recorded other factors with the same impartiality and completeness as in the control cases, but even with such an allowance, some of the differences are too marked to be disregarded. They tend to show that the post-concussional group has less predisposition expressed in home atmosphere, personal history and marked character traits than the controls and less environmental (domestic) stress, but shows the same outcome; the head injury balances the relationship between stress and predisposition. A similar relationship is demonstrable in the symptomatology. The frequency of headaches and irritability is counter-balanced by an infrequency of other neurotic symptoms. Most surprising is, perhaps, the frequency of fainting and apathy as symptoms. Most of the cases of fainting had EEGs done, and none showed characteristically epileptic tracings. Apathy might deserve closer investigation in regard to its possible organic origin; it may be one of those organic symptoms which we are not very efficient yet in diagnosing in its mildest manifestations.

Symonds and Ritchie Russell observed that in their group of "chronic" cases the prognosis depended on constitutional factors rather than on the duration of the post-traumatic amnesia.

In my own cases exact data about the amnesia were available in 136 cases; 59 cases were classified as mild (P.T.A. up to one hour), 43 as moderate (P.T.A. up to 24 hours) and 34 as severe (P.T.A. on 24 hours), and these groups were compared with each other on all the points mentioned before. None of these comparisons, of which some examples are given in Table I, yielded statistically significant differences; only the age distribution showed some accumulation of older patients among the severe group (P. just above .05). This would

TABLE I.

	Mild.	Moderate.	Severe.	Chi square.	P.
Age above 30	20	15	20	5·89	·10-·05
Positive family history	28	18	21	2·76	·3-·2
Positive personal history	25	14	19	4·15	·2-·1
Irritability	23	15	18	2·78	·3-·2
Fainting	6	8	8	2·90	·3-·2
Somatic anxiety	20	19	16	1·99	·5-·3
Lack of drive	13	3	5	4·84	·1-·05
Bombardment among main causes	6	10	8	3·34	·3-·2
Invalided	25	18	16	·2	·7-·5
Totals	59	43	34		

confirm that, in these chronic post-concussional states, the duration of amnesia loses its prognostic value, but the comparison fails to demonstrate any factor showing an inverse relationship to the severity, and thus likely to account for the equal prognosis in mild and severe injuries. To elucidate the point further, 151 cases returned to duty were compared with 142 discharged from the army, with regard to various aetiological factors.

As will be seen from Table II, most of the differences are negligible, and only the differences in family history are statistically significant ($P < \cdot 01$).

TABLE II.

	R.T.U.	Cat. E.
Positive family history	105	73
Positive personal history	80	77
Stress of bombardment	30	34
Stress of separation and regimentation	79	78
Stress of unsuitable work	36	25
Stress of domestic difficulties	44	36
Totals	151	142

It is most surprising to note that the positive family history seems to have a favourable effect on the outcome; I do not think it is possible to give a definite interpretation to this observation. It may be equally surprising that personal history of neurosis or of marked neurotic traits shows no demonstrable effect on the outcome. However, if one singles out the severe cases, one finds a slightly, though not significantly, worse prognosis in cases with a positive family history.

TABLE III.—Severe Cases.

	R.T.U.	Cat. E.
Positive family history	8	11
Negative family history	10	5

χ^2 (corr.) 2·05. P between.

Another aspect may be worthy of comparison, viz. intelligence. Using the Matrices tests, the occurrence of intelligence below the average does not differ significantly from chance in the mild, moderate, and severe groups. In 172 (more recently admitted) cases the Mill Hill vocabulary test was also employed. The results are tabulated on p. 12. They show that in more cases the Matrices score was higher than the Vocabulary group than vice versa. Although the procedure is not sufficiently refined, the distribution certainly does not point to an intellectual deterioration in the group (which would lead to a higher score in the Vocabulary, as compared with the reasoning test). A random sample of 256 non-head injury cases was equally tabulated, and the differences between the two shows that a superior Matrices score is more frequent among the head injuries than among the controls.

CONTRIBUTORY FACTORS.

It has been mentioned before that these late cases of post-concussional states show no demonstrable neurological signs, or, where they show any, they do not account for the clinical picture, as shown by the fact that the vast majority of equally injured patients do not develop these chronic symptoms. The same is true for psychological signs of organic kind.* They are rarely found; they are hardly discriminative, and, again, where they are demonstrable, they can be considered only as one contributory factor. Even if we admit hypothetical structural changes to account for an alteration of reaction type and threshold of response, and if we allow for a constitutional predisposition (demonstrated in Symonds' and Russell's material), we have to look for those additional factors which precipitate and maintain these chronic pictures. There is little doubt, even among diehard neurologists, that these factors are environmental, social and psychological. Moreover, it is agreed that these factors are the important ones, since they are modifiable, i.e. susceptible to treatment.

This aetiological pattern is not very different from that seen in the common neuroses, and the more the psychological factors are important in a late post-concussional state, the more it will approximate the clinical picture of a neurosis. The material sent to a neurosis centre (like Mill Hill) was obviously a selected one; the more psychogenic features a man showed, the greater was his chance of being sent there rather than to a head injury centre.

Calling these states neuroses for short, my clinical material can be classified into:

- (1) Accident neuroses.
- (2) Incidental neuroses.

Needless to say, many cases are mixed. The two main classes may be subdivided into any number of types according to the predominant causative mechanism; very often several factors are of equal importance.

* This aspect of the problem was discussed by Surg.-Lt.-Cmdr. G. Tooth at the same meeting.

HEAD INJURIES.

Matrices.	Vocabulary.			
	Below average.	Average.	Above average.	
Below average	34	9	6	49
Average	34	29	11	74
Above average	7	20	22	49
Totals	75	58	39	172

CONTROLS.

Matrices.	Vocabulary.			
	Below average.	Average.	Above average.	
Below average	26	35	7	68
Average	31	63	21	115
Above average	6	43	24	73
Totals	63	141	52	256

	Head injuries.	Controls.	
Vocabulary higher	26	63	89
Matrices higher	61	80	141
Totals	87	143	230

$\chi^2, 4.58. P, \text{between } .05 \text{ and } .02.$

The same procedure can finally be applied to compare those cases of head injuries that returned to duty with those invalidated out of the Service.

R.T.U.

Matrices.	Vocabulary.			
	Below average.	Average.	Above average.	
Below average	13	5	4	22
Average	20	15	9	44
Above average	3	12	13	28
Totals	36	32	26	94

INVALIDED.

Matrices.	Vocabulary.			
	Below average.	Average.	Above average.	
Below average	21	4	2	27
Average	14	14	2	30
Above average	4	8	9	21
Totals	39	26	13	78

	R.T.U.	Invalided.	
Vocabulary higher	18	8	26
Matrices higher	35	26	61
Totals	53	34	87

$\chi^2, 1.26.$

This shows that the difference between Matrix and Vocabulary score is of no prognostic importance.

1a. *Neuroses due to fear, shame or guilt connected with the accident.*

R. Y—, a private in the R.A.S.C., driving a lorry in convoy, had to pull up sharply, because the vehicle in front stopped suddenly. He hit his head against the windscreen, was dazed for a second, and had a trivial bruise. He complained afterwards of dizziness and intolerable headache. Thorough physical investigation showed no cause for his complaint. Prolonged rest had no effect. During the psychiatric interview he related that the sudden stop of the convoy was due to an accident; a vehicle further forward, driving round a hair-pin bend, had crashed over a parapet and the patient had seen it overturn and somersault down a steep hillside. The patient and others went to the rescue, but found the driver killed. He was thoroughly shaken and developed his present symptoms. He improved with explanation, after he had been promised a transfer to a non-driving job.

Sgt. N. B—, a regular soldier in an infantry regiment, was in the fighting near Dunkirk. He was thrown against a wall by the blast of a shell. He was unconscious for an indefinite period, but able to make his way to the beaches and was evacuated by destroyer. For two years afterwards he suffered from headaches and forgetfulness and felt increasingly irritable. Various periods of rest and treatment did not improve his condition. No psychological factors could be elicited in several interviews. He was given sodium amytal by injection. With violent emotion he reported the following story:

“During the retreat he was in charge of a platoon; most of the men came from his own village. Owing to his injury he was separated from his unit. After he returned he learned that most of his men had been lost. He was afraid to return to the village and to answer all the questions that would be put to him, since he felt responsible for his men.”

He reported sick with his present symptoms.

The fear of having been injured, permanently damaged, is a variant of the other fear reactions. The significance of the head in the body-image, and the impressiveness of unconsciousness and confusion, the popular views of the seriousness of concussion (as opposed to knock-out), all combine to produce the psychological attitude which has been called head-consciousness. No man readily admits to himself, or to others, that his mental functions have been impaired, and if he has reason to suspect such an impairment, the hypochondriacal preoccupation and the repression of his anxiety can form the nucleus of a neurotic reaction. This mechanism is of very striking importance in cases of mild impairment of intelligence, or mild aphasic and similar defects (not covered in this series), but it also occurs in recoverable and recovered cases, when they have become aware of such defects during their convalescence.

Prophylactic explanation and reassurance can do much to prevent such reactions; on the other hand, unskilful management and treatment can be a potent precipitating factor of such neuroses.

1b. *Reaction to treatment* (or mismanagement), in fact, may be classified as a special type of accident neurosis following head injury. Prolonged bed rest is a factor strongly suggestive of seriousness of the injury; in particular, if the patient feels subjectively well, he is liable to conclude, when kept in bed for several weeks, that the doctor must fear serious consequences, and this fear is easily transferred to the patient himself. Such apprehensions, or rather, misapprehensions, are often expressed to the patient, who cannot fail to be impressed and to start watching for after-effects.

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N. I—, a soldier, aged 20 (A.5099), employed as despatch rider, lost control of his motor cycle on loose ground, and ran into a tree. He had a retrograde amnesia of a few seconds, a post-traumatic amnesia of under 24 hours. He was treated at a reception station and felt all right after 10 days. Now he was sent to the nearest hospital for X-rays. He was duly impressed when 8 or 10 pictures were taken. He assumed everything was all right, though he was not told so. He was back in the ambulance, to return to his camp, when suddenly a nursing orderly ran after him; a fracture had been discovered after all, and they wanted to take a few more pictures. The fracture was a doubtful, and certainly trivial, fissure, but on that evidence he was admitted to the hospital and kept in bed for five weeks, in a convalescent home for a further three weeks, and then sent to a convalescent depot. He was put on a strenuous hardening course, but nobody ever talked to him about the seriousness (or otherwise) of his injury. His symptoms developed during his enforced rest in bed. He improved with simple psychotherapy and graded exercises, and his C.O. reported him as doing full duty efficiently and willingly twelve months after his discharge from Mill Hill.

Another case, A.4322, with a much more complicated psychological background, who suffered from intolerable headache two years after a motor-cycle accident, was admitted to a surgical ward for investigation and treatment. He was told he might have a clot on his brain, and that air would be put into his ventricles. However, nothing happened until he was transferred to Mill Hill, still under the impression that he had "a clot on his brain." This man, who had been a "chronic head injury" for 18 months, was successfully treated, passed a W.O.S.B., completed his O.C.T.U. training, was commissioned in a parachute unit, with which he went to France on D-day (12 months after his discharge).

1c. Reaction to the social and environmental effect of the accident.—This is a further type of accident neurosis. This type is not uncommon in peacetime; it has its specific colouring in Army patients, but it is perhaps most impressive in flying personnel after comparatively mild physical injury, but marked psychological reaction which leads to being grounded or boarded unfit for flying duties.

Sgt. A. P—, R.A.F., aged 22, admitted in January, 1945, complained of headaches and giddiness. Volunteered for air crew in 1940, trained as W/Op. A.C.; 320 operational flying hours. While on patrol over the Gulf of Biscay the aircraft was attacked; the pilot took evasive action, got into difficulty and ordered the bombs to be jettisoned. Patient was thrown through the opened bomb doors, but clung to the aircraft and was rescued. He got many bruises all over his body, including his head, and was badly shaken. He was taken off flying duties and developed his present symptoms. When put on non-operational flying he was nervous and jumpy, and finally he was boarded unfit for flying duties. This made him consider himself a complete failure, and his symptoms became worse and worse. Reasons for the intensity of this reaction were discovered in his personality and past history. He lost his symptoms with psychotherapy, but since there was no chance of his being returned to flying duties, he had to be invalided.

2. *Incidental Neuroses.*

An injury to the head, like any injury, may be the last straw to a man in a life situation of stress, just short of causing a breakdown. Among our soldier patients there were a good many who were in a state of sub-neurosis when they met with such an accident. The browned-off soldier at home, the soldier

abroad who suffered under the long separation from home with all the concomitant anxieties, are obviously in a state which made them susceptible to any neurosis-producing stress. The period of contemplation in hospital is liable to increase their anxieties, and produce frank anxiety symptoms and escape mechanisms.

Sgt. L. P—, aged 25, A.4814, was hit by a football on the back of his head. He had an amnesia of one or two minutes, and developed severe headaches afterwards. He was always highly strung, a seclusive, home-tied young man, extremely conscientious at his work, a worrier by nature. He volunteered for the Army in 1939 because he considered it his duty. He had little military training, was soon employed on clerical work and was considered a highly reliable worker. He gained quick promotion and was posted to the War Office. He was given more and more responsible work and started worrying about it. Four weeks before the accident his superior officer went sick; his responsibility and worry increased; he developed diarrhoea, but did not report sick, since there would have been nobody to do his job, but following this accident he was sent to a reception station, and his headaches prevented him from returning to duty. He improved with a period of rest and modified insulin treatment, which saved his face. He accepted explanation and reassurance, and returned to his previous duties. He was doing full duty efficiently and willingly twelve months after his discharge.

Many cases in this group are chronic or recurrent neurotics in whom the post-concussional state is only an exacerbation of this condition.

W. J—, aged 32, A.5638, complained of headache following a motor-cycle accident in which he was stunned for a few minutes. His mother suffers from cerebral arteriosclerosis, his brother from a chronic psychosis; the patient's sister is nervous. He was a nervous child, was frequently off school on account of eye trouble (twitching of lids). He worked as a painter for his father first, later had numerous jobs elsewhere. He had frequent periods of depression, in which he felt like killing himself. Following the accident he developed headaches; he was so worried about his health that he thought his life was finished. He improved, and was called up at that time, though his headaches still persisted. When he had to wear a steel helmet the headaches became intolerable; he became obsessed with his health, kept on thinking about his head injury, and feared he would go mad like his mother. He improved, but was considered unfit for further service.

In some of these cases one can suspect that the accident itself is a neurotic symptom, a subconsciously motivated self-injury or suicidal attempt, but it is difficult to prove this in the individual case.

SUMMARY AND CONCLUSION.

The stages in the treatment of head injuries have been defined and a classification proposed.

A number of observations on the frequency of late effects showed that prolonged after-effects after non-operative injuries occur in about 20 or 30 per cent. of the cases. There is evidence to show that constitutional predisposition is an important contributory factor in their aetiology; others are psychological and environmental stress. In that respect the chronic cases do not differ much from neurotics, though their predisposition is slightly less, their symptomatology slightly different. The prognosis is very similar. The psychological and social factors, susceptible to treatment and environmental manipulation, are of the greatest practical importance. The inevitable con-

clusion is that psychiatric methods, if not a psychiatrist, should be employed at an early stage of the treatment and rehabilitation of head injuries.

PRECIPITATED PSYCHOSES.

The pre-war literature was reviewed in the *J. Ment. Sci.*, Special Number, 1944. No war experiences have yet been published. Only very few psychoses were admitted to Mill Hill; this material, therefore, is not representative. Among 5,000 admissions the diagnosis schizophrenia was made 37 times. In two of these the head injury was considered a precipitating cause; one of them (A.3476) was a man, aged 24, who had had a schizophrenic attack at the age of 17. He recovered and worked satisfactorily as an engineer, but remained solitary and morose. Seven weeks before admission he was knocked out in a quarrel at work. He became anxious and depressed, and complained of lack of concentration. He attended out-patients and was later admitted. He showed severe thought disorder, was slow and depressed, and showed a paranoid attitude towards his workmates. His depression and paranoid attitude improved, and six months after the injury he was considered recovered and returned to the same work with a different employer.

The second case (A.7956) was a soldier, aged 25, of low average intelligence, who had no history of earlier mental disease. He was always shy and solitary. He joined the Regular Army, served in Egypt and Palestine before the war, and took part in the landing in Sicily in 1943. In October he was wounded in action; he was found unconscious, and his mandible was fractured by shrapnel. His post-traumatic amnesia could not be assessed exactly. He was evacuated to N. Africa, and by stages returned to the U.K. Whilst at home on disembarkation leave, about three months after the injury, he began to feel queer and reported sick. He was recommended for admission; on arrival he complained of dizziness (no headache), peculiar thoughts, difficulty in thinking, depression with self-reproach and suicidal thoughts, and ideas of reference. He was reticent and unco-operative, and had auditory hallucinations.

There was a considerable number of depressive reactions among the 350 cases, but the vast majority were clearly reactive in kind. In some cases the problem arose whether the patient's emotional reaction developed on the basis of some permanent change of emotional disposition due to cerebral (frontal) injury.

A.5777, aged 28, Cpl. R.C.S., was described as a cheerful and sociable personality, keen on games and sports, an ardent motor-cyclist, a happily married man who had never shown any signs of emotional instability. He had worked for the same firm all his life, working up from butcher's boy to manager of a shop. He joined in 1940, was stationed in the U.K. until he took part in the N. African campaign; was employed as a linesman. Injured in an accident of which he has no recollection. Amnesia cannot be exactly assessed owing to lack of landmarks. He was taken to hospital in a dazed condition. During his in-patient treatment he noticed the loss of his sense of smell and taste, with "nasty" sensations of taste and smell. He also complained of terrible headaches. During his repatriation and disembarkation leave he became increasingly depressed, morose and disgruntled. He was worried about his memory and concentration, though tests showed no signs of intellectual deterioration. The EEG was abnormal. He did not improve with treatment and was invalided.

In the following case the picture was that of a severe state of depersonalization in the setting of a severe suicidal depression :

B.16, aged 32, admitted to Mill Hill on 14.ix.44.

Complaint.—Loss of all feeling, "as if he had lost his soul." When looking to the right things appear wobbly and he has multiple vision—five to six objects instead of one. Never any headaches, except after encephalogram.

Family history.—Nothing relevant.

Personal history.—Elementary school till 14. Left from Standard 6 (7). Casual labourer for many years. Road sweeper for Lambeth Council, seven years. Last wages £3 6s.

National Service.—Called up August, 1940; P.C. Transferred to C.M.P.; vulnerable points. Home service only.

Previous health.—Rheumatic pains on and off since aged 20. Nervous dyspepsia all his life.

Personality.—Always nervous and highly strung; uncomfortable in the dark. Interested in motor cycles, but could never afford one of his own. Loves wireless sets. Since the days of the crystal set he kept building sets from bits and pieces he could get hold of. Happily married since 1935. Wife had operation for ectopic pregnancy. One child died of marasmus. Two alive.

Present condition.—On 11.vi.44, while guarding a road block, he was hit on the right side of his face by a piece of steel tubing. He was knocked out, retrograde amnesia for a few seconds. Woke up in Ipswich Hospital. Post-traumatic amnesia indefinite—probably about a fortnight. Unconscious on admission. Fracture of right maxilla and infra-orbital margin. Fracture of the right side of the convexity. C.S.F. blood-stained. Right antrum opened—orbital flow elevated. (?) Rational on 20.vi.44. On 23.vi.44 mental conditions still rather strange. He was sleepy and childish. Air encephalogram on July 18; depression of roof of right anterior horn. On July 2 he said he had a terrible experience, when everybody seemed far away and things seemed unreal. He was lethargic, childish and anxious, afraid of leaving his children and of dying. Transferred to convalescent home on August 5, still depressed and complained of loss of interest and double vision. States now that his present condition started suddenly on the journey from hospital to convalescent home.

On admission.—Very little emotional expression. Complete anosmia. Right eye slightly lower than left. Other cranial nerves N.A.D. No weakness or ataxia of extremities; deep reflexes brisk and equal. No pathological reflexes. Orientated in time and space. No gross disturbance of attention. Co-operative and reasonable. Mildly depressed. Considerable emotional lability in spite of his continuous complaint of complete loss of any effect—"If you gave me a new radiogramophone all for myself, it would not give me pleasure."

Deterioration tests.—Marked deterioration.

X-rays.—Fracture right vault, temporo-parietal, right maxilla, zygoma, floor of orbit.

Progress.—Transferred to facio-maxillary unit for repair of orbital floor. There his depression increased; he was considered seriously suicidal and transferred to a mental hospital. He was discharged improved in April, 1945.

He was visited in August. He was still depressed, though able to carry on his previous work as a labourer. He still complains of loss of interest; his initiative is poor. He gets irritable and worries about himself.

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ADDENDUM.

Electro-encephalographic Findings.

Electroencephalograms were carried out in 112 cases at Hill End Hospital by Mrs. Arundel. The tracings were classified into normal (49), doubtful (19), and abnormal (44). The groups were compared in all the points employed before and the significance of the differences calculated.

The doubtful and abnormal groups contained significantly fewer men above the age of 30. Family, social and personal history showed no significant differences. As regards previous character traits, the abnormal group showed an excess of men described as seclusive and lacking drive. In symptomatology, the abnormal group showed more frequently hysterical conversion symptoms. The doubtful and abnormal groups were less frequently below average in intelligence. The boarding-out rate was the same in all three groups.

Comparing mild and moderate cases on the one hand, and severe ones on the other, as regards the EEGs, a definite preponderance of abnormal EEGs in the severe group was found.

SOME CLINICAL APPLICATIONS OF THE REY-DAVIS PERFORMANCE TEST.

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INTRODUCTION.

PROTAGONISTS of mental tests in clinical practice have hitherto shown a decided preference for methods of examination adapted to study capacities already developed or knowledge already acquired. Relatively little attention has been given to the study of *learning*, despite the fact that this function is so obviously affected in many and various neuropsychiatric conditions. One need only recall the widespread loss of plasticity so characteristic of the dementias and the more specific defects of learning associated with various types of focal lesion, e.g. of the language centres or the visual-association areas (*cf.* Cobb, 1944, pp. 214-5; Zangwill, 1945). It may therefore be urged that any technique of studying learning that is objective in character and easily adapted to the needs of routine clinical examination is worthy of attention. One technique which meets these demands will be described in the present paper, together with a small selection of the results obtained on routine psychological testing at the Brain Injuries Centre in Edinburgh.

A. Rey, in 1934, described a new device for studying the acquisition of a simple visual-motor habit. He pointed out that the technique might find a useful application in psychopathology, and reported some observations on individual clinical cases (Rey, 1934, pp. 326-37). The method, christened by Rey the *manual labyrinth*, has since been extended by Russell Davis in Cambridge, and has consequently come to be known among clinical psychologists in this country as the *Rey-Davis Performance Test*.*

The test consists of four 6-in. square boards, on each of which are three symmetrical rows of three pegs (Fig. 1). Eight of the nine pegs on each board are removable; one is fixed. The fixed pegs are in the positions shown in Fig. 1. The examiner presents the boards in a regular sequence, and the subject is required to discover, by trial and error, the fixed peg on each consecutive board. He is then given the boards in the same order and again required to demonstrate the fixed pegs, but this time with the maximum possible economy of choice. The procedure is continued until the subject can indicate unhesitatingly the position of the fixed peg on all four boards on two consecutive trials (Zangwill, 1943). When learning is thus stably acquired, the test may be prolonged (and incidentally made harder) according to Davis's method of rotating the boards progressively through

* I am greatly indebted to Dr. A. Rey, of the University of Geneva, for introducing me to his test in 1939 and for his kind permission to experiment with it further. I have also to thank Dr. D. Russell Davis, of the Cambridge Psychological Laboratory, for acquainting me with his modification of the technique and for so kindly placing some of his unpublished data at my disposal.

a right-angle. Should the patient fail at any point and again make wrong choices on any board the learning procedure is resumed as before until two consecutive successes have been recorded. A complete test will thus comprise the appropriate number of trials with the boards at the standard position (shown in Fig. 1), together with all further trials with the boards rotated through 90, 180 and 270 degrees respectively. If desired, a final re-test may be given at the standard position. The number and distribution of errors are recorded in detail in the manner advocated by Rey (1934, p. 304). If desired, the duration both of the total learning period and the individual trials may be timed. The method possesses the general advantage of performance tests in providing an interesting setting for the display of various types of personality reaction, and any striking features of test behaviour should be carefully noted.

Rey's original work was devoted in the main to studying the evolution of learning and learning methods in young children. He was led to distinguish five methods of approach to the test problem forming an approximate series of genetic levels. These were termed: (a) Isolated choice; (b) systematic choice; (c) unilateral perseveration; (d) limited experimental behaviour; and (e) comprehensive experimental behaviour. The five methods of approach may be briefly explained:

(a) *Isolated choice*: This is seen in children of under 4. Response is confined to grasping an individual peg at random, and performance betrays no understanding of the real problem. There is consequently no learning. (b) *Systematic choice*: This is generally shown by children of between 4 and 5 years. The child tests the pegs on each board in a systematic fashion, but repeats the procedure (which is, of course, appropriate to the first trial alone) on all later trials. Repetition leads to no economy of moves, and there is, in consequence, no learning. (c) *Unilateral perseveration*: This form of reaction is seen in children from 5 to 6 years. The child discovers the constant position of the fixed peg on one of the boards, but proceeds to attack the others as though his discovery held good for them too. Thus if the board in question is the second (centre peg fixed), the child's first choice on the other three boards is consistently the centre peg. Learning is obviously only partial. (d) *Limited experimental behaviour*: This is shown by children over 6. The subject betrays real understanding of the task and its learning possibilities, but confines his analysis of the situation to the individual boards. He does not manage to evolve any kind of scheme linking the reactions on all four boards. Again, learning may be incomplete. (e) *Comprehensive experimental behaviour*: This is the normal procedure in older children and in adults. The subject endeavours to relate, in visual or verbal terms, the order and positions of the fixed pegs on the successive boards. The evolution of such a scheme naturally renders learning very easy and, in consequence, the test seldom gives difficulty to a normal adult (Davis, personal communication, 1943). Rey is careful to point out that these five genetic stages, or levels, of reaction are not rigidly discrete, and he does not attempt a systematic analysis along the lines of the Binet Scale. It is the principle rather than the form of the classification upon which he lays stress (Rey, 1934, p. 322).

A short summary of Rey's work in abnormal subjects may now be given. In *mental defectives* he finds that the method of approach displayed by the subject typically corresponds to one of the procedures shown by normal children below six years of age. Thus the level of isolated choice is seldom surpassed by imbeciles, whereas systematic choice is the rule in morons. Direct choice and unilateral perseveration first appear in the high-grade defective, and at this mental level some learning (albeit slow) is, as a rule, observed. Rey considers that the test performance in defectives can be viewed as the persistence of an "inferior" type of response, and reflects the low general level of mental organization (Rey, 1934, p. 329). In cases of

mental deterioration he suggests that the test may prove distinctly useful in defining the general level of retained cognitive function, and is able to present some interesting individual records from cases of G.P.I. and post-traumatic deterioration in support of his claim (Rey, *ibid.*, pp. 328-37). In conclusion he describes the results given by two cases of *amnesic syndrome* (associated with lesions of the prefrontal areas), and suggests that the method may prove helpful in the differential diagnosis of organic and psychogenic disorders of memory (Rey, *ibid.*, pp. 332-37). Rey's work, although admittedly limited in scope, is an admirable example of imaginative and thoughtful mental testing in the clinical sphere.

Russell Davis's work with the test, unfortunately not yet published, includes studies of normal adults, post-traumatic conditions, and a small group of psychoneurotic subjects. His principal findings, which he was kind enough to communicate to me, may be briefly summarized :

(a) *Normal adults* : Davis reports that the test, even when complicated by his rotation procedure, is too easy to evoke much interest. Of 28 normal young adults, 24 mastered the standard sequence and three consecutive rotations in six trials (or even fewer). The largest number of trials required by any one subject to master the four positions was 16. On the other hand, it is only fair to point out that Dr. M. B. Brody reports far greater variability in some preliminary work with the test in normals (Brody, personal communication, 1945). More extensive standardization will obviously be needed before the test can be advocated as a quantitative procedure for clinical use. (b) *Post-traumatic conditions* : Stereotyped errors are common, especially those in which the subject insists on several consecutive trials on a choice which had been correct at a previous orientation of any given board. Davis also reports that organic cases are in general "wasteful" of moves and errors greater than in the normal. (c) *Psychoneurotic conditions* : In certain cases Davis was impressed by a certain irregularity (or instability) of learning. Such cases may " . . . come very near success and then make an extravagant number of mistakes again " (Davis, personal communication, 1943). Trist (1942) has reported similar observations in neurotic patients, and stressed the fact that a sudden breakdown of performance, associated with a sharp rise in errors and obvious signs of emotional upset, is often precipitated by progressive rotation. The present writer has likewise called attention to anomalies of tempo and procedure commonly observed in testing psychoneurotic cases (Zangwill, 1943).

In view of the fact that this paper will be very largely concerned with Rey-Davis performance in cases of cerebral lesion, a short summary of the present writer's earlier observations on the test in organic conditions is perhaps in place. It was pointed out (Zangwill, 1943) that cases with any degree of retention defect on an organic basis commonly displayed slow learning and a number of qualitative deviations from normal performance. The latter were classified provisionally as follows :

(1) *Stereotyped error* : A pattern of response evolved on any one trial with any given board is repeated without change on several of the following trials with the same board. (2) *Confusions of sequence* : The response appropriate to any one board is consistently elicited by one of the other three. (3) *Unstable learning* : Continued testing (even without rotation) may provoke breakdown after learning appears to be fully established. (4) *Forgetfulness* : Errors occur which appear to be due to momentary absent-mindedness and which are often self-corrected. (A good practical criterion is the reappearance of errors on the second board—centre peg—after at least two error-free trials on this board.) (5) *Breakdown on rotation* : Rapid learning at the standard orientation is followed by breakdown and inadequate re-learning after one or more rotations of the boards.

It was emphasized in our earlier report that these five traits are not exclusively shown by organic cases, and not every such case can be relied upon to display them. In particular, unstable learning with breakdown on rotation may, as we have seen, be observed in neurotics. But these cases commonly show a marked anxiety reaction to the test as a whole, and their performance is apt to give a very different impression to the experienced examiner. Stereotyped patterns of error, furthermore, are rarely seen in the purely functional case. Indeed Davis has himself been unable to detect them in his own material, and they have seldom been recorded in neurotic conditions by the present writer. At the same time, it must be emphasized that more detailed work is needed before any specific feature of Rey-Davis performance can be regarded as pathognomonic for purposes of differential diagnosis. We venture to hope that the records presented in this paper will provide some broad indications of the types of analysis required, and furnish a background for more specific future studies.

II. CASES.*

The cases included here fall into three groups. The first comprises three cases of concussion head injury tested in the acute state, and re-tested after full recovery from the phase of post-traumatic confusion. The second consists of three cases of post-concussion syndrome. In two there were minor cognitive disabilities but no abnormal emotional reaction. The third was a case of post-traumatic anxiety neurosis without significant organic intellectual disability. The third group comprises three diverse and rather more specialized clinical conditions. The first case presented a number of high-grade visual symptoms associated with a fronto-parietal lesion of the right cerebral hemisphere. The second was a case of gross motor aphasia. The third showed a complicated condition in which hysterical symptoms were associated with an organic syndrome in a case of left frontal cerebral atrophy. These cases are included partly for theoretical reasons, and partly because they illustrate the diversity of material that a clinical psychologist may be called upon to study and assess.

Group I: Acute Concussion Head Injury.

CASE 1.—Man, aged 29. High-grade intelligence and secondary education. Sustained concussion head injury with retrograde amnesia 1 hour and P.T.A. 3 days. Showed at first a gross memory retention defect, which rapidly improved during the first week in hospital and cleared up completely before discharge. Air-encephalography showed some degree of post-traumatic brain atrophy. The patient was tested 6, 10 and 20 days after date of injury.

CASE 2.—Man, aged 28. Average intelligence and elementary education. Sustained moderately severe concussion head injury: unconscious 90 min. and confused for 4 weeks. P.T.A. 4 weeks. Thereafter good recovery and no residual psychological disability. Tested $3\frac{1}{2}$ and 7 weeks after date of injury.

CASE 3.—Officer, aged 28. Intelligence high grade and University education. Sustained very severe concussion head injury. Unconscious 1 week; confused, disoriented and amnesic for 7 weeks. Recovery slow in all spheres. Residual

* I wish to thank Mr. Norman Dott, Director of the Brain Injuries Unit, for his kind permission to study these cases and to reproduce extracts from his records.

psychological disabilities 8 months after injury were moderate intellectual and memory deficit and some degree of personality change. Tested 8 and 12 weeks after date of injury.

Group II: Post-Concussional Syndromes.

CASE 4.—N.C.O., aged 27. Good average intelligence and elementary education. Sustained concussional head injury with compound fracture of skull; retrograde amnesia 5 min. and P.T.A. a few hours. Displayed post-traumatic syndrome of headache, giddiness, proneness to mental fatigue and very slight executive dysphasia. Tested 3½ months after date of injury.

CASE 5.—N.C.O., aged 32. Good intelligence and highly satisfactory previous work-record. Sustained concussional head injury with fracture of skull; retrograde amnesia 30 min. and P.T.A. 3 days. Two weeks after injury showed post-traumatic syndrome of headache, giddiness, absent-mindedness and slight intellectual impairment. Six weeks later had fully recovered from these disabilities and showed no residual psychological changes. Tested 4½ weeks after date of injury.

CASE 6.—N.C.O., aged 31. Average intelligence level and elementary education. Sustained concussional head injury two years previous to admission to Brain Injuries Unit with chronic post-concussional sequelae. It was concluded that the latter were being maintained on a psychogenic basis and were associated with considerable anxiety and depression. Tested 26 months after injury.

Group III: Special Conditions.

CASE 7.—Man, aged 26; right-handed. Average intelligence and good previous record as a skilled manual worker. Sustained through-and-through bullet wound of head with resulting atrophy of right cerebral hemisphere, especially marked in the frontal region. Chronic left-sided hemiplegia and hemianaesthesia, organic constriction of visual fields, marked disorders of visual space perception (visual-spatial agnosia) and associated constructional handicaps. No defect of general memory, but some intellectual deficit. Tested 8 months after injury.

CASE 8.—Man, aged 38; right-handed. Superior intelligence level, University education and high professional qualifications. Sustained a virtually complete motor aphasia with right hemiplegia from a left-sided vascular lesion. The patient was tested 2½ years after onset of illness, at which time aphasia was still almost total, but the patient had acquired considerable dexterity in the use of the left hand, with which he performed the test.

CASE 9.—Man, aged 37. This patient had a history of left cerebral thrombophlebitis in addition to concussional head injury. There was evidence of left frontal cerebral atrophy, and almost certainly some degree of organic intellectual and personality change. This, however, had been grossly exaggerated on an hysterical basis, giving the picture of pseudo-dementia (Ganser syndrome). The patient was tested 18 months after original hospitalization for present illness.

III. TEST PROCEDURE.

The general procedure, following that of Davis, has been described in the Introduction. Progressive rotation of the boards was practised in every case (with the exception of Case 9), but was not, as a rule, continued if performance broke down badly at any one position. The number and location of errors ("wrong choices") were carefully recorded, together with any qualitative observations (e.g. peculiarities of tempo or anxiety reactions) of special interest. The tests were not timed, and the subjects were encouraged to work at their natural rates. No help or advice was given at any point.

It has been thought convenient for purposes of exposition to number the boards 1 to 4 and the successive orientations I to V. Fig. 1 shows the four boards at the standard orientation, which we call *Position I*. The first clockwise rotation through

a right angle brings the boards to *Position II*, the second to *Position III*, and the third to *Position IV*. A final rotation, bringing the boards back to the standard orientation, was generally undertaken, and this will be called *Position V*. Positions I and V are of course identical.

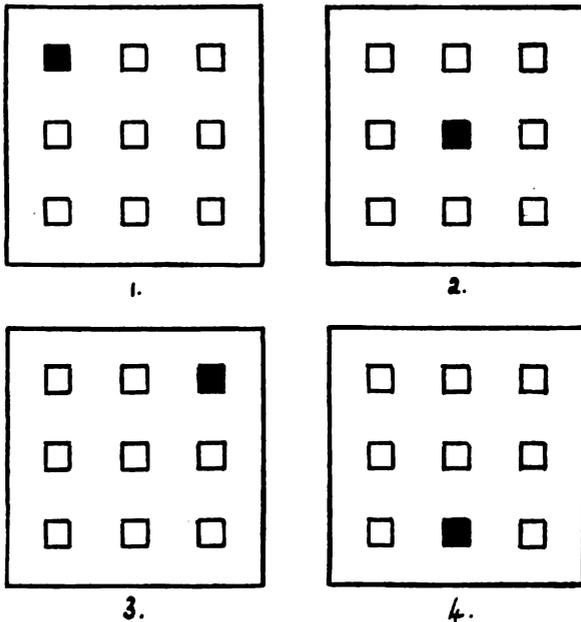


FIG. 1.—The Rey-Davis Boards, showing positions of fixed pegs at the standard orientation.

IV. RESULTS IN GROUP I.

The results in this group show (1) severe disturbances of learning and performance in the post-traumatic confusional state; and (2) marked improvement in test performance following full recovery of ordinary consciousness. The final records in Cases 1 and 2 suggest no residual disability, whereas the corresponding record in Case 3 indicates some persistent impairment of performance. We may briefly describe the main features shown by the individual cases on early and late testing.

Case 1.

Test 1.—The learning curve is shown in Fig. 2 (a). Despite the patient's failure to master the task at the standard position in 10 trials, it will be noted that the curve gives some evidence of progressive improvement. Scrutiny of the original record showed that there was only one case of success on two consecutive trials with any one board (Board 3, Trials 8 and 9). An analysis of the patterns of choice-reaction on the individual trials showed that there was a marked *perseverative error-reaction* to Board 2 (normally the easiest choice to learn) from the 4th to the 10th trial inclusive. On all these trials the patient invariably chose first the peg to one side of the fixed peg, while his second choice was correct.

Test 2.—The learning curve for the standard position is given in Fig. 2 (b). It will be seen that learning is slow, but the last two trials are error-free. Inspection of the original record showed that there was a marked *differential effect* in the rate at which correct choice to the various boards was acquired. Thus there were no mistakes on Board 1 after the 3rd trial or on Board 2 after the 6th trial, but errors

persisted on Boards 3 and 4 until the 9th trial. The stereotyped error described above in connection with Board 2 reappeared on the present test, but was eventually eliminated.

Test 3.—It will be seen from Fig. 2 (c) that learning of the required pattern of choice is now much more satisfactory. In the first place there is obviously some retention of what had been learnt on the previous test, and no errors were made on Boards 1 and 2 on any trial. In the second place there is good *transfer* of the response pattern with rotation of the boards to Position II. Further rotation was not undertaken in this case.

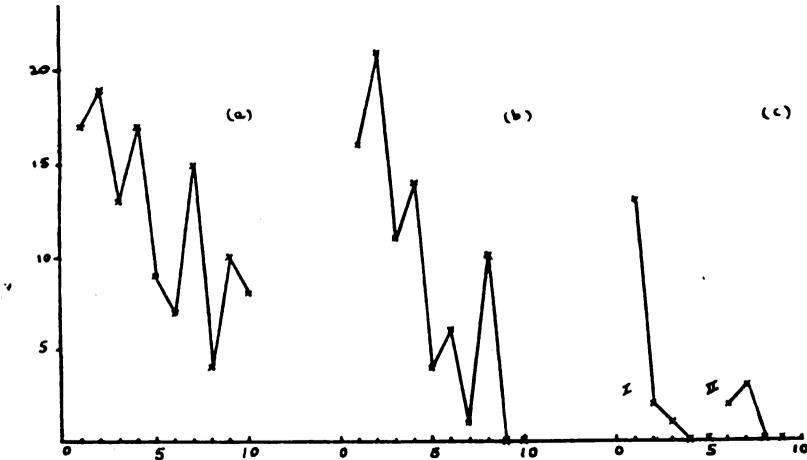


FIG. 2.—Learning curves in Case 1. (a) Test 1; (b) test 2; (c) test 3. Ordinate: Errors. Abscissa: Trials.

This case demonstrates clearly a gross impairment of learning associated with a post-traumatic amnesic state of short duration, and the progressive improvement in performance in the course of its remission. In view of this patient's good intelligence, and his capacity, even whilst confused, to reach a high level on ordinary intelligence tests, his slow learning on Test 1 with failure to master the required response to any board (including the second) is somewhat striking.

Case 2.

Test 1.—The performance in this case gives a rather different picture from that of Case 1. We see from the learning curve (Fig. 3 (a)) that errors are rapidly eliminated at Position I and that learning is virtually complete after three trials. There is perfect transfer of response with rotation to Positions II and III, but a well-marked breakdown on further rotation to Position IV. Indeed errors at this position are not eliminated completely with as many as eleven consecutive trials. On rotation to Position V (the standard position), on the other hand, the correct responses are rapidly reinstated.

An analysis of the record of errors at Position IV brings out some interesting features. On the first and second trials errors were made on every board except the second, but on the third trial errors were made only on Board 3. On the fourth trial, however, the patient, after having chosen correctly on Board 1, made a whole series of errors on Board 2. He tested every peg except the centre one, and several of them more than once. Thereafter, performance remained very defective and betrayed a persistent confusion between Boards 2 and 4. Thus in the case of Board 2 the first choice was always that appropriate to Board 4, and vice versa.

Further, a *stereotyped error reaction* was noticed in connection with Board 4 on four consecutive trials. In all these cases the patient's first choice was the centre peg and the second the correct one.

Test 2.—The learning curve is shown in Fig. 3 (b). The high aggregate of errors on the first trial indicates that there has been little, if any, retention of what was learnt on Test 1. On this test, however, learning is rapid, and transfer is effected very satisfactorily with progressive rotation.

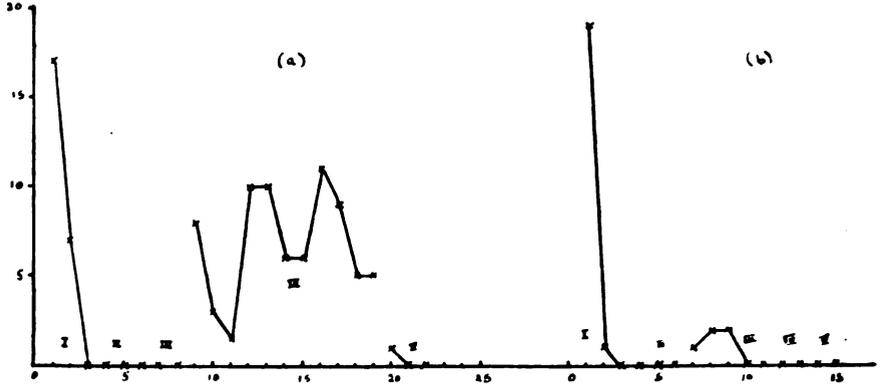


FIG. 3.—Learning curves in Case 2. (a) Test 1; (b) test 2.

The main points of interest in this case are (1) the profound disruption of performance following rotation to Position IV, and the patient's virtual inability to re-learn the required sequence at this position; and (2) the marked improvement in performance associated with recovery from the post-traumatic confusional state. The results on Test 2, indeed, can safely be said to lie within the normal range.

Case 3.

Test 1.—Fig. 4 (a) shows that learning at the standard position is rapid, and that transfer to Position II is reasonably adequate. On rotation to Position III, on the other hand, there is a very marked breakdown after the first trial. Our record in this case indicates that the breakdown was precipitated by an *unexpected error*

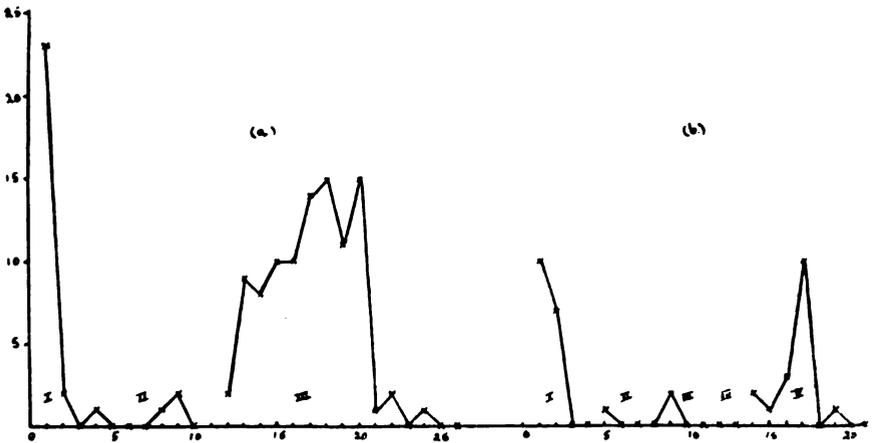


FIG. 4.—Learning curves in Case 3. (a) Test 1; (b) test 2.

on Board 1, which had been dealt with correctly on the previous trial. Before discovering the fixed peg, the patient tested every loose peg on the board, several of them more than once. On the following trial he made mistakes on every board. This suggests that the behaviour pattern acquired at Position I and carried over without undue difficulty to Position II had undergone complete disruption. The correct responses were reacquired very slowly, and ten trials were required before a complete success on all boards was once again registered. It was noticed that from the 5th to the 9th trial at this position the patient's first choice on Board 1 was invariably the bottom right-hand peg. This is another example of what we have called *stereotyped error*. In view of the patient's evident fatigue, the test was given up after the 26th trial.

Test 2.—The results are shown in Fig. 4 (b). It will be seen that learning is rapid at Position I, and the pattern of response adequately maintained until Position V had been reached. There was, however, a marked increase in errors on the 4th trial at this position. Analysis of the errors showed that no fewer than four out of the 21 trials were marked by one or more errors on Board 2.

This case resembles Case 2 in showing a marked disruption after rotation with obvious difficulty in re-learning the required sequence. The re-test, on the other hand, gives evidence of fairly marked residual disability. One need mention only the transient increase in errors at Position V and the relatively large number of errors on the second board. This case, as we have said, not only sustained by far the most severe head injury, but also displayed residual defects in a number of high-grade performance fields.

V. RESULTS IN GROUP II.

The results in this group show (1) some characteristic effects of a mild organic post-traumatic condition on Rey-Davis performance; and (2) special features associated with a psychoneurotic reaction (Case 6).

Case 4.

The record is given in Fig. 5. One may note (a) that learning is rapid at the standard position; (b) that there is excellent transfer to Position II, and on the first trial to Position III; and (c) that the errors on the remaining trials at the latter position show progressive increase. The deterioration at Position III was almost certainly precipitated by an unexpected mistake, in this case on the second trial with Board 4. On the following trial errors were made on two of the boards which had been dealt with correctly on the previous trials (disruption effect), and thereafter no trial was wholly free from errors on at least one board. Even Board 2 was involved in one case. The test was eventually discontinued in view of the patient's evident distress at his failure to re-learn what had at first been learnt so readily.

The main interest of this record lies in the fact that it shows that disruption of performance with rotation is by no means confined to acute conditions (as in Cases 2 and 3). The disruption effect in this case, moreover, is especially striking in view of the rapid initial learning and the relatively mild character of the patient's symptoms.

Case 5.

The complete record is given in Fig. 6. It will be seen that 38 trials were required to complete the test despite the low general level of errors after the first trial. At Position III no fewer than 12 consecutive trials were needed to register two consecutive successes, although the very first trial at this position had been

free from errors, and the maximum number of errors on any one trial was only three. Thus it is plain that the pattern of response showed a rather marked instability. Of the first 26 trials, moreover, no less than seven involved errors on Board 2. This suggests a degree of absent-mindedness far in excess of the normal.

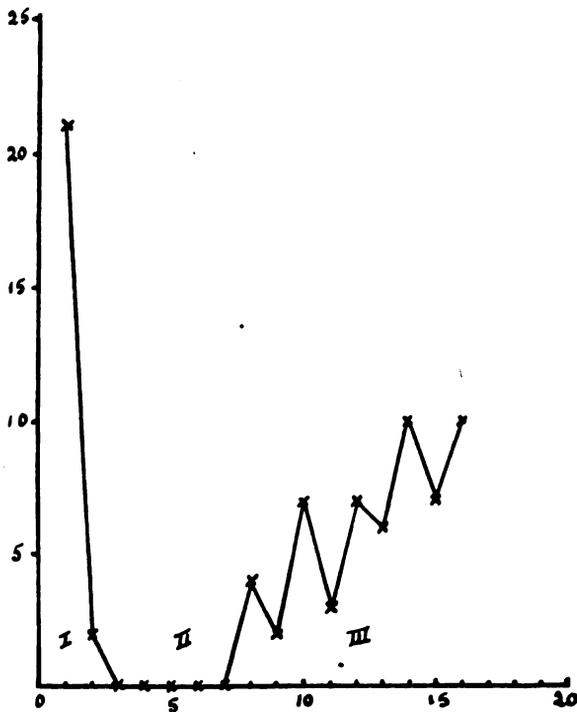


FIG. 5.—Learning curve in Case 4.

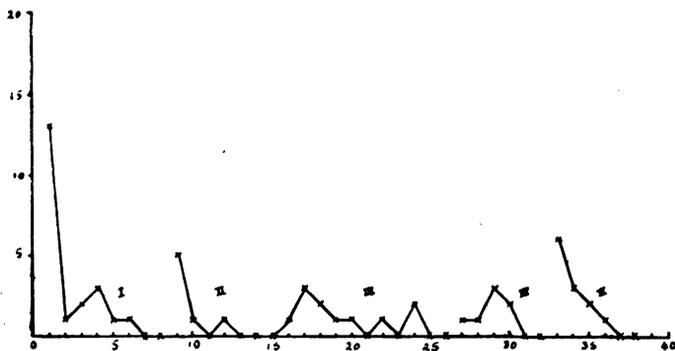


FIG. 6.—Learning curve in Case 5.

In other cases errors appeared to be due to transient perseverative reactions, and in some cases betrayed an insistence on a position which had been correct at a previous orientation of the boards.

The main features shown by this case are thus (1) a high aggregate of errors but a low proportion of errors per trial; (2) frequent errors on the second board; and (3) a certain instability of the choice reactions when once acquired. It

was noteworthy that this patient was exceptionally keen to acquit himself well on the test, and much surprised by his slow learning and irregular performance.

Case 6.

The record, shown in Fig. 7, bears some resemblance to that of Case 4. The curve is more irregular, however, and the total of errors considerably higher. The most striking features of this performance, which cannot be represented graphically, were the *marked anomalies of tempo and procedure* shown on every trial after the first. As each successive board was presented, the patient surveyed it anxiously for a considerable period (often more than a minute) before venturing to select a peg. He then made a sudden, rapid, darting movement and, if the choice were wrong, either repeated the delay, or tested the remaining pegs with an almost feverish rapidity. This peculiar "hover-and-pounce" reaction was shown even in the case of Board 2, on which the patient made no mistakes of choice after the first trial. It was not therefore called forth by true uncertainty. The patient often re-tested a

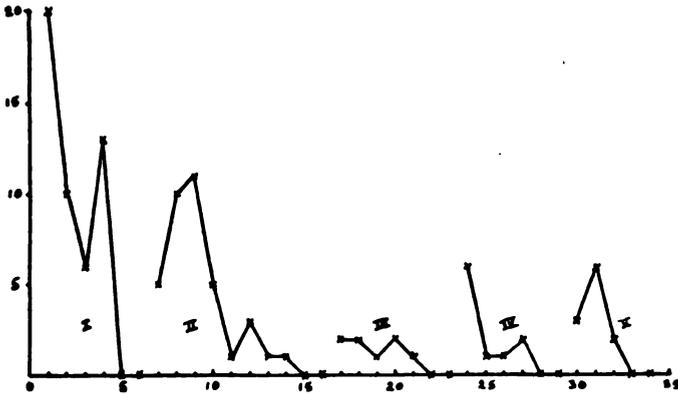


FIG. 7.—Learning curve in Case 6.

given peg more than once on the same trial, and on one occasion tested the same peg twice in succession! He displayed obvious anxiety in the test situation, and had to be constantly encouraged to persevere. In this case, unlike those tested by Trist (1942), the anxiety reaction was not appreciably exacerbated by rotation of the boards.

In this case the peculiarities of tempo ("hover-and-pounce" reactions) and the marked anxiety dominated the test picture. Indeed the insecurity shown by the patient in his choice reactions was at times so marked as to suggest a larval *folie de doute* reaction. Although learning was admittedly slow and errors many, there were none of the clear-cut confusions and stereotyped errors which have been described in the earlier cases. The abnormal traits in this case can be ascribed with very fair certainty to a psychoneurotic anxiety state.

VI. RESULTS IN GROUP III.

The records in this group illustrate the effects of some rather more specialized neuropsychiatric conditions upon test performance. The first case demonstrates the way in which a specific defect of visual cognition may lead to gross abnormality in the test setting. This patient, although not actually

disoriented in central vision, experienced much difficulty in counting scattered objects and in appreciating high-grade spatial relations.* There was also some evidence of a specific memory defect for visual material. The record in this case is included partly in view of its intrinsic interest and partly on account of its superficial resemblance to a psychoneurotic reaction. The second case has been included to give an indication of the test performance of a highly intelligent patient with a very gross disorder of language. This patient was totally aphasic apart from a very few automatic and reactive responses. The third case, which showed hysterical as well as organic mental symptoms, is included in view of its bearing upon practical problems of differential diagnosis in the psychological sphere.

Case 7.

The patient's learning at Position I was very slow, 14 trials being needed. He was quite unable to transfer the pattern of response to Position II, and the test was discontinued after a few trials in this position in view of the difficulty it caused him. It was very noteworthy that the patient was at first *unable to appreciate that the position of the fixed central peg on Board 2 was unaffected by rotation*. He remarked spontaneously *à propos* of this Board after rotation that: "It was the centre, but it wouldn't be the centre now it's turned round." This is a good example of the patient's grossly defective grasp of a very simple spatial relationship. It was also noted that the patient's difficulty in *systematic ocular exploration* led him from time to time to re-test pegs which he had already found to be movable a second or two before. Unlike Case 6, however, this tendency was due to his organic disability, and did not depend on an anxiety reaction in the sense of *folie de doute*. In view of this patient's gross ocular and perceptual disabilities it is creditable that he managed to learn the task at all.

Case 8.

This patient was twice tested with an intervening interval of three months. On the first test he learnt the required responses rapidly at the standard position (4th and 5th trials correct), but performance broke down badly after the first rotation. Only the response to Board 1 showed transfer, and errors were frequent on the remaining boards throughout the 11 trials at this position. In three cases errors appeared on Board 2. On the second test the patient was a good deal slower in achieving two consecutive error-free trials at the standard position and 11 trials were required. Boards 1 and 2 were quickly learnt, and there were no errors on either after the first trial. But errors on the other two boards were eliminated very gradually.

Case 8 was an extremely well-endowed patient, and still reached a high level on performance tests of intelligence. It is therefore tempting to correlate his poor performance on the Rey-Davis test with his inability to formulate the sequence and relationship of the required responses. At the same time it must be borne in mind that comparable records are quite often obtained from cases of organic deterioration without aphasia, and that certain aphasic cases we have had occasion to test have performed very much better than this patient.

Case 9.

The record given by this case at Position I is shown in Fig. 8. The patient was given 18 consecutive trials at this position, but succeeded only in learning the response to Board 2. After he had learnt this, he approached every board on the

* For an account of the general nature of the disability in a case of this kind, see Paterson and Zangwill (1944).

succeeding trials by testing the centre peg (Rey's *unilateral perseveration*). The total of errors per trial shows considerable fluctuation, but there was no evidence of a tendency for errors to diminish after Board 2 had been learnt. The patient's attitude to the test was apathetic, and betrayed no real effort to learn. Rotation was considered superfluous in this case.

This case is not altogether easy to assess. The tendency to unilateral perseveration is, of course, a low-grade response, and not inconsistent with an organic deterioration. The apathy and lack of any real effort to succeed, on the other hand, suggest an emotional disorder. The diagnosis reached in this case was organic deterioration with pseudo-dementia.

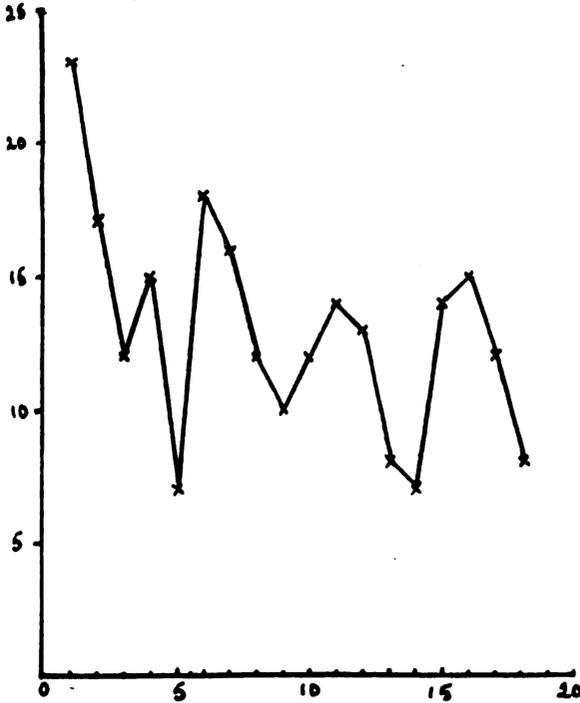


FIG. 8.—Learning curve in Case 9.

VII. DISCUSSION.

Let us consider first the results in the *acute* traumatic conditions. We have seen that only one of the three patients in Group I failed to learn the task at the standard orientation of the boards, and so gross a failure is (in our experience at least) somewhat exceptional. Both the other patients in this group learnt the task rapidly at the standard position, and their performance deteriorated only with progressive rotation of the boards. A comparable breakdown on rotation is extremely common in cases of head-injury and, as we have seen from Case 4, is by no means restricted to the acute condition.*

* Dr. E. Guttman, who has a wide experience of the Rey-Davis test in post-traumatic conditions, has noted the tendency for performance to break down after rotation in a large proportion of his material (Guttman, personal communication, 1943).

We have noted that the breakdown commonly follows upon an *unexpected error* on the part of the patient, and the resulting disruption of response can probably be viewed as a *catastrophe reaction* (Goldstein, 1939). The latter is probably provoked by the increasing difficulty in adapting the original pattern of response to the changing positions of the boards, and no doubt precipitated by the sudden and unexpected error of choice. The fact that comparable breakdowns are observed in neurotic patients (Trist, 1942) is no real objection to this point of view. The psychoneurotic subject, more especially one of the anxious type, is prone to catastrophe reaction in much the same way as the organic case, although in his case the reaction as a rule bears a less close relationship to the degree of difficulty of the task, and the justification of real intellectual handicap is, of course, lacking. From the practical point of view it may be borne in mind that disorders of tempo and procedure of the type described in Case 6 are extremely common in psychoneurotic cases, and in practice it is seldom difficult to judge whether a specific breakdown on the test is or is not due to a purely affective condition.

It is notable that the *learning procedure* in our acute cases betrayed no obvious reversion to the "inferior" types of response and procedure distinguished by Rey (1934). All our patients attacked the task in a more or less systematic manner, and the type of approach displayed was truly on the "experimental" level. Their relatively poor performance (especially after rotation) appeared to derive, not from faulty grasp of what was required, but from simple perseveration of incorrect responses and abnormal difficulty in eliminating specific errors of choice. Thus in errors of the kind which we have called "confusions of sequence," it was plain that mere repetition did not permit the subject to correct the dislocation that had crept into his verbal (or motor) scheme of response. The influence of perseveration is seen even more clearly in what we have called "stereotyped error patterns." Here specific errors of choice are not eliminated after one or two trials, as in the normal, but persist in exactly the same form through a whole series of trials. One may conclude that in patients of this type deterioration is shown, not in faulty and low-grade procedure, but in specific difficulties of learning and execution. The *method* of procedure is intact, but its *realization* is defective.

The records given by two of our three cases of *post-traumatic syndrome* are quite representative of a large number of our records of patients with history of concussion head injury. In the more severely impaired cases (as in Case 4) breakdown on rotation with defective re-learning is surprisingly common. In the less severely handicapped cases (of which Case 5 is an admirable example), the record typically shows a relatively large number of trials with a relatively small proportion of errors per trial. In these cases, further, a certain *forgetfulness* (as shown, e.g., by a relatively large number of isolated errors on Board 2 after it has once been learnt) is commonly in evidence. The general impression given by such cases is one of *inefficiency* rather than true deterioration. Superficially at least, their behaviour has much in common with that of the normal person in a state of extreme fatigue. Our third case in Group II has been chosen to illustrate a psychoneurotic *anxiety reaction* in the context of a post-concussional syndrome. In this case it was seen that learning was slow and

errors many, and that a number of striking deviations from normal procedure were displayed. These comprised erratic tempo, ill-balanced exploration, and an anxiety relating to correct choice so pronounced as to suggest a larval *folie de doute*. Behaviour of this kind is extremely common in anxiety states with or without history of head injury.

The findings in our third group of cases, though of considerable interest individually, are too scanty to permit us to draw any general conclusions. Case 7 is a particularly good illustration of the manner in which a focal defect of visual perception can influence the results on a test of this kind. This patient, as we have shown, had the greatest difficulty in exploring the pegs in a systematic manner, and was unable to appreciate the simple fact that the fixed (central) peg on Board 2 would not change its position on rotation of the board through a right angle. This defect of spatial judgment, so gross as to suggest malingering to the unwary tester, is quite consistent with the nature of the lesion in this case. Our aphasic patient (Case 8) is of interest in showing that absence of formulation does not necessarily affect learning on this test (at the standard position at least), but that it probably interferes with transfer. Certainly many normal subjects make much use of verbal formulae in dealing with progressive rotation, and it is reasonable to suppose that an aphasic patient would sustain some handicap in this respect. Our last case (Case 9) provides a good illustration of the more difficult type of condition that a clinical psychologist may be called upon to investigate. Although the almost complete absence of learning in this case suggested an hysterical reaction, it must be borne in mind that a reaction of this kind may effectively mask a true organic disability (Zangwill, 1943). In such a case the mental tester is advised to interpret his findings with the utmost caution.

It may be said in conclusion that the Rey-Davis method has considerable possibilities in the objective study of organic intellectual disabilities. In addition to being a test of learning in its more mechanical aspects, it gives us a good opportunity of sampling the patient's intellectual approach to a novel and relatively high-grade problem. Further, it provides an interesting setting for the display of personality reactions, as seen, for example, in the tempo of exploration, the method of choice, and the affective attitude to success and failure. From the more strictly practical point of view, the test has proved of real (if limited) service in the assessment of post-traumatic disability and in the differential diagnosis of organic and psychogenic *sequelae* of head injury.

VIII. SUMMARY.

(1) Individual performance on the Rey-Davis learning test is described in nine selected neuropsychiatric cases. They comprise three cases of acute head injury, three cases of post-traumatic syndrome (one with marked anxiety features), two cases of special intellectual deficit-syndromes associated with focal lesions (visual-spatial agnosia and motor aphasia), and one case of cerebral atrophy with hysterical complications.

(2) The three cases of acute head injury showed marked impairment when first tested, but considerable improvement on re-testing after remission of the

post-traumatic confusional state. The progressive nature of the improvement is well brought out in one case. In two cases learning ability was fully restored, but in one there was definite residual impairment. These findings were in good agreement with clinical opinion.

(3) Some characteristic features of performance often associated with mild organic *sequelae* of head injury in the cognitive sphere are illustrated in two cases. These are contrasted with the test behaviour of a case of post-traumatic anxiety-neurosis without significant organic disability.

(4) The influence of a visual-agnostic condition on test performance is described in one case. It is stressed that the performance of a case of this kind must be carefully distinguished from a psychoneurotic reaction, which it superficially resembles.

(5) Performance in a gross case of motor aphasia is described and discussed. Although learning was clearly impaired, it is pointed out that the record does not greatly differ from that of a deteriorated patient without aphasia. The influence of aphasia on a test of this kind cannot therefore be assessed on present evidence.

(6) The close relation of learning defects to catastrophe reaction is emphasized in a number of the cases. It is pointed out that re-learning is commonly impaired following catastrophe breakdown, and performance is thereafter marked by various types of perseverative reaction. These are described and analysed in the individual cases.

(7) It is concluded that the patients, with one exception, betrayed no reversion to the more primitive types of test procedure defined by Rey. In general, the attitude adopted towards the test was high-grade and the procedure experimental.

(8) Some tentative applications of the Rey-Davis method to neuropsychiatric assessment and diagnosis are briefly considered.

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MARRIAGE AND MENTAL DISEASE: A STUDY IN SOCIAL PSYCHOPATHOLOGY.*

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INTRODUCTION.

THE problem of mental disease has been approached in many different ways, and chemical, anatomical, biological and psychological methods have been employed. In certain cases it has been possible to obtain satisfactory results by the use of one isolated method: the serological and anatomical approach has given us a useful solution to the problem of general paresis; the genetic approach has been equally useful in the study of mental deficiency. Such great results may explain the prevailing tendency in psychiatric research to attack *all* the problems of mental disease by the systematic use of one single method, in the hope that the final result is only a matter of time and of technical refinement. One author believes in the anatomical approach, another in the chemical; and there is a tendency to exclude other methods, in the belief that they cannot give results of basic importance. Psychiatry also has its eclectics, but generally the most intensive research work is carried out by the various "schools," and with a definite exclusiveness of methods.

Up to a certain point the accumulation of facts obtained by the exclusive use of one method is satisfactory and useful. But when the time comes for interpretation of these facts, one will inevitably feel the need of a set of more general viewpoints, which can only be worked out through an intensive co-operation between various methods and approaches. In this co-operation one approach is above all necessary—the social approach. Other methods work to a large extent with symbols and abstractions. In social research, on the other hand, the problems are studied *as they appear*. Mental diseases are treated as difficulties of social adaptation, without any attempt to translate them at first into the language of some other level of integration, as for instance the chemical level with its specific language of formulas and other abstractions. The social approach, with its directness, is particularly useful when the time comes for scientific synthesis, for interpretations, and for the working out of general points of view. But if social psychiatry is to fill its place as a factor of co-ordination in psychiatric research, the development of exact methods is urgent.

The central and basic method is that of social observation, which is in fact an extension of the usual clinical observation—an observation not only of the patient himself and his various symptoms, but even of his social environment and his reactions to it. But as a foundation for such an exact social observation we need a complete set of social statistics. Without this our observations

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will never reach the level of scientific facts which lend themselves to quantitative analysis and to the working out of scientific laws.

1. *The Material.*

The present investigation is based upon statistical material from Norway, which in the author's opinion has many advantages. The population of the country is uniform in race, culture and social conditions, and it is relatively stable with regard to migrations. The system of public care for the insane is old and relatively highly developed, and uniform and complete statistical data are available from a long period of years. These statistics cover all, and not only the public, institutions for mental disease (including even the two psychiatric clinics and the only neurological clinic of the country, but in these cases only the cases suffering from psychoses). Finally the size of the population is convenient, so one is not forced to work with more or less satisfactory samples.

The basic material consists of all first admissions in the period of 1926-35, altogether 14,231 cases. With the kind assistance of colleagues from all the institutions, individual index cards were worked out for each patient, giving the main social and clinical facts: age, residence, sex, marital condition, diagnosis, age at onset of the first symptoms, duration of the present attack, condition on discharge, etc. This card index has been completed up to 1940, and makes it possible to follow each patient from his first admission to any Norwegian hospital to his final discharge. Changes of diagnosis can be taken into account, duplications are avoided, and the distinction between first admissions and readmissions becomes reliable. From these cards detailed statistical tables could be worked out, but personal examination of such a number of patients (or case-histories) was of course impossible.

To make possible a combination of this *extensive* statistical approach with a more *intensive* clinical examination, a supplementary material of 707 case-histories was examined more closely, all of them treated in the Psychiatric University Clinic of Oslo, and at that time personally examined by the author. Consecutive admissions of neuroses and functional psychoses were selected, with the exclusion of organic, epileptic, symptomatic and senile psychoses as well as imbeciles. In each case a fairly complete case-history was available, whereby the constitutional and environmental background for the pathological reaction was particularly taken into consideration. Even a material of 707 is sufficiently large to prevent closer analysis of each individual case, so the study of this *clinic material* must be regarded as a compromise between statistical and clinical methods. Nevertheless it completes the *national material* in important points, and is sufficiently large to give results of statistical significance.

2. *The Marital Condition of the Insane.*

The first problem to be selected for study was the remarkable predominance of mental diseases among the single, which is a fairly well-known statistical observation, and which has been treated by Neil A. Dayton and others. The

rates of admission are from three to four times higher in the single than in the married. This predominance shows interesting and typical variations according to sex, age, diagnosis, occupation, etc., and an attempt is therefore made through analysis of these variations to throw some light upon the social background for this remarkable difference.

Generally speaking three explanations are possible :

(1) *The hypothesis of hospitalization.*—A single person, when developing a mental disease, is more readily admitted to a mental hospital, whereas the married are more frequently treated outside of institutions, and so do not appear in our statistics.

(2) *The hypothesis of selection.*—Those who develop mental disease show even before its outbreak certain constitutional traits which act as marriage handicaps, as, for instance, the frequent schizoid personality of later schizophrenics.

(3) *The hypothesis of protection.*—There are in married life certain factors which prevent the outbreak of mental diseases, even if there exists a certain degree of constitutional predisposition. In other words, factors in the life of unmarried persons favour to some extent the outbreak of such diseases.

In the following the incidence of mental disease is expressed by the number of admissions per 100,000 of the population per year. The statistical tables sometimes become rather involved, and the comparison between the admission rates of the single and the married troublesome. In such cases the "*predominance of the single*" (more accurately the predominance of the single among the insane, or the predominance of mental disease in the single) is expressed by means of the quotient of $\frac{\text{rate of admission, single}}{\text{rate of admission, married}}$. A quotient of 4.0 means that the incidence of mental disease (strictly speaking of admissions to mental hospitals) is four times as high in the single as in the married for this particular social group.

Where the factor of age comes in, correction is always introduced by the use of standardized admission-rates, based upon the following age-groups : 15-17, 18-20, 21-25, 26-30, 31-40, 41-50, 51-60, 61-70, and above 70.

3. *The Factor of Diagnosis.*

For practically all diagnoses the rate of admissions is higher in the single than in the married. For obvious reasons the difference is great for the psychoses connected with imbecility and epilepsy, and here the hypothesis of selection gives a satisfactory explanation ; comparatively few of the persons who suffer from these handicaps will get married, and those who marry in spite of their condition will at least be of a comparatively stable type and not apt to develop psychotic complications.

The diagnostic groups with a definitely exogenic etiology all show a rather moderate predominance of the single ; symptomatic psychoses are in the female sex even more frequent in the married, evidently on account of the puerperal cases.

Most important is the striking difference between schizophrenia and manic-

depressive psychoses, while the "constitutional" cases take an intermediate position, which is in good keeping with the mixed character of this diagnostic group. ("Psychosis ex constitutione" is the official term in Norwegian statistics for depressive, hysterical or paranoid reactions which cannot be classified as schizophrenic or manic-depressive.) Here the hypothesis of selection offers a natural explanation. The pre-psychotic personality of many schizophrenics is a most severe marriage handicap, whereas similar seclusive and asocial types are relatively rare among those who develop manic-depressive insanity. But even in the latter, as well as in the senile cases, schizoid and allied constitutional types are more frequent than in the general population, which will explain the small but definite predominance of the single even in these diagnostic groups.

The findings do not exclude altogether the hypothesis of protection, as it is generally supposed that schizophrenia is more readily influenced than manic-depressive insanity by chronic mental and social conflicts of the type which are likely to occur in the life of unmarried persons. But it is most unlikely that this can account for the tremendous difference between the quotients of these two groups, and furthermore it cannot explain why the quotient is higher in schizophrenia than in the largely reactive "constitutional" group.

The hypothesis of hospitalization seems unlikely in view of the facts, as it is hard to explain why this hypothetical factor should be more effective in schizophrenia than for instance in manic-depressive and senile psychoses.

4. *The Factor of Age.*

Our problems of selection or protection by marriage concern the time previous to the onset of the mental disease. The influence of the disease itself on the marriage chances is self-evident, and should, if possible, be eliminated. This could be done by using the age at onset of the first symptoms as a basis for our statistical calculations, instead of the age on admission. But the marital condition at onset is not known, and it cannot be assumed that it is the same as the marital condition on admission, because many patients marry during some remission of the disease. Among our 707 clinic cases, 81 (or 23 per cent. of the total number of married patients) had married during a remission—that is, a considerable time after the first onset, but previous to the first admission. The percentage of "remission marriages" is higher for men than for women (28 to 18 per cent.), and in particular it is remarkably high in schizophrenic men, with a percentage of 40 (a fact which is of considerable eugenic importance).

The best method is to use the *age at onset of the present attack*. The marital condition at this age may safely be assumed to be the same as that on admission, because very few patients marry after the onset of a chronic mental disease, or after the onset of the present attack of a remitting disease. In the clinic material only two such marriages were found. Tables I–III are therefore worked out on this basis.

It was shown that the predominance of the single varies from one diagnostic group to another. Now this might be a mere result of differences in age

TABLE I.—Standardized Rates of Admission per 100,000 per year for Single and Married, by Diagnosis and by Sex.
All Ages above 20 Years (Age at Onset of Present Attack).

	Men.				Women.			
	Single.		S: M.		Single.		S: M.	
	Married.	S: M.	Married.	S: M.	Married.	S: M.	Married.	S: M.
Schizophrenia	71.7±1.9	15.4±0.8	4.7±0.06	57.5±1.5	19.0±0.6	3.0±0.04		
Constitutional psychoses	10.8±0.9	4.3±0.4	2.5±0.12	12.2±0.7	6.5±0.4	1.9±0.07		
Manic-depressive "	13.3±1.0	8.4±0.4	1.6±0.09	18.3±0.9	12.0±0.5	1.5±0.06		
Senile and arteriosclerotic	9.9±1.1	5.9±0.3	1.7±0.12	11.6±0.8	6.3±0.4	1.8±0.08		
Psychoses with imbecility	8.0±0.7	0.9±0.2	8.6±0.20	4.3±0.4	1.1±0.2	3.8±0.16		
Syphilitic psychoses	8.9±0.8	7.5±0.4	1.2±0.10	2.3±0.3	2.6±0.2	0.9±0.16		
Epileptic "	2.0±0.4	0.8±0.2	2.4±0.32	1.2±0.2	0.6±0.1	2.1±0.28		
Organic "	2.2±0.4	1.6±0.2	1.4±0.23	1.4±0.3	1.2±0.1	1.2±0.22		
Alcoholic "	3.8±0.5	2.4±0.2	1.6±0.17	0.4±0.2	0.3±0.1	1.5±0.49		
Symptomatic "	1.8±0.4	0.8±0.2	2.1±0.27	2.2±0.3	2.6±0.2	0.9±0.17		
Other and unclassified types	0.4±0.2	0.2±0.1	2.1±0.85	0.4±0.2	0.4±0.1	1.1±0.48		
All diagnoses	132.8±2.9	48.3±1.2	2.7±0.03	111.8±2.1	52.5±1.0	2.1±0.03		

TABLE II.—Rates of Admission for Separate Age-groups in Single and Married, by Sex and Diagnosis.

	21-25.	26-30.	31-40.	41-50.	51-60.	61-70.	71-.	χ^2 .
Schizophrenia—Men	Single	81.2	106.6	113.5	65.7	44.5	10.2	25.6***
	Married	23.2	25.4	20.6	14.3	6.4	3.3	
S : M		3.5	4.6	5.5	4.6	6.9	3.1	
Schizophrenia—Women	Single	53.8	83.1	86.6	71.5	30.1	12.5	2.6
	Married	16.5	30.3	29.8	21.5	9.5	3.6	
S : M		3.3	2.7	2.9	3.3	3.2	3.5	
Constitutional—Men	Single	..	6.4	11.8	18.9	15.5	9.3	16.3**
	Married	..	4.6	4.8	5.3	5.0	2.7	
S : M		..	1.4	2.5	3.6	3.1	3.4	
Constitutional—Women	Single	8.9	9.3	15.1	23.4	12.9	..	6.6
	Married	5.0	7.6	7.8	10.3	6.7	..	
S : M		1.8	1.2	1.9	2.3	1.9	..	
Manic-depressive—Men	Single	..	8.4	13.1	19.0	19.9	19.1	2.3
	Married	..	5.7	7.0	12.1	14.8	11.5	
S : M		..	1.5	1.9	1.6	1.3	1.7	
Manic-depressive—Women	Single	8.7	14.0	15.6	29.2	33.8	13.7	18.4***
	Married	8.5	7.6	13.0	15.3	19.3	9.5	
S : M		1.0	1.8	1.1	1.9	1.7	1.4	
Senile—Men	Single	..	..	..	..	10.8	54.5	14.8***
	Married	..	..	..	..	6.7	23.4	
S : M		..	..	..	..	1.6	2.3	
Senile—Women	Single	..	..	..	..	16.6	55.4	2.3
	Married	..	..	..	..	10.9	26.8	
S : M		..	..	..	..	1.5	2.1	
Psychoses with imbecility and epilepsy—Men	Single	..	9.0	11.6	16.7	12.3	..	13.2**
	Married	..	2.6	1.7	1.6	1.7	..	
S : M		..	3.5	6.8	10.4	7.2	..	
Psychoses with imbecility and epilepsy—Women	Single	5.8	6.0	8.1	7.0	4.3	..	2.8
	Married	2.0	3.1	2.5	1.6	1.0	..	
S : M		2.9	1.9	3.2	4.3	4.3	..	
All diagnoses—Men	Single	100.6	138.4	174.4	154.5	125.1	107.0	57.4***
	Married	38.4	45.4	52.1	57.4	49.7	47.5	
S : M		2.6	3.0	3.3	2.7	2.5	2.3	
All diagnoses—Women	Single	80.4	115.0	134.0	143.0	107.4	89.6	7.6
	Married	38.3	54.5	63.2	60.0	52.8	46.8	
S : M		2.1	2.1	2.1	2.4	2.0	1.9	

χ^2 is a statistical measure of the difference (heterogeneity) between the age distribution of the single and that of the married. Where it is marked with two asterisks the difference is significant (with a probability of more than 99 to 100)—that is: the predominance of the single varies significantly with age.

distribution. The predominance of the single might be so high in schizophrenics because it tends in general to be high in the younger age-groups. Table II shows that is evidently not the case. Within each diagnostic group the predominance shows no tendency to decrease with age—it remains constant, or (in certain groups) *increases* with age. We may conclude that the variations with diagnosis are independent of the age factor.

Table II shows that in women the predominance of the single remains the same throughout the age-groups. In manic-depressives there is some heterogeneity, which is formally significant, but which does not show any definite trend, and which is therefore nevertheless probably incidental. In men, on the other hand, the predominance tends to increase with age to a maximum in middle age, followed by a slighter decrease in the highest age-groups. This can naturally be explained as a result of selection; the single represent a negative selection, and this tends to weigh heavier with increasing age, because more and more of the presumably best material leaves this group to join the married. In women (and in manic-depressive men) this influence of progressive selection is not in evidence—possibly because selection by marriage is on the whole less important in the female sex (see section 5).

The hypothesis of protection is less promising. The problems of single life may be felt more heavily in middle age, and this may explain why in the male sex the predominance of the single shows a maximum around this age. But it is not easy to see why the same maximum is not found in women as well, and not in manic-depressive men.

The hypothesis of hospitalization is decidedly contradicted by the statistical observations. Among the younger patients the single are frequently still living with their parents, or they have at least a home to which they can return in case of illness. They consequently have greater chances of avoiding hospitalization than the young married patients. With increasing age this will change, until in old age the married patients are more apt to be treated at home than the single. In view of this one would expect the predominance of the single to increase rapidly with age, which is contrary to the observations.

5. *The Factor of Sex.*

The predominance of the single is more marked in men than in women. This is true of all diagnostic groups except senile psychoses, and of all age-groups except those above 61 years.

If the married represent a selected group, then it is to be expected that this selection would be more intensive in the male sex, because marriage to a man means more of a positive effort than to a woman. The customs of courtship make it possible for a woman to become married even if personality handicaps prevent her from taking a very active part in the life of other young people. The clinic material shows that among married women there were 45 per cent. with such handicaps, in their pre-psychotic personality, against only 24 per cent. for the married men.

The explanation offered by the hypothesis of protection is more doubtful. Unmarried life is likely to represent the heaviest strain, not on men, but on

women, because they are allowed less sexual freedom, and because it constitutes a real social handicap (at least above the age of 30-35, when spinster-hood looms on the horizon). Also the desire for family life and for children is probably stronger in women—but then the sexual urge is definitely stronger (or rather more awake) in single men. The sexual protection in marriage is a factor of importance for most married men, but for many wives who never reach sexual adjustment it is of doubtful value, and in addition to this they have all the conflicts of pregnancy and childbirth. Economically, on the other hand, marriage would be more of a protection for women than for men, who generally feel the strain of responsibility increasing when they marry.

The hypothesis of hospitalization again fits in very poorly, as it must be quite evident that a married man has far less chances of avoiding commitment than a housewife, who in many cases can take care of her housework in spite of fairly advanced mental symptoms. According to the Norwegian census of 1930 more than 1,000 insane women were at that time classified as "housewives working in their own homes."

6. The Factor of Occupation.

Table IV shows that in all occupational groups the admission-rate is several times higher in the single than in the married, which proves conclusively that the predominance of the single is not due to a difference in occupational level. The predominance varies from one occupation to another, but these variations do not follow any definite trend: occupations with high and low incomes with secure and unstable employment are scattered irregularly over the table. Now it is a well-established fact that economic factors connected with occupation influence the marriage rate, or particularly the chances of an early marriage. The right part of Table III shows that in the late twenties the marriage rate is (for obvious reasons) high in farmers, public servants and trade owners, low in seamen, farm labourers, clerks and salesmen. But the mainly economic

TABLE III.—Standardized Rates of Admission in Single and Married Men, 26 to 60 Years of Age (at Onset of the Present Attack) by Occupation. All Diagnoses except General Paresis and Alcoholic Psychoses.

	Admissions per 100,000 per year.			Married per 100 in the general population.		
	Single.	Married.	Rate S : M.	26-30.	31-40.	41-50
Seamen, officers and crew	243.6	39.8	6.1 ± 0.16	39	76	91
Fishermen	122.7	23.9	5.1 ± 0.16	38	70	84
Public service	199.4	47.2	4.2 ± 0.22	60	86	93
Farmers	157.6	38.2	4.2 ± 0.10	58	80	87
Farm labourers	173.8	42.8	4.1 ± 0.11	33	57	69
Artisans	157.9	51.1	3.7 ± 0.10	48	77	86
Clerks	98.5	29.7	3.3 ± 0.24	38	83	89
Labourers	126.4	41.5	3.0 ± 0.08	50	77	85
Professional service, teachers	128.9	44.0	2.9 ± 0.18	41	77	90
Salesmen and waiters	119.7	40.6	2.9 ± 0.27	38	73	85
Trade, owners and proprietors	89.7	33.9	2.6 ± 0.18	54	80	88
Chauffeurs, technicians, railroad-men	100.5	40.0	2.5 ± 0.27	55	83	92

Correlation between the quotient S/M and the percentage of married in the age-group of 26-30 (columns 3 and 5 of the table): $r = -0.24$.

TABLE IV.—Standardized Admission Rates in Single and Married, 20-59 Years of Age, by District of Residence. All Diagnoses except General Paresis and Alcoholic Psychosis. The Right Part of the Table shows the Percentage of Married in the General Population.

	Admissions per 100,000 per year.						Married per 100 in the general population.					
	Men.			Women.			Men.			Women.		
	Single.	Married.	S: M.	Single.	Married.	S: M.	20-29.	30-49.	50-59.	20-29.	30-49.	50-59.
South-Eastern	{ Rural	113.7	36.1	3.2±0.14	110.0	53.9	2.0±0.13	22	73	40	75	75
	{ Urban	140.8	31.4	4.5±0.12	114.5	60.5	1.9±0.10	29	84	37	74	74
Eastern	{ Rural	159.4	37.8	4.2±0.14	135.4	53.4	2.5±0.12	17	70	37	75	75
	{ Urban	171.7	33.0	5.2±0.12	126.6	51.9	2.4±0.10	24	81	37	77	77
Southern	{ Rural	170.9	37.9	4.5±0.17	149.1	49.7	3.0±0.13	15	68	34	74	74
	{ Urban	186.9	43.8	4.3±0.14	132.7	42.7	3.1±0.11	23	79	33	71	71
Western with Bergen	{ Rural	183.5	31.5	5.8±0.11	159.8	39.6	4.0±0.10	15	73	31	71	71
	{ Urban	176.1	28.4	6.2±0.14	124.4	60.9	2.0±0.10	22	80	28	69	69
Northern.	{ Rural	116.7	21.6	5.4±0.12	88.9	29.2	3.0±0.10	17	74	36	77	77
	{ Urban	128.5	19.1	6.7±0.17	101.5	43.4	2.3±0.12	23	81	31	73	73
City of Oslo	..	209.2	49.8	4.2±0.07	162.2	75.1	2.2±0.07	18	73	23	62	62

factors which determine these differences evidently do not influence to any great extent the incidence of insanity in the single and the married; there is no correlation between the third and the fifth column of the table.

It follows that our hypothetical "selection by marriage" has very little to do with the economic selection which actually takes place with marriage in the general population. In fact other considerations have already led us to assume that the selection in question is one by personality type.

The introduction of this *personal* factor may explain the irregular aspect of Table IV, because a selection by personality traits will not necessarily follow the lines of economic selection. In the public services, for instance, the chances of an early marriage are apparently favourable, but nevertheless the married have a relatively low incidence of insanity, which would indicate a particularly strict personal selection. Schizoid and allied types will, in other words, in this occupational group have a comparatively small chance of breaking through the marriage barrier, in spite of economic conditions which favour marriage. The opposite seems to be the case with salesmen and waiters; here the social and economic conditions do not favour marriage, but nevertheless a comparatively large number of personally handicapped types pass the marriage barrier, so that the admission-rate for the married becomes relatively high. This difference between groups which occupy about the same place on the social ladder can naturally be ascribed to a difference in social attitude; in the public services a serious outlook, a feeling of social responsibility and a certain caution of enterprise tends to predominate—as a result of selection as well as of habit. In such a social atmosphere any personal marriage handicap tends to become accentuated. In private business life, on the other hand, the atmosphere is more enterprising and easy-going, and the possibilities of personal contacts are also better, and so the handicaps are more easily overcome.

Similar considerations might be invoked in order to explain other irregularities on the table—for instance, why the predominance of the single is higher in farmers than in farm labourers, while the opposite would rather have been expected in view of the social conditions of these two occupational groups.

Altogether the statistical observations neither confirm nor contradict in any convincing way our "hypothesis of selection," but they show conclusively that such a selection must at any rate be of a personal and not of an economic nature.

The *hypothesis of protection by marriage* is, however, decidedly less likely in view of the statistical data. Protection of an economic nature is excluded by the lack of any corresponding trend in Table IV. As to sexual and personal protection, there is no reason why it should vary from one occupation to another. In particular one would not expect to find such a protection to be most effective in seamen and fishermen.

Even more decisively do the statistical data speak against the *hypothesis of hospitalization*. If variations exist in the tendency to hospitalize the insane, then these variations would undoubtedly depend mainly upon economic differences, but Table IV shows that the predominance of the single is largely independent of the economic level.

Altogether the findings are inconclusive, but the fact remains that, the predominance of the single is not mainly determined by economic factors, like level of income, level of training and education or security of employment. At any rate the influence of such factors must be to a large extent obscured by more important factors of a personal nature.

7. *The Factor of Residence.*

Table IV gives admission-rates for single and married in five main sections of Norway. Among the "urban" communities are included not only cities, but also suburban and industrial communities which are administratively classified as rural, but which are so densely populated that the social conditions are in the main urban. General paresis, alcoholic and senile psychoses are left out, as their disproportionately high incidence in cities (which was shown by the present author in a previous study) would represent a source of error: the relatively low predominance of the single in these diagnostic groups would unduly influence the urban admission-rates.

The table shows that in all parts of the country the rates of admission are much higher in the single than in the married, but there are certain regional variations, many of them statistically significant.

In the male sex the predominance of the single is everywhere higher in the urban districts, while for women the opposite is the case. (In both cases Southern Norway forms the only exception.) Now the general marriage-rates show exactly the same picture: for men the percentage of married is highest in the urban districts (probably because the social and economic conditions are more favourable); for women it is highest in the rural districts (probably because the considerable surplus of women in the cities reduces their marriage chances). This means that the predominance of the single is highest in places where it is in general most easy to get married, which suggests social selection as the underlying cause: individuals with personal marriage handicaps tend to remain single even where the social and economic conditions in general favour marriage, and consequently they will become relatively more and more numerous among the single the more this group is being reduced by marriage.

The hypothesis of protection is far less promising. Socially as well as economically the single are probably most heavily handicapped in rural districts, whereas marriage, on the other hand, will most readily lead to social problems under urban conditions. But this is so for both sexes, and so this hypothesis cannot explain why the findings are opposite in men and women.

When the various rural districts are compared, we find that the predominance of the single is highest in the West, North and South, that is, where the marriage rate is *lowest* (and this negative correlation is high for both sexes). This is rather bewildering, and can only be explained by assuming that the mechanism of selection by marriage is not the same in urban and rural districts. It seems that in the countryside favourable general marriage chances will help even the personally handicapped to break through the "marriage

barrier"—in other words, that here social and economic conditions mean more and the personal factors less than in cities.

The explanations offered above are far from satisfactory. Nevertheless, the fact remains that the statistical data indicate selection rather than protection as the decisive factor. The marriage handicap which underlies this selection seems to be of a personal rather than an economic or social nature, but its mechanism is far from clear.

8. *The Pre-psychotic Marriage Handicap.*

The hypothesis of selection is based upon the assumption that persons who develop mental diseases have even before the onset had reduced chances of marriage as compared with the general population. It is possible to test this assumption by demonstrating in the past histories of the single clinic patients social or personal factors likely to have constituted marriage handicaps. In Table V a number of such factors are listed. Most of them are seen to occur with the same incidence in the married patients (which in this case may be used as a control group), and consequently do not seem to have had the expected influence upon the marriage chances.

TABLE V.—*The Incidence of Pre-psychotic Marriage Handicaps (Factors Likely to have Reduced the Chances of Marriage) per 100 Patients Above 25 Years of Age, Single and Married.*

	Men.		Women.	
	Single.	Married.	Single.	Married.
Psychopathic heredity	39	48	40	42
Unhappy relations between parents	17	16	15	15
School record below the average	17	16	13	14
Neuropathic trends in childhood	22	18	27	18
Personality handicaps	55	24	42	25
Chronic alcoholism	17	18	..	..
Venereal diseases	5.4	7.2	1.9	4.3
Invalidism, poor health	13	17	24	26
Unemployment, irregular employment	38	19	..	..
Economic difficulties	28	26	9	19
Number of cases	92	166	106	162

Personality handicaps (mostly traits from the schizothymic-schizoid register), however, are twice as common in the single as in the married. This indicates that there is a certain selection connected with marriage, and that this selection is based above all upon personality factors. The difference is smaller in women than in men, which is in good keeping with the observation that the predominance of the single is less marked in the female sex. It is natural that personality handicaps should (in this particular connection) mean less to women, owing to their more passive rôle in courtship.

The influence of personality type as a marriage handicap is illustrated in some detail in Table VI. In the single balanced types are definitely less frequent, while schizoid and schizothymic types predominate. Hysterical and infantile personalities are found as frequently among the married as

TABLE VI.—*Pre-psychotic Personality of Single and Married Patients.*

	Men.		Women.	
	Single.	Married.	Single.	Married.
Personality well balanced	28	35	20	34
Schizothymic	25	12	17	12
Schizoid	24	6	15	6
Sensitive and depressive	15	31	32	24
Hysterical and infantile	3	3	10	14
Hyperthymic and other unbalanced types	5	13	6	10
Total	100	100	100	100

among the single, in good keeping with the general experience that such types have (particularly in the female sex) surprisingly good chances on the marriage market. Sensitive and depressive types are in the male sex even more common among the married; evidently their serious outlook on life, coupled with considerable depth of feeling and craving for human contact, are factors which are predisposing to marriage; in women on the other hand such traits seems to act rather as handicaps. That hyperthymic and allied types should predominate among the married is not surprising.

There is undoubtedly an *economic* selection connected with marriage. In occupational classes with a high income and stable employment the percentage of marriages (particularly of early marriages) is higher, and in each class an analogous selection is at work. This economic selection is difficult to distinguish from the selection by personality type, because personality is one of the factors which determines the degree of economic success. It does not seem to be a factor of primary importance, however. The clinic material shows that 50 per cent. of the patients with a definitely psychopathic personality had steady occupation up to the onset of the present attack, against 66 per cent. of the well-balanced types. Among the psychopathic types the schizoid with 48 per cent. steady employment and the unstable types with 44 per cent. seem to be most severely handicapped. These differences are fairly large, but not sufficiently decisive to show that personal and economic selection are identical—they merely prove a certain degree of overlapping.

Table V shows that unemployment or irregular employment previous to the onset of the present attack is twice as common in the single as in the married, which seems to verify the existence of an economic selection. But nevertheless positive complaints of economic difficulties are no more common in the single than in the married. Many single men are able to get through periods of unemployment without serious economic difficulties, because they live with parents or other relatives, or because their responsibility is limited. The married, on the other hand, may well have serious economic problems in spite of steady occupation. A more detailed study of the nature of the economic difficulties in question shows that the problem of the single has generally been unemployment and lack of the bare necessities of life, frequently with periods of vagrancy. In the married it has more often consisted in defending a somewhat higher but uncertain standard of life against adverse

conditions of work and income : a new and larger farm has been bought and the patient worries over the increased responsibility ; a house has been built on borrowed money, etc.

We may conclude that the married start out as an economically privileged group—a result of “economic selection by marriage.” They remain to a large extent protected against unemployment—partly because they are forced to the policy of sticking to the secure jobs instead of taking chances, and partly because employers tend to favour the married when work is scarce. But their initial protection against economic difficulties gets lost gradually because of the increasing responsibility of supporting a growing family. The economic factor seems, therefore, to be of a selective rather than a protective nature.

9. *Sexual Factors.*

What is known of the pre-morbid sex life of the single patients gives further support to the hypothesis that we here deal with a social group with a definite marriage handicap—see Tables VII and VIII. Overt sexual conflicts were found in only 15 per cent. of the single men and 18 per cent. of the single women. But this merely means that their maladjustment has mostly been of a more passive and indirect type : more than half of the single have had little or no contact with the other sex. In men this passive maladjustment is definitely linked with schizophrenic psychoses and schizoid personality type, while the manic-depressive patients seem to have led a more normal sex life. This is in good keeping with the observation that the predominance of the single is insignificant in the latter diagnostic group. In women, on the other hand, the attitude of sexual passivity seems to occur more independently of diagnosis and personality type, which may be a result of their more passive rôle in courtship : a passive attitude towards the other sex does not signify as much in a woman as in a man as a symptom of psychopathic personality. When it comes to the frequency of actual engagements, the difference between manic-depressives and schizophrenics is rather marked even in the female patients.

The attitude of sexual passivity manifests itself in different ways. Some are merely cold and uninterested : have never cared for such things ; “doesn’t understand those things at all.” This type is most common, and is linked definitely with the schizoid make-up. Common is also the shy and bashful type, interested in the other sex, but awkward and unable to make contacts. Others are characterized as childish and undeveloped, immature, “like a child,” and this immaturity is also present in other spheres than sex life. Still other types are more rare : those who are abnormally haughty towards the other sex, always fault-finding and hypercritical—nobody is good enough for them ; or those with intersexual traits, the feminine men and the masculine women ; or finally those who are unable to get through the process of emancipation from the parents, but prefer to stay at home instead of founding their own family.

It is quite evident that single life to many of these passive individuals is the most “normal” and adequate attitude, and that it is not necessarily connected with any inner conflicts or any feeling of want or of inferiority.

TABLE VII.—*Pre-morbid Sex Life of Single Patients by Diagnosis, per 100.*

	Men.			Women.				
	Schiz.	Man.-dep.	Neurosis.	Total.	Schiz.	Man.-dep.	Neurosis.	Total.
Little or no connection with the other sex	62	21	50	53	57	59	35	51
Normal connection	17	24	11	16	17	2	10	11
Is or has been engaged	13	48	25	21	23	37	45	33
Active sex life with loose relations	8	7	14	10	3	2	10	5
Total	100	100	100	100	100	100	100	100
Patients with overt sexual conflicts—per 100	15	7	20	15	8	20	31	18

TABLE VIII.—*Pre-morbid Sex Life of Single Patients by Pre-psychotic Personality Type, per 100.*

	Men.			Women.				
	Balanced.	Schizoid-schizothymic.	Sensitive, depressive.	Other types.	Balanced.	Schizoid-schizothymic.	Sensitive, depressive.	Other types.
Little or no connection with the other sex	40	64	39	45	53	53	53	38
Normal connection	31	11	11	11	7	12	10	17
Is or has been engaged	19	19	32	33	37	30	37	31
Active sex life with loose relations	10	6	18	11	3	5	..	14
Total	100	100	100	100	100	100	100	100

Marriage to them would not mean a solution to the sexual problem, but a constant danger of conflicts and maladjustment. As a group they have a high incidence of psychoses, particularly of schizophrenia—but this is primarily a result of selection, and not of lack of “protection by marriage.”

In others sexual passivity is an attitude which is forced upon them by their personality handicap, and which must lead to a series of mental conflicts. Not a few find a solution in masturbation, but even this may lead to new and bitter difficulties. In such types also the incidence of psychoses is high, and here there is actually clinical foundation for the hypothesis that lack of the “protection by marriage” has been a pathogenetic factor. It is, of course, difficult to decide (even after a careful clinical analysis) with which of these two types of sexual passivity one is dealing in each individual case, but it is the author's impression that they are about equally common. This would mean that the factor of “lack of protection” *may be* at work in about 25 per cent. of the single patients.

Among the single patients one-fifth of the men and one-third of the women were or had been *engaged* on admission. But a closer analysis of these cases shows that engagement is very far from being a sign of good sexual adjustment. Among 81 schizophrenic and manic-depressive patients who were or had been engaged, the engagement was broken or the relations were more or less unhappy in 70. In most of these 70 cases there is direct evidence that the patients themselves are at least partly responsible for the difficulties: they are unable to decide between several possible partners, and at last are left without chances; or the engagement is a silent and sentimental feeling for some colleague or childhood comrade, and ends in silent disappointment when the partner tires and marries another; or it lasts for years and years because the patient is unable to decide on marriage (economic reasons may be given, but personal inhibitions are mostly responsible). Quarrels and difficulties are frequent, with jealousy on the part of the patient as the most common background. Sometimes the patient breaks off relations for some trivial reason, which shows the typical self-centred and over-critical attitude; in other cases the partner withdraws, and this often results in life-long bitterness, because the ability to readjust is missing. Not infrequently their choice has been remarkably unwise (a really bad girl, a worthless fellow, a tuberculous invalid), which may be what Freud has described as flight-mechanism, but which is sometimes merely a result of helplessness and lack of common sense. In 3 cases only was the engagement broken for obvious economic reasons. Overt sexual fears and inhibitions were found in only 6 cases, but no doubt furnished the subconscious background in a far greater number.

In a majority of these 70 broken engagements the social and sexual maladjustment of the patient was clearly responsible for the failure, and so one may conclude that these patients remained single as a result of the “selection by marriage.” But there can, on the other hand, be no doubt that most of them suffered from this failure on one of the most important fields of social adaptation, and the possibility therefore exists that they belong to the group in which lack of protection by marriage (or in other words the handicaps of single life) has been an aetiological factor.

10. *Environmental Factors.*

The hypothesis of protection is based upon the assumption that married life is in some way or other more favourable for mental health. Now nothing is more difficult than to establish that environmental factors have actually been of pathogenetic importance. The present material offers merely a tabulation of environmental difficulties which the patient is known to have undergone previous to the onset of the disease. The numbers given are, of course, definitely minimums.

TABLE IX.—*The Incidence of Environmental Handicaps per 100 Patients, all Ages.*

	Men.		Women.	
	Single.	Married.	Single.	Married.
Connected with parents and childhood	61	59	67	68
Lack of higher education and training	56	56	58	81
Unemployment, at first onset of disease	22	8	..	..
Unemployment, at onset of present attack	26	16	..	..
Other economic difficulties	20	19	9	19
Somatic diseases, invalidism	16	18	22	27
Alcoholism	15	18	4	6
Erotic and marital	15	22	18	38

While the importance of the factors listed on Table IX is therefore doubtful, it is nevertheless of some significance that only one of them (unemployment in men) shows a higher incidence in the single than in the married. The erotic difficulties of the single are more than outweighed by the marital problems of the married. And the privilege enjoyed by the married in the way of less unemployment is outweighed by their increased economic responsibilities. Altogether the material (taken for what is worth) gives no evidence of any protection by marriage.

Table X gives further evidence in the same direction. It shows that

TABLE X.—*Environmental Factors of Possible Aetiological Significance per 100 Patients.*

	Men.		Women.	
	Single.	Married.	Single.	Married.
Conflicts in sex life	8	11	20	21
„ work	7	16	13	6
„ family life	8	6	7	12
Conflicts with colleagues, friends, neighbours	8	9	4	8
Grief (death or illness of relatives)	2	11	7	14
Economic difficulties	7	17	3	11
Emotional shock, anxiety	2	7	4	4
Somatic diseases, poor health	11	13	14	18
Abortion, childbirth, pregnancy . . . . .	..	..	..	15
Total*	53	90	72	109
Of which factors connected with marriage . . . . .	..	21	..	52

* The figures do not represent the number of cases, as several aetiological factors may be registered in each individual patient.

environmental factors, which the clinic, after prolonged examination and treatment, has found to be of probable pathogenetic significance, are at least as frequent in the married as in the single. Of particular interest is the high number of aetiological factors directly connected with marriage, especially in women.

TABLE XI.—*Marital Conflicts per 100 Married Patients.*

(Conflicts connected with the patient's illness not included.)

	Men.	Women.
Husband (wife) or parents-in-law "difficult," psychopathic, etc.	13	18
Husband (wife) alcoholic . . . . .	..	12
Husband (wife) physically ill or invalid	4	4
Husband (wife) deceased	5	10
Unhappy relations for which patient is responsible	13	7
Other conflicts	1	1
No such difficulties present	64	48
Total	100	100
Conflicts in sex relations (+)	8	22
No children after 5 years or more (+)	11	11
Six children or more (+)	16	11

(+) Alone or in combination with one of the conflicts listed above.

A study of the overt conflicts in the married lives of the patients (Table XI) makes the importance of protective factors even more doubtful; at any rate they will in many marriages tend to be outweighed by marital difficulties. Frequently it is possible to trace these difficulties back to the patient's own social, sexual and personal maladjustment; but this does not in the least alter the fact that married life will frequently lead to conflicts which may prove too much for those who are predisposed towards mental illness.

Among the strictly *sexual conflicts* in marriage, frigidity in the women and impotence or ejaculatio praecox in the men are most common. But it is likely that the "sexual protection by marriage" is deficient also in the numerous cases in which the spouse is psychopathic, alcoholic or physically disabled. In some cases patients of schizoid or sensitive personality type will break off sexual relations for ethical or religious reasons when it seems undesirable to have more children. In others the sexual urge is strong and poorly controlled, resulting in extramarital relations, and consequent feeling of guilt. Jealousy, justified or not, is among the most common causes of marital conflicts in our patients.

Among the *social conflicts* those connected with parents-in-law or with children of an earlier marriage take the first place, beside those caused by the illness or death of spouse or children. Less usual are the cases in which marriage was brought about by pregnancy, or in which it was poorly matched, as when a man married his housekeeper, or when a methodist married a man from outside the church.

In spite of all these conflicts, or rather conflict possibilities, there is only one single case in which a definite connection could be established between marriage and the outbreak of the psychosis: a schizoid man developed a depression because of the increased responsibility of married life.

Now the objection is unavoidable that our patients are just the cases in which the protective factors have failed, and the lack of a control material of normals is regretted. What we have actually observed is that the mental diseases of the single differ from those of the married in structure and background: the constitutional elements weigh heavier, while the environmental elements are relatively less important. This indicates, however, that the explanation for the predominance of mental disease in the single must be sought in the constitution—in our words, in our “hypothesis of selection,” especially a selection by personality traits.

II. *The Factor of Duration of the Illness.*

The duration of the illness previous to admission is to a large extent a function of the clinical picture: acute cases with a severe disturbance of behaviour are more readily admitted. But admission depends also to some extent upon the social conditions of the patient. Now the social conditions which are responsible for an early admission (poor and crowded homes, no relatives who can take care, etc.) are generally the same which determine the extent of hospitalization of the insane as a whole. In other words, if in a certain social group the average duration of the illness previous to admission is long, then it is to be expected that a comparatively large number of the insane are never admitted at all. The extent of hospitalization cannot be determined directly, as our statistics deal with the insane in institutions only. The duration previous to admission therefore becomes a valuable test for the hypothesis of hospitalization. If the predominance of mental disease in the single is due to a more complete hospitalization, then one would expect a shorter duration of the illness previous to admission in the single than in the married.

In Table XII the duration is given in broad age-groups by diagnosis as well as by sex and by marital condition. In cases with remission only the present attack is counted, in order to avoid the source of error which lies in the frequent marriages during a remission of the disease.

There is no need to discuss the findings in detail. A glance at the table is sufficient to show that there is no difference in duration between the single and the married, which is a strong point against the hypothesis of hospitalization. The assumption is justifiable that the predominance of the single is wholly dependent upon other causes.

12. *The Rate of Admissions in the Widowed.*

A study of the incidence of mental diseases in the widowed is of great importance for the solution of our problem: is the predominance of insanity in the single due to protection or to selection by marriage? After the death of the spouse the protective factor decreases in importance or disappears altogether, while the factor of selection remains, and so theoretically can be studied in pure culture. In practice, however, this experiment is far from perfect. The social and personal life conditions of the widowed are not only characterized by loss of the protection by marriage. They have to face

TABLE XII.—Duration of Illness Previous to Admission in Single and Married. All Ages.
(In remittent cases the duration is of the present attack).

Duration in whole years.		0-1.				2-4.				5-9.				10-.				Total.		Average duration.																																						
Men	Schizophrenia	Single	49	32	13	6	100	3.1	Married	51	28	13	8	100	3.2	Constitutional	60	26	8	100	2.6	Married	54	27	9	10	100	3.5	Manic-depressive	90	8	1	1	100	0.8	Married	84	12	1	3	100	1.2	Senile	45	32	19	4	100	3.0	Married	45	37	14	4	100	2.9		
		Single	49	29	13	9	100	3.4		Single	51	31	11	7	100		3.1	Single	56	28	8		8	100	3.1	Married	54	30		8	8	100	3.2	Manic-depressive	85		9	3	3	100	1.2	Married		83	12	3	2	100	1.1		Senile	45	34	12	9	100	3.6	Married
	Women	Schizophrenia	Single	49	29	13	9	100	3.4	Married	51	31	11	7	100	3.1	Constitutional	56	28	8	8	100	3.1	Married	54	30	8	8	100	3.2	Manic-depressive	85	9	3	3	100	1.2	Married	83	12	3	2	100	1.1	Senile	45	34	12	9	100	3.6	Married	46	37	12	5	100	2.9

TABLE XIII.—Admission Rates for Single, Married and Widowed Above 30 Years of Age on Admission.

Standardized rates, relative (married = 100).	Men.						Women.					
	Single.		Married.		Wid.		Single.		Married.		Wid.	
	Absolute rates.	Difference Wid.-mar.										
31-40	218	48	92	44±18.2	158	60	66	6±11.2				
41-50	207	58	74	16±12.4	173	60	80	20±8.7				
51-60	159	52	60	8±8.8	133	57	76	19±6.8				
61-70	143	42	47	5±6.9	107	45	52	7±5.3				
71-.	71	60	35	-25±5.9	85	37	45	8±5.4				
Schizophrenia	707	100	144	44±30.2	373	100	92	8				
Manic-depressive	166	100	107	7	164	100	126	26±17.4				
Senile	144	100	78	-22±10.8	227	100	147	47±12.6				
General paresis	135	100	143	43±35.2	91	100	132	52±40.7				
All diagnoses	336	100	131	31±12.8	256	100	122	22±8.2				

environmental problems which in many respects may make their social adjustment more difficult than if they had never been married at all. But this is not always the case, and many widows and widowers will, when the first shock is over, still be able to enjoy at least part of the privileges of family life (home life and children, etc.). It is therefore difficult to determine to which degree the protection by marriage is lost by the death of wife or husband.

What complicates the problem further is that the factor of selection does not remain the same in the widowed. It is well known from other branches of vital statistics that those who remain widowed represent a negative selection, because the socially, mentally and physically privileged will tend to re-marry.

These sources of error are so important and so difficult to correct that the value of a statistical investigation becomes doubtful: individual analysis of the influence of widowhood in each separate case seems indispensable. Another difficulty lies in the fact that even a material of 14,000 admissions does not contain a sufficient number of widowed to give results of statistical significance.

With these reservations we present in Table XIII rates of admission for the single, the married and the widowed. We find that in both sexes the total admission-rate is significantly higher in the widowed than in the married (the difference being more than twice its standard error). But this moderate increase does not bring the admission-rate of the widowed anywhere near that of the single, which is more than twice as high.

The age distribution of married and widowed differs so markedly that standardized rates will tend to cover up valuable information. A study of separate age-groups shows that in men the difference in disfavour of the widowed is very marked (and statistically significant) in the thirties. It decreases with age, and above the age of 70 the admission-rate of the widowers is significantly *lower* than that of the married. In women, on the other hand, the difference is most marked in the forties and fifties, and it is particularly small in the thirties. These observations are best explained as resulting from a selection by re-marriage: widowers frequently re-marry, and consequently those who remain widowers represent a negative selection with regard to predisposition towards mental disease. The influence of re-marriage tends to diminish rapidly with age, and furthermore it is less important in women, whose chances of re-marriage are not nearly as good.

The number of cases is somewhat small for a subdivision by diagnoses, and the standard errors are consequently very large for some diagnostic groups. Nevertheless it is of interest to notice the high incidence of *general paresis* in the widowed of both sexes, higher even than in the single. Conjugal infection is probably the explanation. Furthermore we notice that in the male sex *schizophrenia* is considerably more frequent in the widowed than in the married (the difference is 44 ± 30 , and so rather suggestive, if not quite significant). In women, on the other hand, there is a slight difference in disfavour of the married. This is evidently a result of selection by re-marriage—a factor which will naturally influence the rates of schizophrenia in particular. For manic-depressive psychosis the admission-rates in the widowed are for both sexes only insignificantly increased—evidently because the mechanism of selection is less important for this diagnostic group. The hypothesis of protection does

not explain the findings nearly as convincingly: the loss of the hypothetical "protection by marriage" would have made itself felt in widows as well as in widowers (or even particularly in them), and it would probably influence the incidence of melancholia even more than that of schizophrenia.

Senile psychoses are in the male sex significantly less frequent in the widowed than in the married, while in the female sex the opposite is the case. It is possible that senile widows may be more readily hospitalized than the widowers, owing to their social and economic status, but it is unlikely that this can alone explain the findings. Here we must in fact resort to the hypothesis of protection: In advanced age the "loss of protection by marriage" must be particularly hard on women, because to them widowhood means economic and social hardships in addition to personal grief. The absence at this age of any selection by re-marriage contributes to the lower rates in the male sex. Why senile psychoses (particularly above the age of 70) should actually be *less frequent* in widowers than in married men is difficult to explain in light of the hypothesis of protection. Is it possible that the economic, personal and even sexual responsibilities of married life represent a burden rather than a protection to men of advanced age?

We conclude that the statistical findings seem to support the hypothesis of selection rather than that of protection. The widowed have lost the (hypothetic) protective influence of married life—and nevertheless their incidence of mental disease is only moderately higher than that of married people, and less than half of what is found in the single. Only for the psychoses of advanced age does a loss of protection by marriage seem to be in evidence, and in the female sex only. For the younger age-groups, and particularly for schizophrenia, selection is the only possible explanation, and in the widowed we have been able to show that it exists even in the form of a "selection by re-marriage."

Neil A. Dayton finds that the admission-rate is much higher in the widowed than in the single, and concludes that "apparently marriage is a protective factor of considerable importance." His figures are misleading, however, as he has not taken into consideration the difference in age distribution.*

The divorced are not included in any of the groups discussed above, and their number is in Norway too small for a separate examination. Besides, a divorce is too frequently a mere *result* of the disease,† and therefore its possible effect as an aetiological factor can hardly be studied by statistical methods.

SUMMARY.

The observation that the incidence of mental diseases is higher in the single than in the married is confirmed in a representative material of 14,231 first admissions to Norwegian mental hospitals. There are three possible explanations to this:

* In a later and more comprehensive publication Dayton has shown that when the age distribution is taken into consideration, the admission rate of the widowed lies, even in his material, well below that of the single. This book was not available in Norway until January, 1946, and so it was not possible to discuss Dayton's findings in relation to the present material.

† In Norway it is possible to obtain divorce on the grounds of incurable insanity of more than three years' standing.

(1) A single person, when developing a mental disease, is more readily admitted to a mental hospital (*hypothesis of hospitalization*). This hypothesis is contradicted by most of the statistical and clinical observations, and need not be discussed further.

(2) Those who develop mental disease present even before its outbreak certain personality traits which act as marriage handicaps, and the married consequently represent a positively selected group (*hypothesis of selection*).

(3) There are in married life certain factors which prevent the outbreak of mental diseases (*hypothesis of protection*).

The statistical analysis shows that the predominance of mental disease in the single presents certain characteristic variations :

1. It is much higher in schizophrenia than in manic-depressive psychoses. It is high in psychoses with imbecility and epilepsy, low in general paresis and in organic and symptomatic psychoses. This indicates selection by personality type rather than protection as the underlying factor.

2. In women the predominance of mental disease in the single is independent of age. In men it increases with age to a maximum about the age of 40-50. This again indicates selection rather than protection. In men the single group is reduced by marriage up to this age, which leads to a progressive selection and an increasing rate of mental diseases. In women this progressive selection stops at an earlier age, and is also less intensive.

3. The predominance is more marked in men than in women, which points in the same direction ; a positive selection by marriage according to personality traits will weigh less heavily in the female sex, because of its more passive rôle in courtship.

4. The predominance varies from one occupation to another, but irregularly, and without any connection with the level or security of the standard of living. It follows that our hypothetical selection by marriage has little or nothing to do with the *economic* selection, which is a statistically well-established fact.

The hypothesis of protection is decidedly contradicted by these occupational variations. Protection of an economic nature is excluded by the lack of any corresponding trend in the statistical data ; and as to sexual and personal protection, there is no reason why it should vary from one occupation to another, and why it should for instance be particularly marked in sailors (who present a very high predominance of the single).

5. When different parts of the country are compared, the predominance of the single is highest where the general marriage rate is highest, which is for men in the urban districts and for women in the rural ones. This seems to indicate that personal marriage handicaps are felt most severely in places where the social conditions in general are favourable for marriage.

6. A clinical study of a smaller but representative material shows that personality traits (particularly from the schizoid register) which are likely to act as marriage handicaps are actually twice as common in single as in married patients. This is particularly true of the schizoid traits (shut-in personality), while hysterical and infantile as well as hyperthymic types are found at least as frequently among the married.

Economic difficulties are fairly equally divided between the single and the married; but while in the single they have mostly consisted of unemployment and lack of the bare necessities of life, they have in the married generally taken the form of a struggle to defend a somewhat higher but uncertain standard of living against adverse conditions and the increasing expenses and responsibilities of family life. The married start out as an economically privileged ("selected") group, but their advantage over the single in this respect tends to get lost gradually, because of increasing economic burdens. The economic factor, therefore, seems to be of a selective rather than a protective nature.

7. A study of the pre-morbid sex life of single patients gives further support to the hypothesis that we are here dealing with a social group with a definite marriage handicap. Generally their sexual maladjustment is of a passive type, and linked with schizoid personality traits.

8. The hypothesis of protection is based upon the assumption that married life is in some way or other more favourable for mental health. A detailed clinical study of the environmental conflicts, which may have contributed to the outbreak of the disease, does not reveal any predominance of such conflicts in the lives of the single, and so gives no support to the hypothesis. On the contrary conflicts which are directly connected with married life are fairly common.

9. The incidence of mental diseases in the widowed is only slightly higher than in the married, and much lower than in the single. The loss of the hypothetical protection by marriage (in addition to many serious problems of personal and social readjustment) is evidently of no great influence upon the incidence of mental diseases in the widowed, which indicates that this protection cannot possibly be sufficiently important to explain the marked predominance of mental diseases in the single. The slight difference in disfavour of the widowed may easily be explained in accordance with our other hypothesis as a result of selection by re-marriage. This would also explain why it is more marked in men than in women: widowers re-marry more frequently than widows.

GENERAL CONCLUSIONS.

It is shown beyond doubt that the incidence of mental diseases is much higher in the single than in the married, and that this "predominance of the single" among our insane is no statistical figment caused by such factors as a difference in age distribution or in the tendency to hospitalize the insane.

It has not been possible to show positively the existence in married life of any factors (sexual, personal or economic) which protect against the outbreak of mental disease. This may be due to inadequacy of method and material, but there seems to be statistical and clinical evidence against the existence of such factors, and in any case it is most unlikely that they should be of primary importance.

It has been positively established, on the other hand, that the predominance of mental disease in the single is at least to a large extent a consequence of a

selection by marriage, and that this selection is based upon personality rather than upon economic factors.

In the author's opinion the problem of "protection or selection" is a basic one in social psychiatry, the further study of which is of importance even for our conceptions in general of the pathogenesis of mental disease and of the balance of "nature and nurture" in psychopathology.

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PSYCHOLOGICAL INVESTIGATION OF A GROUP OF INTERNEES AT BELSEN CAMP.

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INTRODUCTION.

This investigation was carried out at Belsen between May 21 and June 27, 1945. As it was impossible to examine psychiatrically all the cases, only those showing evidence of psychological upset were referred for examination by the physicians. In addition, to obtain a cross-section of the population, I selected at random 60 to 70 cases in hospital and convalescent areas—ones that did not fall into the first group.

Owing to the congestion in the camp, the administrative difficulties and the physical illnesses of so many of the patients, investigations were carried out under far from ideal conditions and usually without the necessary privacy.

The methods of investigation were :

- (a) Interviews in the wards and follow-up of cases whenever possible.
- (b) Interviews in the Sister's duty room.
- (c) A small number of cases were interviewed in the convalescent area.

In every case unconfirmed histories were obtained and the medical case-sheets, if any, were inadequate. This was due to the very poor or non-existent documentation of the Germans.

BRIEF HISTORY OF BELSEN CAMP.

The following points are brought out in the history of the camp, to indicate factors causing the different forms of breakdown (disorders of personality, habit and behaviour disorders, psychoneurosis and psychosis).

Initially the camp of Belsen was used for Russian prisoners of war. About June or July, 1944, the first women internees were brought there. They came from Labour Camps for "convalescence"; they were found unfit physically as slave-labour on account of various organic diseases due to malnutrition. One or two months later they were joined by Dutch and Belgian women and children. In September or October a convoy of 1000 Polish women arrived from Warsaw. A small hospital was set up in which internee doctors were employed, but supervised by a German medical officer. About November or December, 1944, the first mixed convoys arrived and a male camp was formed. In January, 1945, the last Russian prisoners of war left the camp, and from then onwards it was used purely as a concentration camp.

At least 90 per cent. of the internees had previously been in other labour or concentration camps. Often they went from one camp to another, and Belsen seemed to be the last on the list. There it was extermination by

starvation. According to the information I received, the rations were about 9 oz. of bread and two pints of turnip soup per day for each internee.

Many of the internees came from the notorious camp of Auschwitz; they had no names—only serial numbers tattooed on their forearms. In that camp they lived under continuous fear of death, where anyone was likely to be selected for the gas chamber or the incinerator; anyone was likely to be given an intravenous injection of petrol or creosote, etc. (Many of them had seen their relatives killed or sent to the gas chamber, and all they could do was to go with them. (Nearly all the internees were deprived of the few treasured possessions, such as photographs, etc., which would have reminded them of the ties linking them with the outside world.)

The following were the living conditions in the camp before the liberation: (The men and women were separated. A "children's home" was included in the women's camp. They lived in overcrowded wooden huts, without beds, and in many cases without blankets—some without any clothing at all. In some cases the living lay beside the dead.

Many of the internees were too weak to walk. They defaecated and urinated even inside the living-huts. The sanitation was insufficient and more than inadequate.

To these stresses were, in many cases, added those of living in close contact with uncongenial companions.

When first entered by British troops, the camp contained approximately 50–60,000 people, of whom about 10,000 lay dead in the huts and about the camp.) (Official figures given by the Military Government: 55–60,000 people on arrival, April 15, 1945. On May 1, 1945, about 52,000 people were still alive in the camp areas.)

The internees were evacuated to the adjoining German barracks (ex-Panzer Training School), and the concentration camp itself was emptied and burned. Four hospital and two convalescent areas were functioning on my arrival at the camp.)

It will be seen from the above history that these conditions were more than sufficient to produce the "concentration camp mentality" and different kinds of breakdown.

REACTION TYPES SEEN.

(A) *General and Common Reactions.*

It was noticed that all the patients showed from a dulling to a complete failure of social adaptation; they had lost the gregarious sense and each lived entirely and only for him or herself.

Even family ties had little or in many cases no meaning. The liberation has improved this. There was a blunting or loss of responsibility towards death, cruelty, humiliation.

The sense of values was depreciated. Thieving from the Germans and from one another was rife; lying was the order of the day. Avarice and concealment of food, even when there was plenty (since the liberation), were predominant features.

In short there was a complete absence of the personal and moral ethics in the struggle for existence. Apathy to incidents within the camp; fear for the future of civilization in some, apathy in others. Constant fear and suspicion brought up through years of insecurity in camp life. As time passed, memory of the outside world weakened and seemed to disappear from the internees' consciousness. This produced a restricted initiative arising from the conditions of camp life, and from the almost unbelievable concentration of interest and attention on food.

Bodily habits.—The standard of these was adjusted to the very lowest type in the camp, probably through the humiliations to which the educated classes were subjected and the extremely bad and inadequate sanitary conditions.

(B) *Specific Reactions.*

- (i) Aggression with psychopathic tendencies, inborn or acquired.
- (ii) Masochistic, passive, with or without depression.

The sudden and unpleasant change of environment produced anxiety and feelings of insecurity. Then the poverty, the progressive starvation and the fear of death and cruelty produced apathy, indifference and dullness in a great majority of the internees and rage in an energetic minority. The minority comprised the aggressive type, who showed, in addition, inborn or acquired psychopathic features. (They displayed hardness and insensibility to the feelings of others, with an absence of remorse. Thereafter they acquired control over the poor, weak and inadaptate inmates, though primarily their aggression was directed against their gaolers.

The passive types showed apathy, with failure to respond to environmental stimuli, which would otherwise call forth an effect of some kind. The apathy was accompanied by discouragement, seclusiveness, introversion and depression. Psychomotor retardation was obvious and complete carelessness in appearance general.

SYMPTOMATOLOGY AND BEHAVIOUR DISORDERS.

The symptomatology was different in men, women and children, though some symptoms were common in all internees.

(a) *Common Symptoms.*

The passive types showed a marked reduction in activity, with all gradations up to complete immobility in certain cases.

Impairment of memory for remote events was common to all, even at the time of the present investigation. Family ties were loose until after the liberation.

Terror and fear symptoms were general.

The common normal affects, such as joy, happiness and gladness noticed since the liberation were seldom the true expression of the feelings of these people. They were only a pose—a means to express their gratefulness to their liberators.

Hiding and saving food, even when hunger seemed satisfied at each meal, was common.

Once they realized that they were free again they did not complain as usual—wearily and hopelessly—but fiercely, bitterly and resentfully.

The internees showed a fairly marked social anxiety or loss of confidence in social relations and situations.

During their stay in the concentration camps they had realized that the lessons of civilization and morale seemed rather on a superficial level. At present to those people, good habits, tradition and formality to help maintain decent standards are something foreign, utterly remote.

(b) *Men.*

On the whole behaviour disorders were more profound. Aggression or apathy were more marked than in the women. There was noticeable carelessness in appearance, even after the liberation. Sexual reactions were abnormal. Homosexuality and great sexual appetite were common.

There was slow response to liberation and limited rehabilitation, and inability to express their joy when the British troops entered the camp. They were staring aimlessly at the British tanks, and their first impulse was to get hold of the food stores.

(c) *Women.*

Maternal instincts were normal but dimmed, even after the liberation. At the time of the liberation there was a dulling or even complete lack of sense of modesty. They were undressing publicly, and to those who were present they seemed sexless.

After liberation return to normal was fast. It was interesting to note that as soon as the first primitive necessities of food and sleep were seen to, they asked for forgotten luxuries, such as combs, mirrors, powder, lipstick, pyjamas. They showed a marked interest in their personal appearance, and the very fact of possessing civilized garments acted like a powerful tonic.

One of the chief symptoms was amenorrhoea. It was reported that in the Labour Camps about 60 per cent. and in Auschwitz and Belsen at least 90 per cent. of the women suffered from amenorrhoea. The usual explanation given was that bromide or some other chemicals in the food produced the condition. In some of the cases interviewed I was able to find definite evidence that the emotional element was prevalent (Cases 5 and 6).

Greatly exaggerated sexual appetite and some sexual abnormalities were present.

(d) *Children.*

Young children from one to eight years of age exhibited no marked disorders, and did not show fear or terror symptoms. They seemed cheerful and happy. They were laughing and smiling, and played with the toys given to them (Cases 11 and 12).

Children of 8 to 16 years of age were more precocious than normal children—they evinced fear reactions, but readjustment was reasonably fast (Case 13).

NEUROSIS AND PSYCHOSIS.

From the first general survey of the camp (hospital areas) no figures were obtained as regards the psychotic and obvious neurotic cases.

I advised that certain wards should be used for such cases only. This was done, and after four weeks 46 psychotic patients were assembled (40 women and 6 men).

The reactions were mainly schizophrenic in that they showed depression, introversion—including two catatonics—and a few had maniacal outbursts. The older patients exhibited a schizophrenia simplex, but patients between 20 and 30 years of age exhibited fluctuating paranoid features, all associated with fear of hunger, death and torture. It was reported that they did not react to the liberation.

Delusions were not common. One patient had delusions which were associated with a fear of injections (aroused by the German methods of preparing people for the incinerator [Case 18]).

On the whole it was very difficult to determine whether we were dealing with a toxic psychosis due to avitaminosis, a post-typhus confusional state, or pure endogenous psychosis. The documentation prior to the liberation was extremely poor or *nil*, and often I met with the phrase, "I think she (or he) had typhus."

The gross neurotics were the only ones referred for opinion. Symptomatology was mainly of the conversion type associated with the gross fear of death. The conversions were either inability to see or inability to hear—"shutting out the unpleasant" (Cases 15 and 16).

In most of the cases previous neurotic history was denied, but this may have been partially protective, as the Germans destroyed the unfit.

The low number of psychotics and gross neurotics was probably the result of elimination either by the Germans or natural means, when they were unable to look after themselves in the manner required under concentration camp conditions and adopted by everyone, e.g. stealing, lying, "organizing."

TREATMENT USED.

Thorough explanation of the condition with reassurance was usually rejected. One had to fight against distrust and suspicion while interviewing and treating the patients.

Firm but sympathetic handling, with gradual lessening of the firmness, proved more satisfactory. Gradually family ties neared normality. They showed interest in their future, and discussed freely the difficulties of re-adaptation.

The diminution of symptoms was most marked in those who had prospects to return to in their own country, where they expected to go back to a normal civilized home life—as opposed to the more unfortunate internees who had no prospects of returning to security in their own country, or whose personal problems were difficult or insoluble. This, of course, applied mainly to the Poles. In the case of Jews of all nations who had lost everything (families,

homes, social positions, etc.) the anxieties of readaptation and feelings of insecurity were more marked.

DISCUSSION.

The causal agents of the "concentration camp mentality" are, of course, obvious and entirely due to fear, although one cannot forget the complete isolation from the outside world and the exposure to conditions which induced humiliations. The subsequent reactions of everyone—not only those who showed evidence of mental disorders—were due entirely to their fight to exist. It was a struggle for the survival of the fittest. The thieving, lying, etc., were entirely protective. It was interesting to note how even after the removal of their fear these reactions persisted, e.g. the purposeless hiding of food and stealing, even when plenty was available. This resembled in many ways the senile reactions. They were acutely afraid of to-morrow.

In the neurotic types the fears abnormally exaggerated were nevertheless completely controlled by their necessity of living, i.e. they stole although they knew the penalties.

The instinct of preservation dominated the whole outlook of everyone, except the young children, who were reasonably treated in Belsen. This I gathered from the histories as given to me by those interviewed. Even the strong maternal instincts in certain cases were obliterated; mothers in some cases elected their children to go to death and did not go with them.

The response to treatment is indicated before, and the factors influencing it.

METHODS OF TREATMENT AND REHABILITATION.

Any man visiting for the first time a concentration camp like Belsen would have difficulty in believing that human beings could suffer and fall so low in the scale that they no longer seemed to be ordinary men and women, but something "sub-human." He would realize that these people are sick in mind and body, and would ask, "Will they be fit again—will they be able to re-adjust themselves into normal society and become useful citizens?" The answer is: "Yes."

My opinion of the methods of treatment and rehabilitation of these people after liberation and satisfaction of the primary needs like food and comforts is:

(1) Quick removal of all possible from the camp area and from the sound of the language of their gaolers.

(2) Segregation by nationalities and, if possible, districts and towns. Treatment and nursing by their own nationals. Employment of enemy staff is strongly condemned, and should only be used as a very temporary emergency.

(3) Rehabilitation should begin in the wards as soon as the patients are fit, and should consist of reading their own literature and current newspapers. Discussions with people, whenever possible, who have recently come from the area of their homes.

(4) Going on to occupational therapy, in which they are taught to do useful things and encouraged to look after themselves and to earn their keep, e.g. in one square the medical officer in charge got hold of cloth, needles, thread,

etc., distributed them to the patients and encouraged them to make their own clothes. This turned out to be a great success. It was only an example of purposeful occupational therapy.

(5) Opening of, as soon as possible, communications with their homes and relatives who might be in other camps, by means of registers.

(6) Later, when the patients are physically fit or convalescent, family camps should be set up and everything should be done to bring the families together.

(7) The prison discipline should not be suddenly discontinued. Slow readaptation to liberty is very much better than sudden removal of discipline.

(8) As the patients improve so should the normal methods of civilization be allowed to impinge on them. They should not be given too much too liberally, but should learn to work for their privileges and necessities.

(9) Apart from the general outline of that management enumerated above, in those cases requiring individual psychiatric help, and in whom insight is sufficient, free discussion of the symptoms (cause and effect) should be undertaken.

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APPENDIX.

ILLUSTRATIVE CASES.

CASE I.—K. R—, aged 31, male; single, Polish, R.C.

Seen in "convalescent camp."

History.—There is little relevant in family or personal history. Civil occupation, priest. Sent to concentration camp as a "political prisoner" in 1941. Has been in different camps until he finally landed in Belsen in March, 1945. While there he had typhus. He felt exhausted and "broken," and was so weak that he was unable to leave the hut. Many of the men in the hut were sick—some were actually dead—but no one seemed to bother. "It didn't affect me any longer. I just got used to it," he says.

He states: The lack of food and chronic hunger have produced apathy and depression. Psychomotor retardation was general; fear of death was absent; complete lack of modesty was obvious; lack of responsibility towards fellow men was more than common. He himself felt humiliated—"political prisoner, and being treated like a criminal!" The only interest shown by the internees was in food. They were continually hungry, and in the last stages of the existence of the camp cases of cannibalism have occurred. The internees had one chief worry—one fixed idea: "How can they organize (steal) food?" Nothing else mattered to them.

When the camp was liberated by British troops on April 15 the male prisoners hardly knew how to express their joy; they were just staring at the British tanks, and then their first impulse was to get hold of the food stores. They ate raw turnips and anything else they found. As soon as the first primitive necessities of food and partial rest were seen to, the apathy steadily disappeared.

On examination.—Thinking, behaviour, concentration and memory do not appear to be impaired. He seems to be full of initiative. His conversation is rational, and up to his intellectual standard.

Opinion.—Catholic priest. Good, adequate personality, whose mental state has not been affected by the long stay in German labour and concentration camps. It was considered that he was fit mentally to resume his duties as a priest.

CASE 2.—M. M—, aged 26, male ; Belgian, married, Jewish.

Seen in hospital ; bed patient. Has had diarrhoea for ten days. Shows signs of malnutrition.

History.—Reveals some familial neurosis. He lived a very protected existence, and was a student of law at the University of Brussels. He was rather fussed and spoiled by his parents. His previous history shows mild neurotic traits. He lived in Brussels until 1944, and in March, 1944, was taken to a concentration camp. Most of the time he spent in Auschwitz, and arrived at Belsen one week before the liberation.

He states that he was "chronically hungry" and physically weak. This weakness produced some kind of apathy and "mental depression."

On examination.—He is pale, weak and under-nourished. He is self-centred, full of self-pity and continually asking for food. He expresses various minor functional complaints. His memory is slightly impaired for certain past events.

No persuasion or explanation can move his fixed demand about receiving chocolate, fruit or similar "luxuries."

Opinion.—Neurotically predisposed individual, unaggressive and poorly adapted to meet difficulties and sudden stresses. Exposure to these has produced apathy, depression and indifference. These symptoms are disappearing rapidly.

Once his physical condition improves and he returns to his normal environment he will probably be fit to resume his former work.

CASE 3.—K. S—, aged 31, male ; Polish, married, R.C.

History.—No gross psychopathy in family history.

Left primary school at 13½ years of age. He had to work since 12 years of age because of financial difficulties at home. At the age of 16 he became an apprentice driver mechanic. Before the war he was employed as driver in charge with the Warsaw Bus Corporation. Past history shows mild psychopathic tendencies, although he never had any serious trouble with the civil police. For three years he had been employed by the Germans in different labour camps. Says that he managed well because "he knew how to look after himself and was able to organize" (concentration camp vocabulary: "to organize" = exchange of goods = stealing). Arrived at Belsen two weeks before the liberation.

Physical condition.—No disability.

Mental state.—Intellect average. Co-operative, rather cheerful, no evidence of apathy or helplessness. Much preoccupied with his future and family. Full of initiative and ideas, though at times doubtful because of the insecure future of Poland. Shows little responsibility towards others, and there is evidence of psychopathic tendencies. He is still "organizing," though he realizes that this is theft. He seems to have no appreciation of the value of money. The things he wants to get hold of are clothing, food and cigarettes. When told that at present such an attitude was wrong, he said: "I have struggled for years and survived ; now nothing affects me. I have seen thousands of bodies—I have seen children and women being killed for no reason at all."

Opinion.—Individual of average intelligence, who spent several years in German concentration camps. Displays some psychopathic trends (thieving, lying), which seem to be marked accentuation of his former mild, latent tendencies. If and when returned to his pre-war environment, he will almost certainly resume his former job in a satisfactory manner.

CASE 4.—R. A, aged 34 ; male, Polish, R.C.

Seen in hospital area. Bed patient, though fit to walk about and to look after himself. Apparently had typhus.

History.—He was brought up in a peasant family and never attended school. There is little relevant in family or personal history. Farm labourer all his life. In 1942 sent as "slave labour" to a German labour camp.

Frequent changes, but felt all right as long as he was fed fairly decently. At the beginning of 1945 was transferred to Belsen concentration camp. The sudden change and the "horrible" camp conditions affected him greatly. At first he became depressed, but soon re-adapted himself and did his best to "organize" food. Managed fairly well, then was ill (? typhus) for about two weeks.

On examination.—States that he is hungry, but would be perfectly fit if he could get more food. He shows no signs of malnutrition.

Illiterate, intellect below average, but partly compensated by inborn intelligence. Explanation as regards the difficult food situation and difficulties in general is immediately rejected.

Memory seems hardly impaired. He has one fixed idea, which is the topic of all his conversations—"Food."

Opinion.—An illiterate peasant who has always lived in the country. The stay in labour and concentration camps has hardly affected his previous personality. When returned to his normal pre-war environment he will undoubtedly readjust easily.

CASE 5.—R. A.—, aged 24, female; Roumanian, single, Jewish.

Seen in "convalescent camp," where she is waiting evacuation to Roumania.

History.—Educated in Roumania (secondary school).

Congenial home environment. She lived with her parents—a very protected existence. She never had to earn her living. She describes marked emotional instability features all her life. Never seemed to be able to settle anywhere; often felt "unhappy"—"There was always something missing." Treated by own physician and advised to go to Budapest for "psychological treatment." After several interviews with the psychologist she mixed better and on the whole noticed a change in herself. Soon she got "bored with social life."

Travelled for several months and improved once again. Then the war began and the Germans occupied Roumania.

In 1944 (April or May) she was taken to the concentration camp in Auschwitz. Following the sudden change she stopped menstruating. Amenorrhoea lasted six months.

In Auschwitz there were periodical medical "selections" for the gas chamber and crematorium. The "prisoners" had to parade naked in front of the German camp medical officer. Whoever was unable to leave his bed because of illness, or had some infectious or skin disease, was usually "selected." Six months after her arrival at the camp she attended one of these selections. She had "some spots" on her left arm and was frightened to death. Suddenly, while waiting in the queue, she started menstruating.

Later was transferred to Belsen concentration camp, but no recurrence of amenorrhoea.

On examination.—At present she complains of "frigidity" and "lack of sexual desire." Duration—all her life. Anxious, worried and irritable on this account.

Thinking, attention and memory appear hardly impaired. Intellect well above average. Shows no acute anxiety symptoms, though worried because of her "sexual difficulties."

Opinion.—She is an emotionally unstable person. Her history reveals various neurotic traits dating from childhood. Camp life has aggravated temporarily her constitutional neurosis.

She is recovering slowly, but requires psychotherapy.

CASE 6.—G. H.—, aged 35, female; Polish, married, Jewish.

The above-named is a doctor, and at present employed as such in one of the hospital areas.

History.—There is nothing relevant in her family or personal history. Happy and normal early home environment. College, university, and qualified at the age of 24 years.

Employed as a doctor in Poland until 1942. She did all she could to avoid a concentration camp. Suddenly she realized that she would be sent to one and this was a "terrific shock" to her. Once she got to Auschwitz she stopped menstruating. The amenorrhoea lasted nine months. During that time she was employed in the camp hospital area; fed fairly well according to camp scale. After nine months the amenorrhoea disappeared without any special treatment. In 1944

she was transferred to Belsen concentration camp. Same trouble for about 12 months, which she attributes to the sudden change of environment and the continuous insecurity. Once she settled and continued to be employed as a doctor her amenorrhoea disappeared.

On examination.—She admits some mild impairment of memory, but otherwise she feels perfectly fit. She is obviously worried about her husband, whom she hasn't seen for several years. She is also worried about her own future, which seems to her very insecure.

Concentration and thinking normal. There is no evidence of any overt anxiety or acute neurosis.

Opinion.—Previously good adequate personality. The stay in concentration camps has produced temporary mild neurotic symptoms, which were a culmination of a series of anxious reactions. The predominant sign was amenorrhoea.

Her present anxiety and general attitude as regards her family and future are entirely justifiable.

On the whole, no frank psychiatric illness or serious personality change.

CASE 7.—B. M—, aged 24, female ; Polish, single, Jewish.

May 22, 1945 : Seen in hospital area. She is a bed patient at present. Her sister occupies the bed beside her.

History.—There is nothing relevant in the family history. She left school (secondary) at 17 years of age. No previous serious illnesses, no evidence of previous psychopathy. Before the war she appears to have lived a very protected existence with her parents. In 1940 she was compelled to live in the Ghetto. In 1942 she was transferred with a number of other women to a labour camp in Germany. She remained in labour camps until January, 1945, when she was finally sent to Belsen concentration camp for "convalescence." There she contracted typhus and dysentery.

Physical condition.—She complains of general weakness and fatigue. At present no acute organic disease. Seems physically tired and under-nourished.

Mental state.—She converses freely, shows an impairment of memory, and on the whole appears rather apathetic. She seems self-centred, and displays little or no feelings even towards her sister. She realizes that her sister is seriously ill, but seems helpless, and does not even try to talk to the doctor or nurse about it. She keeps repeating, "What can I do? My sister doesn't want to eat—she is getting worse daily," when questioned about her.

There is a definite blunting of responsibility towards death and cruelty following prolonged exposure to it.

May 28, 1945.—Her condition is gradually improving. She shows more insight into her sister's condition. Her only interests at present are directed towards her own appearance, food and her sister.

June 3, 1945.—Her sister died yesterday. For the first time she became tearful, seemed upset about her loneliness, and said, "I am alone now. I have no relatives left—I have no one."

June 5, 1945.—Her physical and mental condition are much improved. She is able to walk about and takes interest in her personal appearance; she is preoccupied with her future, which seems very uncertain and insecure; shows little initiative, and her attitude on the whole is a passive one—"Let's wait and see what happens," she says.

Opinion.—Previously fairly adequate personality. At present she shows the typical signs of the "concentration camp mentality," e.g. apathy, depression and blunting of ethical and moral values. She is likely to return to her normal self if properly handled, and will probably require re-education after convalescence.

CASE 8.—G. A—, aged 26, female ; Czech, married, Jewish.

Seen in convalescent area.

History.—Nil relevant in family history. Congenial early home environment. Secondary education; school certificate. Lived with her parents until aged 20. Then she married. Her husband was a doctor; she lived a protected existence, without any financial difficulties, had a nice and well-furnished home. Had one child. She denies previous neurotic features and says that she has always been rather cheerful, mixed easily with other people and has had no serious illnesses. In concentration camps for over two years. At first in Auschwitz, where she lost

her child (killed by the Germans). In Belsen since January, 1945. Had typhus, and previously for months suffered from malnutrition. She says, "I was chronically hungry. I had to "organize" otherwise I would not have survived."

She admits that even at present she must "organize" food and clothes. She explains that her appetite is "terrific" and her clothes are shabby. She realizes that "organization" means stealing, but nevertheless adds, "It doesn't matter."

On examination.—She is rather talkative and gives the impression of happiness. Shows slight motor over-activity. She does not appear affected by the separation from her husband, who, she believes, is in Russia. She shows a great interest in her personal appearance; her "sexual appetite" seems exaggerated, and produces a certain amount of aggression towards the opposite sex. Her attention is normal; her memory is mildly impaired for remote events.

Opinion.—An extraverted young woman whose present behaviour and reactions are only an exaggeration of her normal previous personality. Mentally she is hardly affected, except that she acquired psychopathic tendencies during her stay in the concentration camps. These will almost certainly disappear once she returns to a normal home environment.

CASE 9.—J. J—, aged 28, female; Polish, single, R.C.

At present employed as a doctor in one of the hospital areas.

History.—She denies any familial or previous personal psychopathy. She was brought up and educated in Lwow. For over a year she was under Russian occupation; then the Germans overran the country and occupied her home town. At the time she was a student of medicine at the Lwow University. She was involved in Polish underground work. When she was just about to be qualified she was caught by the Gestapo and sent to Auschwitz concentration camp. After one or two months she was transferred to the camp hospital area and was there employed as a doctor. Slowly she adapted herself to the "new life," and realized that this was only a temporary unpleasant change. She used to receive parcels from home, and they were a big help owing to the small rations.

About February, 1945, she was transferred to Belsen; had typhus, but recovered rapidly. Since the liberation she has been employed on medical work.

During her stay in the camps she has suffered from amenorrhoea for three months; occasionally felt depressed, but never to a psychotic degree.

On examination.—At present she feels occasionally irritable and restless. This she attributes to the insecurity of the future of Poland. She doubts whether she will be able to return home, as her home town is likely to be incorporated into the Soviet Union. She also admits some slight memory impairment; otherwise she feels perfectly fit, though she realizes that "something has changed in herself."

She says, "My emotions, my reactions to normal life are different." She feels that the fear, the horrors and the humiliations have affected her. Her personal problems, which are various and difficult, some even insoluble, have produced a mild degree of brooding introspection and resentment.

On the whole her conversation is up to her intellectual standards. There is little evidence of any gross changes in her mental condition.

Opinion.—A woman of good, adequate personality, who shows no evidence of previous neurotic ill-health. Held in concentration camps for over two years as a "political prisoner," where she was treated as "a common criminal." Her readjustment may be long because of her personal problems, which seem complicated. Nevertheless, I feel that she would readapt rapidly if repatriated and returned to her normal pre-war environment.

CASE 10.—P. P—, aged 38, female; Russian, married, Orthodox.

Seen in the Maternity Block. Pregnancy—8½ months.

History.—She is a nearly illiterate peasant, brought up in Russia (Ukraine). She denies previous serious organic or functional diseases. Her husband is in the Russian Army. When her country was overrun she joined the partisans and was with them nearly two years. In October, 1944, she was sent to labour camp and transferred to Belsen in February or March, 1945.

On examination.—She seems a very cheerful woman, clean and tidy. She shows a good deal of interest in her personal appearance. She is co-operative, converses freely and is anxious to return home. The sister in charge of the ward states, "She is the cleanest woman in the Maternity Block."

Opinion.—A woman of low intelligence and very poor education. The frequent and sudden changes of environment (living with the partisans and in labour and concentration camps) have not affected her mentally. She will readjust easily when returned to her pre-war rural environment.

CASE 11.—P. W—, aged 6, Czech girl; Jewish.

Seen in children's hospital. Bed patient. Pulmonary tuberculosis.

History (as given by the child).—Her parents were "very young." She is an only child. She was happy at home and seems to have been in a congenial home environment. In Belsen for a long time on her own.

It is reported that she has been in the children's home even before the liberation.

On examination.—In the wards she is cheerful; she plays with the other children, and is very proud of the doll she was given by the sister. She is friendly with the staff, and likes them because they are very nice to her. It was easy to establish "a friendly relationship" after a few minutes of conversation. Physically she appears well developed; her intelligence rating seems normal for a child of her age.

She is cheerful and seems happy in her present environment. No evidence of timidity or sensitiveness. She plays with the toys she was given, and especially likes the doll she was given by the sister. Answers questions with a friendly smile, but her attitude changes when asked about her parents. She then becomes somewhat morose and sad. Eats well and often saves bread or biscuits "for later." She says that before she was often hungry, and therefore now she keeps the food in case it happens again.

Opinion.—Six-year-old child, who shows no serious behaviour or habit disorders. Personality deviations are *nil* or negligible.

She seems hardly affected by the stay in concentration camps. Now, if brought up in a normal environment and properly handled, she should show no gross personality disorders.

CASE 12.—L. G—, aged 6½, Dutch boy; Jewish.

Seen in the children's hospital. No acute organic disease except impetigo.

On examination.—Full interview is somewhat difficult, as the child speaks Dutch only and understands little German. It is reported that the patient is somewhat timid, mainly with people he has not seen before. In the ward he seems cheerful, mixes well with the other children, plays with them, and on the whole is easy to handle. The boy seems to be of average intelligence, bright looking, and when spoken to in German he does his best to answer the questions. He often smiles, and does not appear to be unduly shy. In general displays no gross personality, behaviour or habit disorders.

He states: He lived with his parents in Amsterdam until September or October, 1944, when they were sent to Belsen concentration camp. Soon afterwards he was separated from his parents and hasn't seen them since. (It is reported that his parents probably died in the camp.) Since then he was kept in the children's home, and after the liberation he was transferred to the Children's Hospital.

Opinion.—A bright and fairly cheerful youngster who, in spite of the stay in concentration camps, shows no marked disorders, such as fear and terror symptoms. Readaptation is fast, and immediate return to a congenial home environment would be beneficial.

CASE 13.—R. F—, aged 10, Polish girl; Jewish.

Seen in the hospital area. She lives in the same room with her grandmother, mother and younger sister. During the interview only the children were present.

History.—Before the war she lived with her parents in Warsaw. Congenial early home environment. The house was apparently comfortable, clean and well kept.

Soon after the fall of the Polish capital the Germans forced the Jews to live in a ghetto. Her parents wanted to avoid this and the whole family went to the south of Poland. She has not seen her father for 18 months. She arrived at Belsen concentration camp three weeks before the liberation.

On examination.—She converses freely and shows no marked disorders of behaviour or habit. She seems more precocious than a normal child of ten. She has evinced fear reactions, but readjustment is reasonably fast. She says, "I wouldn't be alive now if my parents hadn't escaped from Warsaw." When asked

why, she says, "The Germans used to kill the children and burn them in the crematorium." She talks about the German atrocities and horrors, without the normal sadness, without the emotional reactions one would have expected. Apathy is hardly noticeable, but slight apprehension is still present.

At present she seems hopeful, and says that it is possible that her father is still alive in Buchenwald. She adds rapidly, "I would be very happy; I wouldn't miss anything if my father could only be with us."

Opinion.—A ten-year-old girl with no history of previous important personality or behaviour disorders. At present readjusting well. Soon she will probably be as normal as any child of her age, though somewhat more precocious.

CASE 14.—S. A—, aged 12, Italian girl; R.C.

She is at present a bed patient in the Children's Hospital. Cough and "chest trouble" for several weeks. No clinical signs of tubercle.

History.—Brought up in Fiume. Congenial and happy early home environment. Father Jewish, mother Catholic. Father a wee bit strict; somewhat spoiled by her mother. Average at school. Mixed well with the other children. No special habit or behaviour disorders admitted.

Because of her father's denomination she was sent with the rest of her family to Auschwitz concentration camp. After several months she was separated from her parents, and she hasn't heard from them for over 12 months.

While in Auschwitz an identity number was tattooed on her forearm. She seems very much upset about it.

Arrived at Belsen three or four weeks before the liberation.

On examination.—Makes no complaints. Feels perfectly fit, and wants to return to Fiume as soon as possible.

Exhibits nothing abnormal in her attitude and general behaviour in the ward. Mixes well with the other children and enjoys having toys. Cheerful during the interview; intellect seems average according to her age. She talks freely about the horrible sights she witnessed in the concentration camps, and there is little evidence of emotional upset.

Opinion.—A twelve-year-old child with no previous personality, behaviour or habit disorders. She has spent 18 months in concentration camps, and now seems hardly affected mentally. When returned to her home environment she will probably be as normal as any child of her age.

CASE 15.—K. J—, aged 35, male; Czech, married, R.C.

Seen at the hospital. The Medical Officer reports: Had typhus. Recently diarrhoea for several days. Now complains of deafness, but no physical disability found.

History.—Primary education. Mild neurotic trends in civil life. He lived in Prague, where he was employed as a cook in a hotel. He was sent to a labour camp in July, 1944, and has been in Belsen since March, 1945. States that about six weeks ago he was removed from Camp No. 1. At the time he did not realize that the camp was liberated by the British and thought that "his end had come." (In the past he saw many of the inmates being removed and no one has seen them since.) Next day he became very nervous and his hearing was impaired. Ever since then he has been somewhat deaf, feels nervous, and has palpitations with precordial pains.

On examination.—He is tearful, hypochondriacal, preoccupied with his mild bodily ailments. He wants to return to Czechoslovakia at once and wants to see his wife. He is a dependent, self-centred type who hardly responds to reassurance and explanation. He cannot understand why he shouldn't be able to return home—as the war is over and he is a free man again. In spite of the fact that his intelligence seems average and explanation is given, he has difficulty in grasping the problems which have to be solved before he can be repatriated.

Opinion.—A neurotically predisposed individual who developed conversion symptoms following the change of environment, separation from home and excessive fear. He will probably recover from his present symptoms when returned to his normal environment.

CASE 16.—T. T—, aged 21, male; Polish, single, R.C.

June 1, 1945.—He is a bed patient, and was referred for examination by the German medical officer with the following symptoms: Blindness, contracture of

right fingers and left toes. Physical examination is negative. Clinical notes not available. The medical officer says, "I think he had typhus and mild encephalitis."

History.—He denies any previous family or personal psychopathy. School and employment records fair. He has been in German labour and concentration camps since January, 1943. While in Belsen he was hungry and thirsty; he found a bottle of alcohol and drank it with some of his inmates. Three of them died. He was given an injection, vomited, and then felt much better. Next day he became blind, his fingers (right hand) and toes (left foot) became "deformed." He has remained like this since (six or seven weeks).

On examination.—His face is expressionless, and he stares vacantly at the wall in front of him. He lies quietly, with little spontaneous movement. He seems to be "preoccupied or dreaming." When spoken to he answers questions intelligently. He never smiles, and his facial expression remains unchanged. He appears apprehensive and displays fear reactions. Psychotherapy, including persuasion, explanation and reassurance, fails and is rejected. He is suspicious and distrustful, and one has to fight against it. Firm and rough "treatment" is tried and proves successful. Rest, slight sedation and firm handling are recommended.

June 6, 1945.—He sleeps well. He has been up since yesterday and takes interest in his surroundings. He is no longer blind, and the contractures are hardly noticeable.

June 10, 1945.—The acute conversion symptoms removed. Patient is cheerful, converses freely and shows no gross fear reactions.

Opinion.—A 21-year-old boy, with no previous neurotic trends. Of average intelligence. During his stay in Belsen concentration camp he developed conversion symptoms which were associated with the gross fears of horrors and death. The symptoms produced were contractures and blindness. The patient tried to avoid seeing the obstacles placed in his path ("shutting out the unpleasant"). He has now recovered from his acute condition and is now fit for re-education and readaptation to a normal environment.

CASE 17.—S. J.—, aged 28, female; Polish, single, Jewish.

May 28, 1945.—Seen in hospital. She is a bed patient and has been in the ward for about two hours. She was found wandering round the square. She was apparently confused, did not know her name, the number of her bedroom or block. Past history not available, but it is reported that she had typhus.

On examination.—The patient is unable to give a clear and coherent account of herself. She says that she is hungry, otherwise no complaints. Her face is expressionless, she is slow in thought and in speech, and there is a general reduction in activity. Emotional blunting ++, disorientation for time and place ++, confusion +. Besides her bread, she keeps a basket with old bread (uneatable). When questioned about it she says, "I must preserve it—I may starve."

Treatment recommended.—Rest, observation; fluids by mouth to be given freely and enema with normal saline.

June 2, 1945.—Much improved, though memory still impaired. Patient gives a fair account of herself and says she must have had a "nervous shock." She shows a fair insight into her condition, and thinks that it was due to typhus or some "mental shock."

June 6, 1945.—Patient greatly improved since first seen on May 28, 1945. To-day her attention and thinking are hardly impaired, but a slight impairment of her memory is still present. Shows a good deal of interest in her surroundings, and mixes well with the other patients. There is little of interest in the personal or family history. Recommend transfer to convalescent area.

June 12, 1945.—The patient has completely recovered from her confusional state. Her memory still appears somewhat impaired for past events, but this is common to almost all ex-internees.

Opinion.—The history of this case suggests a toxic confusional state (post-typhus).

CASE 18.—R. A.—, aged 18, female; Polish, single, Jewish.

May 29, 1945.—Seen in hospital; bed patient. The medical officer in charge of the ward states that she has had typhus recently. During her convalescence

seemed somewhat confused, and two days ago suddenly became restless, suspicious and deluded. At present shows signs of malnutrition.

History.—Gives a poor and not very clear account of herself. Prolonged questioning does not help, because she is suspicious, restless and agitated.

On examination.—She seems unable to fix her attention; is readily distractible and continuously preoccupied. Continually reflects on one topic, which is associated with a fear of injections (aroused by the German methods of killing internees or preparing them for the incinerator). She is deluded, and expresses different ideas of reference. She is apprehensive of all the medical officers and nursing sisters. She repeats, "You are getting ready for the injection; it will kill me," etc.

As soon as a medical officer approaches her bed she seeks for cover. Persuasion or reassurance cannot move this fixed idea. Everything has been done to reassure the patient, but without avail.

Sedation and observation recommended.

May 31, 1945.—Condition as above. At times she apparently appears hallucinated, though no hallucinations are detected during the interview. Refuses food and is difficult to handle. Remains deluded, restless and very apprehensive; at times even agitated. She says that last night a cinema picture was given in the ward especially to prevent her from hearing the shouts and screams of the other patients who were given injections. Her ideas of reference are numerous. Physical condition very poor. Recommend tube-feeding.

June 2, 1945.—The patient died last night. It is reported that her mental state remained unchanged.

Opinion.—The history of this case suggests a toxic or post-typhus psychosis.

CASE 19.—M. F—, aged 33, female; Polish, married, R.C.

June 15, 1945.—seen in hospital. She is a bed patient in the psychotic ward. It is reported that she had typhus about four or five weeks ago. At the time she was apparently elated and talkative. Lately lived for two weeks in the convalescent camp. Three days ago she suddenly became elated, talkative and excitable. Admitted to the psychotic ward as a case of G.P.I.

On examination.—It is difficult to get an adequate history from this patient. She is highly deluded, over-active, and shows a typical flight of ideas. Her insight and judgment are *nil*. Her attention is distractible; she is talkative and expresses some grandiose ideas. She thinks that she is very wealthy—she is a goddess—she knows all the medical officers because she has met them in Poland. At times seems aggressive and very irritable.

Sedation and observation suggested.

June 20, 1945.—Quieter in the past two days. She remains deluded and occasionally elated. Physical examination negative.

June 26, 1945.—Although she appears to be more settled, her mental condition is really unchanged.

Opinion.—This patient showed at first symptoms of an acute mania. It is difficult to state without further observation whether this is a case of acute mania or toxic psychosis. The possibility of cerebral syphilis should be considered.

CASE 20.—M. J—, aged 23, female; Hungarian, Jewish.

May 31, 1945.—Seen in hospital. She is a bed patient and shows signs of malnutrition.

History is not available. The medical officer states: She had no typhus. For the past ten days has been depressed, mute, and at times stuporose.

On examination.—Face expressionless, general reduction in activity, almost negativistic. Flexibilitas cerea positive. Shows no interest in the environment. Usually mute, but at times answers simple questions.

June 6, 1945.—Remains depressed and apathetic. At times talks in monosyllables when questioned. Her voice is flat and toneless. She feeds and sleeps well.

June 15, 1945.—Condition as above.

June 23, 1945.—Physically unfit for shock therapy. The only possible treatment at present is rest and observation in the psychotic ward.

Mental condition hardly improved.

Opinion.—Schizophrenia—katatonic.

POST-CHOREIC PERSONALITY AND NEUROSIS.

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I.

IN the relatively short period which has elapsed since the important findings about personality changes after encephalitis epidemica became known, those findings have been mainly responsible for the enormous advance in our knowledge of the sub-cortical direction of man's emotional and volitional life. This advance in psychopathology subsequently gave rise to the question whether similar sequelae could be found in the personality structure of those who had suffered from other forms of post-infectious encephalopathies. Chorea, which had already offered the puzzling problem of why the rheumatic virus becomes "neurotropic" in certain cases, was amongst the first to be considered, whereas 25 years ago no psychiatrist would have seen a special problem in the personality structure after choreic illness. The first investigations which dealt with entirely new problems in chorea minor were those of E. Straus, (1927), who found that *hyperkinetic symptoms* are frequently found, either in a generalized form, or as localized tics as sequelae of chorea minor, and of E. Guttman (1927) and Schulz (1928), who both showed that *hereditary predisposition* of the brain plays an important role in persons who fall ill with chorea minor. A *follow-up study* of chorea cases with regard to personality development had not been undertaken until the present author's first publication on chorea (1934).

II.

Not only chronological procedure, but also the explanation of heuristic principles, which guided the author in his recent investigation, make it necessary to refer first to the findings of the previous investigation, which was carried out in 1933.

The material consisted of 24 cases of postchoreics (in addition to which one case of "chorea-psychosis," viz., of chorea with direct transition into psychosis in a youth, aged 21, was dealt with in detail). Of 50 cases which had been found on the registers of the University Hospital for Children's Diseases in Basle, Switzerland, as treated for chorea minor between 1910 and 1930, the whereabouts of the majority was found out, and they were invited to undergo a re-examination. 24 persons declared their willingness to have it done, and were seen, either in the Psychiatric Out-patients' Clinic (under the direction of Prof. J. Staehelin, who had suggested this follow-up study), or at their homes. 13 cases were female and 11 male, an accidental and atypical distribution, as it is statistically proved that out of 100 cases of chorea, somewhat about 65 belong to the female sex. As to the period which had elapsed since the illness in our cases, 4 cases have had chorea more than 20 years ago; 5, 16-20 years ago; 4, 11-15 years ago; and 6, 6-10 years ago. The oldest patient was 35 at the time of the follow-up, so that in every case at least one of the parents was still alive and able to give an account of the patient's childhood.

As to the methods adopted for personality assessment, in the first instance the usual psychiatric exploration was used, supported by statements of the parents, while out of the numerous auxiliary methods which would have been possible, the author restricted himself to two: the first one was the Rorschach Test, and the second a Characterological Item Sheet, i.e., a sheet containing 45 pairs of characterological opposites, like confiding or seclusive, amenable or strong-headed, shy or cheeky, and so on, which had to be filled in by one of the parents. Besides the examination of the postchoreic personality, special attention was paid to heredity, to social environment, and to physical constitution.

The findings allowed of a subdivision under five headings:

1. Hyperkinetic symptoms.
2. Neurasthenic symptoms.
3. Psychasthenic symptoms.
4. Peculiarities of character development.
5. Peculiarities of temperament.

Hyperkinesis is the symptom most obvious to the eye, and is found, to a higher or lesser degree, in every postchoreic. The hyperkinesis is either generalized and constant, in the form of fidgetiness, restlessness, inability to sit still or kneading the fingers; or else localized and episodic. The latter becomes apparent mainly in form of *tics*, which are usually facial, but sometimes appear as shrugging of the shoulders or head-nodding. Blinking of the eyes is a frequent symptom, and sometimes stammering is found in form of mild defects

of co-ordination in speech. Creak and Guttmann (1935) have described compulsive utterances in postchoreics, which apparently are equivalents of tics, and Straus (1927) has described a case of "coprolalia," i.e., the uttering of dirty expressions. In one of my cases a troublesome singultus was found, which can be regarded as a tic localized in the diaphragm, and has been frequently observed in encephalitic states. Before the sequelae of encephalitis epidemica were known, every tic used to be regarded as hysterical, but since then we have learned that a tic can be a residual symptom of a focal lesion in the striatum, and the same applies to genuine hyperkinesis as a whole. Frequent symptoms of hyperkinesis are also shakiness during writing, or spilling while water is poured out into a glass. There is also a marked tendency in postchoreics to show an increased amount of associated movements, which can easily be tested by letting the patient squeeze the doctor's hand or turn a coin round which lies on the palm with the fingers of the same hand, or use a dynamometer.

Neurasthenic symptoms which are very frequent in postchoreics are headaches, sometimes resembling migraine, and vertigo, attacks of which can spread over many years; less frequent symptoms in this group are insomnia, vomiting and enuresis. Psychasthenic symptoms have been put into a special group, not as if the author would not follow the doctrine of psychosomatic unity—which in fact he does—but because certain symptoms as phenomena reveal insufficiencies in the dynamics of psychic functions. These symptoms which postchoreics frequently complain of are forgetfulness, difficulties in concentration, difficulty in learning new things, diminished perseverance, and being quickly overwhelmed by fatigue. Postchoreics frequently complain of getting frightened by a sudden noise or at the appearance of an unexpected person. The most characteristic symptom, however, in this group is the fact that postchoreics show less vitality than the average person of their age; they are quiet. Their families people soon come to notice that the postchoreics show definitely less vitality than before their illness. Postchoreics make the impression, sometimes at once, of colourless, lame or faint personalities without much drive in life. One can hardly meet a postchoreic who has distinguished himself in his (or her) career, or has done anything outstanding in any respect. The author proposes to call this dynamic weakness of psychic functions a *psychic hypokinesis*. We shall meet this phenomenon again in the discussion of the Rorschach results. Similar features have been observed in other states following a subcortical lesion (e.g., even more grossly after carbon monoxide poisoning).

There are striking characterological peculiarities in postchoreics. What members of their families tell us about postchoreics always goes in the same direction, and postchoreics are very much aware of their peculiarities themselves: they are sensitive, seclusive, taking everything very seriously, querulous and suspicious. They are inclined to brood over things and to grumble a lot. As a whole it can be said that they resemble *schizoid psychopaths*.

While attitudes, sentiments and tendencies form the *substance* of character in its stricter sense, there are, on the other hand, some *formal* qualities characteristic of a person or of personal dynamics, such as appear in features of

experience type, affectivity and temperament. It is just this group that the Rorschach Test deals with centrally, and it is with respect to this group that the Rorschach Test—as the author concluded (1934)—shows a characteristic result. It is not difficult to diagnose a person as predominantly introvert, extratensive or balanced, but the Rorschach Test is very helpful in finding out some essential formal qualities of intellectual and affective life in the respective person in the short time of an experiment. According to Rorschach results, intelligence itself is unimpaired in postchoreics, which is evident from the number of whole answers and good form answers. Most striking, however, is a lack of productivity revealed by the sum total of responses, which often falls below 20. This lack of ability to become impressed and to evoke associations under the influence of new impressions is mainly due to the mental hypokinesis mentioned before, and partly also to the meticulousness of those persons who cannot recognize an object as such if it is actually a mere inkblot. Stereotype responses are also frequent. If we consider the ratio between the kinaesthetic and the colour responses in the results, we find that the postchoreic usually proves, by means of the Rorschach Test, predominantly and distinctly *introvert*. There is, however, another important fact which emerges from the Rorschach results, and which probably could not have been expressed so accurately without the help of this test. We find that the number of both kinaesthetic and colour responses is very small in postchoreics, which shows that they are neither *good* introverts nor, of course, good extraverts. They represent an experience type which Rorschach himself called the “coartated” (*i.e.*, restricted or narrowed-down) type, which indicates that the subject is not equipped with a wide or deep range of feelings either in his inward or in his outward life. From the material available it even appears that this “coartation” shows a progressive tendency with age. The usually small number of colour responses, taken absolutely, indicates that postchoreics show a limited adaptability to their environment. This, together with introversion, shows them again as schizoid characters. As another feature, they see rather frequently “intermediate” forms, that is, the white gaps between the forms, which according to Rorschach reveals a tendency towards opposition. They also frequently notice slight differences in shade and brightness, which according to Binder (1932) reveals “dysphoria” or disgruntledness. This feature sometimes goes together with another one known as a neurotic symptom, *viz.*, the “colour shock” (affective rejection of the colours displayed in the test).

In summarizing these findings it clearly appears that these five groups of symptoms, *viz.*, hyperkinesis, neurasthenic and psychasthenic symptoms, characterological and temperamental peculiarities, form a closely-knit and sharply defined complex of symptoms typical of the postchoreic person. One group of symptoms may be more prominent in one postchoreic and another group in another, but the complete symptom-complex is always found to be present. It would, however, be a fallacy, after all the deviations we have found in the postchoreic, to think of him as grossly abnormal. This is not at all the case: to the layman the postchoreic will frequently appear quite normal. The postchoreic is, within certain limits, able to adapt himself

to life and to make a success of his job ; he is fond of his home and his family like other people. It is merely due to a necessarily thorough psychiatric analysis that the psychopathological personality structure of the postchoreic does now appear distinct and defined. There may be mild and severe cases amongst postchoreics, but never is the picture as severe as in a postencephalitic state. The fact that moral deterioration goes with subcortical impulsivity and hypokinesia in a typical postencephalitic case, whereas moral over-conscientiousness goes with subcortical lack of drive and hyperkinesia in the postchoreic state, inevitably suggests a distinct cerebral representation of these psychopathological structures.

III.

Having dealt with the psychopathological structure of the postchoreic, we have still the question of *heredity* to discuss. It is a crucial question, because it is decisive for our whole view of the problem. The findings are quite clear : given optimal conditions, a hereditary disposition of the brain can be found in every case of genuine chorea. The only case out of 24 (in the first series) where there was no proof of a hereditary factor had already originally been diagnosed as hysterical chorea. Very good conditions for genealogical investigations were existent in Switzerland, with her stationary population : looking up a certain name in the registers of a mental hospital sometimes revealed facts about ancestors which were unknown to the family itself. The highest number of hereditary factors in the ancestry of 24 cases was represented by *psychopathy*, particularly of the irritable and excitable type, the second highest number by *schizophrenia*. In the family trees of 24 cases there were 8 certain and 3 probable cases of schizophrenia, and in most cases the psychosis was of a catatonic type. This corresponds with the findings of Guttman and Schulz, the latter stating that the schizophrenia index in choreics is twice as high as in the normal population. Chorea itself is also frequently found in the family trees of postchoreics, though seldom dominant. Epilepsy, migraine and alcoholism also appear amongst the hereditary factors, though not as conspicuously as schizophrenia. Kehrer (1928) has once pointed out that a principle might be working in nature favouring the "alternation" of heredodegenerative manifestations. An interesting fact concerning the affinity between chorea and schizophrenia has been found by Guttman (1936). He took those in-patients of Maudsley Hospital who have had chorea in their history, and found that amongst 24 cases the most frequent diagnosis later (*viz.*, in 7 cases) was schizophrenia. Furthermore, he found that when he investigated the pre-morbid personality of those psychotic cases, it had to be described in exactly the same terms in which the present author has described the postchoreic. It may be mentioned that the rare cases of chorea-psychosis often show a marked similarity to schizophrenia, which has been stressed by A. Lewis and Minski (1935).

It has been suggested that in the same way as there is a constitutional schizopathy in certain families, a constitutional *choreopathy* could be thought of in other families. As a matter of fact, Kehrer has coined the term "*choreo-*

pathic families." There is, indeed, one fact at least which supports this view, namely, the occurrence of chorea in a series of brothers and sisters. In the Basle series reported here there was a group of 5 children out of 6 in a family who had chorea, and in the Mill Hill series there were quite a number of groups of choreatic sibilings. The onset of chorea, of course, must have taken place in different years in order to exclude the possibility of hysterical chorea (which can even lead to school epidemics, e.g., Basle, 1852). One child in the Basle series of 5 postchoreic sibilings died of heart failure. Another point which speaks in favour of familial choreopathy is a recent finding in *electroencephalography*. In 1941 Jasper and Usher published results which showed that the E.E.Gs. of sibilings of choreic families not having had chorea themselves showed abnormalities resembling those seen in the E.E.Gs. of choreics or postchoreics.

We now have to reconcile the fact of a *hereditary predisposition* with our statement about a *change in personality*. On the basis of the fact that there is a constitutional predisposition of the brain in all cases of chorea (apart from the hysterical type), an attempt might be made to refute the author's conclusion that a change in personality takes place after chorea. The argument would run as follows: if chorea is constitutionally predisposed, the state after chorea does not constitute a real change in personality. Sometimes in early childhood, that is in the pre-morbid history, traits are found which, though being less outspoken, resemble the postchoreic personality traits. Besides, the onset of chorea usually occurs so early that we cannot reach a conclusion as to the premorbid personality of a certain child (Gamper, 1935). These are the arguments *contra*, and now we have to reply to them: let us take the minor ones first. The weight of evidence that children were showing certain traits before chorea is not a considerable one in the light of the innumerable children who show those same little neurotic traits and yet do not develop nervous trouble in later life. More important is the frequent remark heard from parents of postchoreics that the children *have* changed after chorea, that they have become quieter, show less vitality and are more listless and irritable. Guttman (1936) found in the record of one of the rare cases with a late onset of chorea the following description: "Before 13 normal, gets on fairly well with people. Between 13 and 16 energetic and sociable, fond of parties, lots of friends. First attack of chorea at 14, recurrence at 16½. Since then has become more difficult and quarrelsome. Criticizes people and is afraid people may criticize her." Given good observation there should be no doubt that a comparison can be drawn between the early and the later stage of development in the first few years. Child psychology has shown that already at the age of 3 a characteristic nucleus of personality is formed in a child. In future, it can be expected, objective records will be available about every child's development through the work of educational psychologists putting down observations and test results at certain intervals.

Turning now to the relationship between constitutional disposition and manifestation of symptoms, we may be allowed to take the following view: psychopathology, in the first line, records the *phenomenal* structure of personality (not the *genetic* structure). The child of a psychopath is not called

a psychopath unless it *shows* psychopathic traits, though constitutionally it might have predispositions for developing psychopathic traits. The conclusion is as follows: a phenomenal change in personality, even if it was constitutionally preceded by a state of potential change and thus implied within the framework of personality, is a real change of personality in the light of psychopathology only at the time of its actual appearance. It cannot be found practicable to separate the hyperkinetic symptoms and to recognize them as choreic sequelæ without recognizing the characterological symptoms in the same way. We have tried to demonstrate that the picture of the post-choreic personality represents a unity. Neither is it consistent to recognize the personality change after encephalitis epidemica and to deny it in the case of chorea, for the sole reason that the picture is not such a gross one. Surely the same argument ought to be applied to two groups of phenomena which are very much akin owing to the nature of their respective cerebral substrate. Besides, it cannot be denied that the actual, bloodborne attack of the streptococci or virus on the brain-cells means a serious change to them, and from what we gather from the facts it appears that the results of this attack are not entirely reversible. It is significant that out of 24 cases in the Basle series only one failed to show the characteristic complex of postchoreic symptoms, and this was a case diagnosed as hysterical chorea already at the time of illness. Practically speaking, the postchoreic syndrome enables us to make, even after many years, a *differential diagnosis* between what *has* been a genuine or a hysterical chorea. The author was recently able to exclude, on such a basis as has been pointed out, the possibility of a genuine choreic attack from the doubtful history of a patient in the Mill Hill series. (NOTE.—The name "St. Vitus' dance" reminds us of the time when all cases of chorea were regarded as hysterical before the infectious origin was known.)

IV.

A second series of cases was collected at Mill Hill Emergency Hospital (Neurosis Centre) in 1943 (last quarter) and 1944 (first quarter). This series comprises 28 cases (including one which had passed through Mill Hill as a case of neurosis and was later admitted to the Holloway Sanatorium, Virginia Water, in a psychotic state). There were 23 Service cases in this series (including two ex-Service patients who had been discharged for neurosis, but were in need of further treatment), and 5 civilian neurotics. Amongst the latter has been included an exceptional case, viz., the postchoreic mother of a postchoreic girl, the mother having had a breakdown with depressive anxiety symptoms in earlier life similar to that which her daughter showed now. A few "ordinary" postchoreics who were found in the families of our cases but were free from neurosis were omitted from this series, though one was particularly interesting, being the daughter of a schizophrenic mother and the sister of a soldier treated by the author for severe neurosis together with schizoid symptoms. Apart from the soldier, who later became psychotic, and the above-mentioned postchoreic mother of a patient, all (26) cases were seen in the acute state of neurosis. The aim of this second investigation was

to throw light on the relationship which apparently exists between postchoreic personality and inclination towards neurosis.

The procedure was the usual psychiatric exploration, taking the whole life-history (including questions about heredity) and particulars about the civilian work record or/and military record, together with the circumstances of the development of the neurotic symptoms. The complex of symptoms established in the first investigation (1933-4) served as a guide for possible questions, and this procedure helped, without being in any way suggestive, to unroll the complete picture of the postchoreic personality in each case. Physical examination helped to assess constitution and to detect possible heart trouble. In addition, the Rorschach Test was done by the author in each case, and some motor tests were given to each patient for the purpose of examining the co-ordination of the hands and the tendency towards associated movements. For E.E.Gs. the patients were sent to Hill End Hospital (by E.M.S. arrangement). It is to be regretted that interviews with parents could be arranged only in a few cases, so that objective information about childhood is missing in most of them. Information about heredity was scanty, but even so a great number of hereditary facts has emerged. Intelligence was tested (in most of the cases) at Mill Hill Psychological Laboratory with Raven's Progressive Matrices (plus Vocabulary Test).

The catamnestic period (i.e., the time elapsed between the attack of chorea and the investigation) was—

1-5	years in	0	cases.
6-10	"	4	"
11-15	"	6	"
16-20	"	11	"
21-25	"	3	"
26-30	"	3	"
50	"	1	case.

The distribution of 6 female cases against 22 males is accidental and quite atypical, as there must be more female postchoreics than male ones, but conscription affected the male population more.

The frequency and variation of symptoms either observed in these postchoreics or reported by them is illustrated by Table I.

NOTE.—“Emotional” has been included in the temperamental group (including the formal features of affectivity), though the “near reflex” character of crying implied by being “emotional” as seen in post-choreics also reflects on their psychasthenic side. It is of interest to note that choreic children start being “emotional” and “irritable” during the attack itself.

It will be of interest to record some *gross symptoms* reported by the patients.

Group I.—When I have to write in front of other people I get shaky (the same happens when I pour out a cup of tea or light a cigarette), or I feel the anxiety I might get shaky (Case 16). I sometimes spit numerous times (Case 4; has been teased because of that and his fidgetiness). My hand runs away when I am writing, and generally I feel the desire to rush everything (Case 27). I became shaky while

TABLE I.—Symptoms in Neurotic Postchoreics.

<i>Group 1: Hyperkinetic.</i>		<i>Group 2: Neurasthenic.</i>	
Fidgety, shaky, jumpy	17	Dizziness, giddiness	19
Cannot sit (or stand) still	10	Headaches	14
Bad co-ordination	10	Insomnia	13
Tendency towards associated movements	9	Easily tired	11
Tics	8	Nail-biting	7
Eye blinking	7	Enuresis (or dribbling)	6
Stammering	5	Sick feeling (or vomiting)	6
Shaky writing	5	Blushing	4
Picking fingers	4	Easily breathless	4
Tremor (head, lips or tongue)	3	Perspiration	3
Urged to rush	3	Palpitation	2
Impulsive writing	2	Nightmares	2
Impulsive movements	1	Burning feeling over body	1
Explosive speech	1	Head feels numb	1
Clumsy	1	Much yawning	1
Loses control when observed	1	Observes his breath	1
Can't aim in throwing	1	Pseudo-hallucinations	1
		Claustrophobia	1
<i>Group 3: Psychasthenic.</i>		<i>Group 4: Characterological.</i>	
Bad memory	8	Shy (bad mixers).	19
Bad concentration	7	Self-conscious	7
Fear of dark	7	Touchy, sensitive	6
Difficulty in grasping	6	Inclined to worry	6
Lack of endurance	6	Seclusive	5
Easily frightened	6	Over-conscientious	3
Lack of drive or energy	4	Very religious	3
Absentminded	3	Meticulous	3
Irritated by noise	3	Prudish	2
Mind goes blank	2	Hypochondriacal	2
Easily muddled	1	Feels inferior	2
Daydreaming	1	Timid	2
Listless	1	Overdependent	2
Loses interest	1	Feels bullied	1
Cannot shout	1	Self-centred	1
Hesitant speech	1	Obstinate	1
Cannot find words	1	Drinker	1
Difficulty in spelling	1		
<i>Group 5: Temperamental.</i>			
Irritable, excitable	17	Apathetic	2
Emotional	9	Brooding	1
Moody	8	Bad-tempered	1
Inhibited	7	Impulsive	1
Less lively than before	5	Likes change	1
Inert	2		

standing before a superior (Case 1). I sometimes put things down with extraordinary force, and recently the force of my movements pulled my stitches away. I have been reprimanded in cinemas for swinging my legs (Case 12). I was a nuisance on training because I threw the hand grenades in the wrong direction (Case 20).

Group 3.—I have never been able to shout (Case 21). I can't worry (Case 22).

Group 4.—When I come out of cinema I have to take a taxi because I cannot stand the glances of the people in the queue. When the lights go on I have to go to the cloakroom (Case 2). I had the impulse to give my clothes away (Case 2). I don't go to a dance because I am afraid of being touched. I am afraid of having a person behind me in the door (Case 12).

It will be noticed that in the symptoms they display neurotic and non-neurotic postchoreics are very similar. There is no difference in essence, but in degree, apart of course from conversion symptoms.

The *Rorschach Test* was done in all cases but one (27). Only 10 out of 27 produced more than 20 answers, which is indicative of the diminished mental agility found in postchoreics. The main ratio in the Rorschach result (M : C, kinaesthetic to colour responses) indicated in all cases a tendency towards "coartation" (restriction on both introversive and extratensive side). In 13 of our cases the figure is not higher than 3, and in 24 not higher than 5 on either side. A plus in favour of introversion was more frequent, but the contrary also occurred. We found the latter in 4 out of 6 female cases, and in 3 male patients in whom body build was nearer to the pyknic type. Enke (1927) found relationships between Rorschach result and body build. Generally speaking we found an extratensive plus (which is actually a plus in social adaptability) to be an indication of good prognosis in postchoreics. It is of interest to note that in two postchoreic brothers there was similar coartation (0 : 1, 1 : 2), and the same was the case in mother and daughter (2 : 4, 3 : 5). Responses referring to the white space between the blots (indicating a tendency towards opposition) and responses recording differences of shade (indicating dysphoria or disgruntledness) were also frequently found (the latter 12 times). "Colour shock," which is a neurotic reaction, was found in 8 cases.

The *Intelligence* was tested in 20 cases by the Progressive Matrices method. In 7 cases the intelligence was above average, in 3 average, in 10 below average. Only one conclusion can be drawn from this : chorea does not impair intelligence, though it does impair vitality and consequently mental output and productivity.

The *Electro-encephalogram* was secured in 21 cases. 14 E.E.Gs. showed abnormal features in form of slow waves and low voltage waves ; 7 were within normal limits. According to expert opinion the abnormalities were of a nature usually found in constitutional alterations of the brain. In one case only the result resembled an epileptic E.E.G. (outbursts, in patient 21, whose paternal uncle was epileptic). The E.E.G. was also recorded in three siblings of choreics : in two it was abnormal, in one normal. It will be of interest to collect more material in this line.

Motor tests were performed in most of the cases : drawing of patterns (simultaneously with both hands), finger-to-nose test, diadochokinesis, closing one eye at a time, standing on one leg. Tremulous drawing, defective co-ordination and a strong tendency to perform associated movements were frequently found. In Fig. 1 three examples are given of drawings by postchoreics. The pattern demands a co-ordination of both hands.

Though the inquiry into *heredity* in this series was not as successful as in the previous one, owing to the nature of the present material, quite a number of hereditary facts have been established. In the family trees of our cases 3 people were in mental hospitals (1 certain schizophrenic), 2 had chorea, 4 were epileptics, 7 were excitable, 1 was unstable (psychopath), 1 was neurotic, 4 had rheumatic fever, 1 had migraine, 3 had a nervous breakdown or nervous trouble (vaguely described). There was, furthermore, a remarkable number of *choreic siblings* : Cases 14 and 19 are brothers, and have a third postchoreic brother ; Case 9 is a nephew of 14 and 19 and has, therefore, 3 postchoreic uncles ; Case 8 has a postchoreic brother and sister ; Case 18 has a postchoreic

sister; Case 27 has two postchoreic sisters. Finally, Cases 28 and 3 were *mother and daughter*. It may be noted that four of our cases belonged to Jewish families, and three non-neurotic postchoreics were amongst their siblings.

As regards *constitution*, no measurements were taken of body build, but an eye was kept on it during the physical examination. Seven of our cases appeared to be definitely on the leptosome (asthenic) sides, where 3 appeared mesosome (in the terminology of W. L. Rees, 1945), and only 3

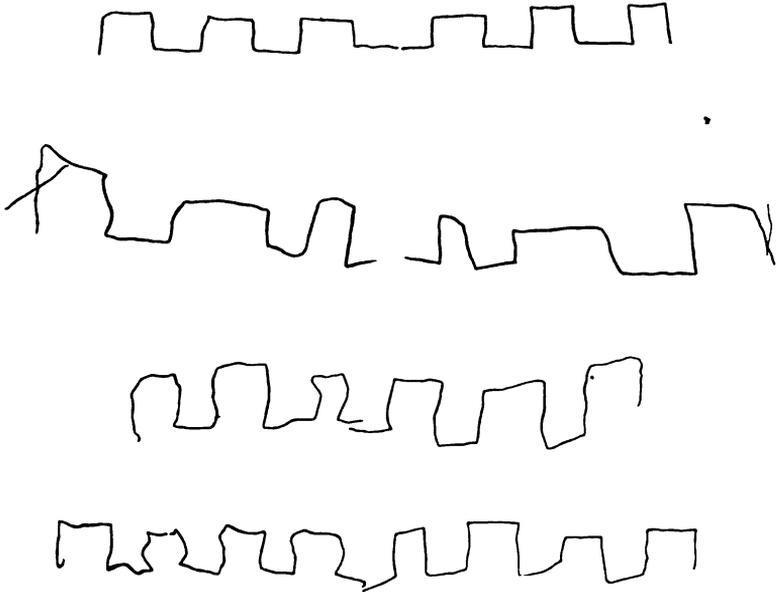


FIG. 1.

eurysome (nearly pyknic). The rest (15 cases) would, on mere inspection, be placed between leptosome and mesosome build, so that a preponderance of the near-asthenic type results. As already remarked, mesosome and eurysome body build go together with a good Rorschach result and hold out a good prognosis for the postchoreic.

Objective information about *childhood* was missing in most of the cases, owing to the nature of the present material, which is regrettable with regard to the theoretical importance this question has. In 14 cases mild "neurotic traits" before chorea were reported (such as fear of the dark, prolonged enuresis, stammering, nailbiting, extreme shyness). In all these cases there were known hereditary factors, too. In a number of cases, however, it was said that the patient had been a "happy child without any nervous signs." Twice a "broken home" was reported.

As regards *previous health*, one patient reported convulsions he had as a baby and two reported head accidents (without fracture). Case 3 had

encephalitis after vaccination at the age of 3, and Case 9 meningitis at the age of 7. Two patients had rheumatic fever before chorea (one together with jaundice), 3 had it after chorea. One patient got chorea after scarlet fever and one after diphtheria. Only 3 Service cases had nervous trouble in civilian life. Case 7 had a lorry accident 4 years before admission with amnesia and later short "black-outs" (E.E.G. abnormal, but father had epileptic fits). Case 10 was 5 months off his job during air raids, and Case 26 had two nervous breakdowns at the age of 21 and 29 (once 14 months out of work). Patient 12 had been thrown down by blast. While 4 patients reported previous heart trouble, the author found a mild systolic murmur in one case and tachycardia in Case 11 diagnosed as effort syndrome. Amenorrhoea and acne rosacea were present in the depressive young girl (Case 3).

In their *civilian work* only a few reached a somewhat higher standard: we found an engineer, a journalist, a technician, a Cook's tours organizer, a nurse and a probationer nurse. There were 3 clerical workers, and the rest were skilled and unskilled workmen and shop assistants. Postchoreics generally lack ambition and drive. Patient 20, who fancied himself as an artist, produced carpet designs with a meticulous repetition of small details.

In their *military record*, likewise, our Service cases did not show particular achievements. It is first of all noteworthy that out of 20 male soldiers in our series not a single one has seen fighting or has been retained in a combatant unit. Only two became lance-corporals, and one was a sergeant who, owing to his usability as an interpreter, was offered a commission but refused. Two have been out with Expeditionary Forces (on non-combatant duties). The time between enlistment and admission to a Neurosis Centre varied widely: while 5 cases out of 23 served less than a year, 6 other cases had served in a simple capacity more than 3 years. The young hyperkinetic and impulsive postchoreics were found out or broke down earlier; the older ones, with predominantly characterological peculiarities, were able to hold out longer, this being a sign of their conscientiousness. Many cases improved under the therapeutic measures (direct and indirect) of the Neurosis Centre (sedation and reassurance, P.T., occupational therapy, participation in a less authoritative community life and help in family affairs by the Social Worker). The usual disposal was regrading (to Category C) and recommending for more suitable posting and work (sometimes using the "Annexure Scheme" of the War Office). The cases with gross postchoreic symptoms (hyperkinetic, neurasthenic or schizoid) and showing an anxiety state were regarded as unfit for any form of service, and recommended for discharge in Category E. In this way the gross postchoreic state has been recognized as a disability.

The *diagnosis* which was affixed to the cases by various psychiatrists varied a good deal: the most frequent one was Chronic Anxiety State, sometimes with the addition of "depressive" or "somatic" or "hysterical" features. Effort Syndrome on the one hand, Hysteria and Hysterical Amnesia on the other hand also occurred. While the purely postchoreic state could be labelled as "Schizoid Psychopathy with motor and behaviour anomalies," there were, as a rule, anxiety or hysterical symptoms superimposed on top of the postchoreic traits.

V.

Three *case-records* are given below in order to present a more *dynamic* view of how neurosis develops on the basis of a postchoreic personality structure.

CASE 5.—Pte. A. B—, R.A.O.C., aged 19.

Complaints.—Facial twitchings, restlessness, depression.

Family history.—Father suffers from rheumatism; master tailor. Mother very excitable; bad tempers; 1 sister.

Personal history.

Childhood: There was much friction between parents about him. He would not eat and cried a lot. Bedwetting till 8; terribly scared by darkness. Was extremely shy, did not mix; mother kept him at home.

School: Kindergarten, elementary till 14; good scholar in spite of interruptions.

Work: Junior clerk 2 years. On outbreak of war 6 months' course in instrument making; then helped father as cutter and keeping books. Had friction with mother, but liked to work with father.

Previous health: Had chorea aged 8. It started with twitchings in the face and later the arms became shaky. Some minor attacks until 14. Facial twitchings and fidgetiness remained. Double pneumonia, aged 11.

Service: Call-up April, 1943, Category B 1. Storesman's course passed. Posted as storesman, but employed on odd jobs.

Present illness: Within 3 weeks after call-up he got into a very bad state. Could not keep his face still for a moment; walked restlessly around in camp, even at night sometimes; felt bullied and teased, slept badly, became depressed. Sometimes when lying on bed he had vivid "visions" of a firing gun or of mother's face. Got worried about these visions.

Sex: Girl friend, aged 17, killed in blitz; since then no interest; very shy.

Interests: Cycling, reading travel books; wants to stay in tailoring.

On admission.—Short, puerile lad. Sullen expression, depressed. Blinking. Many facial tics; very fidgety. Talks a lot and in extraordinarily quick tempo; speech has explosive character. Feels resentment about his treatment in the Army.

Physical examination.—C.N.S.: nil abnormal apart from tics. Heart, lungs, N.A.D.

Mental.—Intelligence Grade 2. Rorschach: Highly introvert, neurotic.

E.E.G.—Abnormal.

Progress.—Depression eased; restlessness diminished on luminal. Occupation: went to clerical course with good result.

Diagnosis.—Anxiety state in schizoid psychopath with speech and behaviour abnormalities due to chorea in childhood.

Recommended.—In view of the fact that speech and behaviour of this soldier appear abnormal and would be the subject of constant remarks, besides the fact that his attitude is schizoid and unsuitable for any unit, he is recommended for Category E.

CASE 17.—Gnr. C. D—, R.A., aged 24.

Complaints.—Shakiness, headaches, anxiety dreams.

Family history.—Father died of stroke. One brother in Army. No nervous trouble in family.

Personal history.

Childhood: Normal child as far as he remembers.

School: Elementary 5-14; was backward; afraid of teachers.

Work: Messenger boy 6 months; various jobs; last ones, in brass foundry 18 months, newspaper packer 14 months.

Sex: Single; was engaged; gave up out of fear of being given up. Feels inferior towards girls.

Interests: No hobbies; not fond of company.

Previous health: Chorea, aged 5-6. Chronic otorrhoea since 9.

Service: Volunteered July, 1939, for Territorial Army, R.A.; not employed on guns, only carrying ammunition. 1940 to Middle East; short time on guard on pipe line in Palestine. Later in Libya, accidentally blown up by booby trap (while working as postman); got shrapnel into calves, all removed in hospital. Top phalanx of left big toe had to be amputated. Developed insomnia, anxiety dreams, became restless and showed lack of concentration. Has not been on duty for 12 months; medical board, recommended him for evacuation in Category D.

On admission.—Tense, apprehensive, tremulous.

Physical examination.—Coarse tremor of outstretched fingers. Heart, lungs, nil abnormal. B.P. 130/90. W.R. negative. Scars on lower limbs.

Mental.—Intelligence, Grade 3. Rorschach: "restricted" type. E.E.G. normal.

Diagnosis.—Chronic anxiety state, moderately severe, with neurasthenic symptoms in post-choreic person.

Recommended.—In view of his poor prospect of giving further satisfactory service he is recommended for Category E.

CASE 18.—L/Bdr. E. F.—, R.A. (L.A.A.), aged 31.

Complaints.—Breathless on exertion; feels jumpy, depressed and worried.

Family history.—Father died of heart trouble, aged 48, when patient was 3. He was unstable. Mother excitable. Father's brother died of bad heart after rheumatic fever. Three sisters, two brothers. One sister has heart trouble, another sister had chorea and is still fidgety.

Personal history.

Childhood: Brought up by mother, who married a second time. Was frequently ill. Prolonged bed-wetting and nail-biting; afraid of the dark.

School: Elementary till 13; 1 year open-air school after chorea. Passed scholarship, but could not take it up, owing to ill-health.

Work: Junior clerk 5 years, and colour matcher 7 years, in the same firm. Over-conscientious and meticulous in his work, irritable.

Marital: Married, aged 27, a nurse 3 years older. She used to go to the same chapel; knew her many years. No child. They want to adopt one.

Service: Called up September, 1940, Category A 1. Did not tell about chorea. Posted to searchlight battery, but worked as a storesman. January, 1943, promoted L/Bdr. When unit went into battle course, patient was seen by specialist and boarded C for chronic bronchitis.

Previous health: Aged 8, hit head on table. Had a "fit" same day, no repetition. Aged 12, chorea. Aged 16-19, slight depressive phase, with stomach trouble. Aged 20, appendicectomy, with following pneumonia. After that lost hair. Was in bed 6 months with weak heart. Seven years ago second depressive phase, having seen stepfather dying. Second time pneumonia, and since then chronic bronchitis.

Personality: Shy before chorea. Afterwards developed into somewhat weak, sensitive personality. Became very religious in adolescence, and strict Methodist (like a "conversion," as he experienced it). Wanted to go abroad as a missionary, but not accepted because of health. Still wants to go as missionary after the war. No smoking, no drinking.

Present illness: Six weeks ago, when he reported sick with bronchitis, it was noticed that he was also jumpy and depressed. Was too fidgety to sit still as a storesman, and got worse by worrying about his wife's health and his own.

On admission.—Shows marked emotional lability, quickly changing from tearfulness into laughter. His behaviour seems to be somewhat immature, and he seems to be dependent on his wife.

Physical examination.—Rather pyknic physique. Reflexes lively, no tremor. Chest: numerous rhonchi; slight degree of emphysema. Effort tolerance test: 88, 140, 100.

Mental.—Intelligence, Grade 2. Rorschach : good social adaptability.

E.E.G.—Abnormal (slow waves, but no focus).

Progress.—Has recovered quickly from depressive phase ; emotional lability and fidgetiness less marked now. Very reliable and amiable ; made friends in the ward.

Diagnosis.—Anxiety state with depressive features in post-choreic person.

Recommended.—Annexure Scheme, Pay Corps, near home (recommendation has been implemented).

These three cases show how one or the other group of postchoreic traits (hyperkinetic, neurasthenic, characterological) enters as leading feature into the neurosis. A further case is added, which later became *psychotic*.

CASE 15.—Pte. G. H—, aged 22 (April, 1941).

Complaints.—Shortness of breath, pain in ankles and calves.

Family history.—Mother has heart trouble, has to rest in the afternoons. Father in good health. Two siblings are well.

Personal history.

Childhood : No neurotic traits.

School : 5–18, away many times with minor ailments. Was very nervous in examinations.

Occupation : Clerk.

Service : He volunteered for Territorial Army in April, 1939 ; was classified A 1 and put into infantry. Later, in May, 1940, following his attack of influenza, he was graded C and sent to a Home Defence unit.

Habits : Teetotal. No sports. Reads a lot, particularly history.

Sex : Single.

Previous health : Pneumonia in first year ; ailing child. Aged 5, mild attack of chorea. Aged 16, rheumatic fever. After his illness he was seen at the National Heart Hospital and told to go easy for the rest of his life.

Previous personality : Schizoid, hypochondriacal, seclusive.

Present illness : When he was examined for the Army he was told that his heart was all right, and graded A 1. As soon as training began he became tired out very easily and breathless on exertion. He was eventually graded C, and became an Army clerk. In February, 1941, he had headache, sore throat and fever, which was diagnosed as influenza, and a few days later he had dull aching pain in the chest and shortness of breath on effort. He had a persistent fluctuating temperature for 6 weeks, and all investigations during this time were negative. His symptoms continued after his recovery, and he also began to get pain in the legs and ankles upon walking. Transferred to Mill Hill.

On admission.—Thin, asthenic. Effort tolerance test : 92, 110, 100. He is hypochondriacal, self-centred, and very suggestible. Intelligence is average. He sleeps poorly, and is awake feeling breathless. He does not like the Army, and suggests that Army life has precipitated his trouble. There is a hysterical element in his symptoms.

Diagnosis.—Effort syndrome.

Recommended.—This man will never make a useful soldier, and his discharge from the Army is therefore recommended.

This record was found in the Mill Hill registry. The author saw this patient first on his admission to the *Holloway Sanatorium*, Virginia Water, on June 9, 1944, in an acute *psychotic state*.

The certifying doctor wrote : Patient states that he has venereal disease, which is killing him. His father, mother, brother and sister have all committed suicide.

The father stated : Patient's mother's brother had a psychotic phase like this. Patient's mother had rheumatic fever and her two other children had it too. Patient was in very poor health after his discharge from the Army, and was for a

period in a Rehabilitation Centre. He has been unable to keep a job since then, and was afraid of mixing with people. His delusions started gradually: he said he had syphilis and passed red urine. Blood test was done and proved negative. On May 23 he spoke of a suicide pact with his father. On May 30 he was admitted to Brookwood Hospital, Woking, in a state of extreme excitement and full of delusions. He spent some days in a padded room.

When examined on the day after admission the patient showed no physical defect. His body build was typically asthenic. In the face he had a bad acne. His nutritional state was unsatisfactory. Blood test again negative. Mentally he was full of abstruse delusions, but orientated. His talk was not flowing freely; he uttered short remarks with a sharp voice and an air of superiority.

Soon after admission he made an attempt to escape through the window. Now kept in bed, he is very restless and jumps in and out of bed. He implores the doctor to get him out from here: "You save your soul. You save the world from annihilation." He feels a successor of Jesus Christ; wants to be buried and to rise again. Besides these religious delusions he has a lot of paranoid ideas: the Gestapo rules the country; spies are everywhere; everybody is out to torture him. He accuses himself of having V.D. He doubts the reality of his parents; keeps talking of a "fake father." He does not admit being ill. Thinks the food is poisoned.

22.6: Extremely paranoid. When spoken to he hesitates to answer: "It could be used against me." Tries all doors to escape. Sweets and strawberries seen on his locker came from his "non-real parents."

29.6: Insulin treatment (modified) started. Up for the rest of the day. Broke a pane of glass with his foot.

30.6: Still thinks his food is poisoned and that everything he says will be used against him.

2.7: Sits about quietly, talking to nobody, with an expression of misery on his face. He now admits that the food is all right.

7.7: Keeps his shoulders hunched. Says he feels very strong. Asks repeatedly: "Is this a trick? Do you feed me to kill me afterwards?"

20.7: Has already reached a high dose of insulin, but shows no reaction. Is restless the whole morning and tries to get out of bed. He demands in a stereotyped manner "roast-beef," whenever the doctor passes by. "Himmler has ordered me to be fed on the fat of the land." He talks of visitors, "who said they were my parents." Sometimes dirty at night. E.C.T. started 3 times a week, together with insulin.

26.7: First time expresses the wish to be occupied.

29.7: After 4 E.C.T. a sudden turn towards improvement took place. He is free of delusions, smiles, starts a conversation, reads newspapers and books.

7.8: Has not maintained improvement when E.C.T. was left out. Again on regular E.C.T. Comes in for treatment smiling and talking incessantly.

30.8: Relapse into delusional state. Accompanies everything he does with a flood of stereotyped phrases: Is it beneficial to me? Is it beneficial to you?

Insulin treatment stopped. Has gained weight considerably.

31.8: Became very excited and had to spend a night in the strong room. Banged on the door and shouted at the top of his voice: "I want to play billiards to-night." To persons approaching him he said with a wild expression in his face: "I love you. Kiss me!"

1.9: Needs E.C.T. maintenance doses.

3.9: Again friendly, but manic, with flight of ideas. Shouts, "The war is over," and goes around shaking hands with everybody. Wants to be received at Buckingham Palace and to broadcast on the B.B.C. Wants to meet a girl.

8.9: Much quieter after 3 E.C.T.

10.9: Has become rational again, though still talkative. Desires to do some work in the ward.

15.9: After a visit home (near the hospital) he deteriorated considerably. Talks incessantly and interferes with other patients.

22.9: His excitement has taken a paranoid turn again. Talks of "sadism," and has taken two attendants by their throats.

8.10: E.C.T. resumed as he shows a more manic state again. Also second course of insulin started. Gets now vaccine injections for his acne, which has deteriorated so much that the pustules reach the size of little boils.

27.10: Had 8 E.C.T., and has improved considerably. Somewhat quieter, and more rational.

6.11: In a manic state again, with flight of ideas; talking incessantly. Says "the war is over," and goes round and round to shake hands with everybody within reach.

10.11: Slight improvement. Has finished E.C.T. (had 31 altogether) and insulin course. Acne much improved by injections. He still talks a lot and interferes with other patients.

18.11: Somewhat quieter. More rational.

21.11: His father wants to take him home now. Discharged.

Rorschach results: The first test was done some days before his discharge.

Responses, 13 (very distracted). Main ratio 1:7, colour shock. Nine *symbolic* interpretations, like "lot of black paint; means fifth column in Great Britain or defeat of Germany." "Bird is flying away; I should not remain here." "The blue skies are around the corner." A second test was done some months after his discharge. Responses, 24. M:C ratio, 2:3, colour shock. No symbolism, but associations like chest, decay, weeping, mournful, fright, Dante's Inferno.

20.7.45: *Catamnestic* remarks: Patient has remained rational all the time (8 months). His behaviour at home, where he works on his father's land, has been satisfactory throughout. His face shows very little acne now. He takes a lively interest in current affairs, and goes to a club. Sometimes he goes taciturn for a few minutes, and appears deep in thought, but otherwise he converses freely and smilingly. Physical state now more satisfactory.

VI.

Compared with peace-time findings the incidence of neurosis in postchoreic persons has undoubtedly increased during the war years. In the Swiss series of postchoreics no acute state of neurosis had been found, and not a single person had been in need of psychiatric treatment during a long catamnestic period. Guttman (1936) found only 12 non-psychotic postchoreics amongst 3 years' admissions to Maudsley Hospital. They consisted of 4 cases of anxiety state, 4 cases of hysteria, 3 of moral abnormality and 1 of neurasthenia (in addition, there were 7 cases of schizophrenia and 4 of depression). These are small numbers if one takes into account that the Annual Health Report of the L.C.C. mentions 1,094 cases of chorea for the year 1934 alone, and that the Report of the School Medical Officer, L.C.C., for 1938, mentions 2,026 new cases of children who were admitted to rheumatism supervision centres. While 12 non-psychotic postchoreics had been admitted to Maudsley Hospital in 3 years, 12 neurotic postchoreics were *present* on a certain *day* during this investigation at the Mill Hill Neurosis Centre, thus forming $2\frac{1}{2}$ per cent. of its total population. Even if one takes into account that such a centre serves a very large area and naturally accumulates cases, and that military conditions demand a quick hospitalization and disposal of such cases, the incidence of neurosis in postchoreics during war-time appears remarkably increased, and we have now to investigate the causes of it.

In peace time a postchoreic person will seldom find himself in a situation which would not be in accordance with his mental agility and his vitality, both of which have suffered, as we have found, through the cerebral affection. He will always be, more or less, in a situation of his own choice and be able to "go easy." War time, however, intensifies and multiples the *stresses* brought upon him: there is conscription or direction of labour, there is separation, there are air raids and lack of commodities. In military service

the postchoreic is put under the stress of strict discipline and rigid training. The adaptation to these conditions demands from the postchoreics an output of energy to an amount which they are frequently unable to muster with their impaired vitality. The result is "maladaptation" with all its emotional consequences. Masserman (1943) deals in his book *Behavior and Neurosis* with maladaptation as the central factor in the etiology of neurosis. The answer to a maladaptive situation is an emotional conflict, which postchoreics cannot master so easily owing to their defects in psychosomatic constitution. Unable to master their conflicts, they break down, they develop anxiety or other forms of neurosis with all the variety of somatic and psychic symptoms. Thus it appears that the central factor in the neurosis of the postchoreic is the same one as in any neurosis, viz., the emotional *conflict* between *two levels*. We can call these levels the level of "demand" on the one hand and the level of "readiness to respond" on the other hand. It should not be overlooked how powerful a formative factor in human existence conflict can be, both as regards integration as well as disintegration of personality (this dual aspect of conflict is referred to in the author's publication, 1933). Even in effort syndrome emotional conflict has been regarded as the underlying principle (Dunn, 1942). Recent investigation by A. Lewis (1941) and others has shown that psychobiologically there is no difference in principle between anxiety state and effort syndrome. Postchoreics are prone to develop effort syndrome owing to the attention they pay to their heart.

In the postchoreic the emotional conflict meets with special conditions, viz., the presence of a *pathoplasic factor* which facilitates a development towards neurosis. This factor is the *neurasthenia* which we have found to be always present as a part of the postchoreic syndrome. Considering the amount of stress to which a postchoreic might be subjected, and his peculiar affective structure, he has indeed not a far way to go from neurasthenia to neurosis. The peculiar motility of the postchoreic on the one hand and his peculiar characterological-affective structure on the other hand constitute additional pathoplasic factors in the process of neurosis formation. The question of pathogenesis within the postchoreic structure, to which Guttman (1936) has given some consideration, now finds its solution by looking at the postchoreic syndrome as a unity. This does not exclude that in the final phenomenal picture of the neurosis one or the other feature may take the lead.

As this investigation comes to the conclusion that the postchoreic state implies a minor or major disability with some more potential dangers in the background, one is entitled to draw a practical conclusion, viz., that every postchoreic deserves a thorough psychiatric examination already on enlistment, and that according to the result a *suitable employment* must be chosen unless the person is found unfit altogether. The same care should be exercised by Industrial Medical Officers or their equivalents in civilian employment.

The theoretical side to which this investigation points is the relationship between the various post-infectious personality changes or sequels. The post-encephalitic and the post-choreic state are so different from each other and so well defined that they seem to have a localisatory implication, both of them pointing to subcortical regions. Recently changes in personality after

meningitis have been described by M. N. Pai (1945). The picture is a more diffuse and variant one ; it may include deterioration both on the intellectual side and on the behaviour side together with neurasthenic symptoms. In meningitis the cortex is the nearest part to become the victim of irreversible affection, and this might be the reason for the variation. Kinnier Wilson (1940) sums up the histopathological findings in chorea by stating that the lesions are predominantly of the toxic-degenerative type and that they are diffuse, involving both cortical and infracortical regions. Most of the authors agree on the selective tendency to befall the neostriatum ; some include the thalamus as well. Kinnier Wilson's statement that in chorea "no residua are to be dreaded" (apart from tics) cannot be maintained any longer in the light of the facts which have now accumulated.

VII.

The detrimental and life-long after-effects inflicted upon people by their chorea in childhood suggest the question whether anything could be done in the way of *prophylaxis* or *more effective treatment* in order to prevent their appearance or to lessen their danger. The first idea which presents itself is to shorten the duration of the attack or to mitigate its severity. This idea has actually been pursued by clinicians in the last decade or so, even without having any knowledge of the postchoreic sequelae. Now that we know those sequelae it is the more urgent to achieve this aim.

The therapy of chorea is still in a rather chaotic state. The old proverb, "Medicus curat, natura sanat," seems to guide those who think that whatever medicine is given, the chorea will fade away in "its time." But just what is its time? Kinnier Wilson (1940) states that the average duration is from 6 to 8 weeks. Surely this is a long time to allow the toxins to have their effect on the brain-cells, though only the first period of attack might count. Apart from the traditional medicines like calcium-aspirin, liquor arsenicalis Fowleri and luminal, many others have been tried out. The first drug which proved effective in the sense of cutting down the duration was *Nirvanol* (phenylethylhydantoin, used since 1930), but many dread its dangers. It has, however, been shown that if one is careful in the prescription of the drug (small doses for a short period, regular blood-count), its dangers (haemorrhagic nephritis, dermatitis exfoliativa, agranulocytosis) can be easily avoided. There appears as a rule a morbilliform rash and pyrexia between the 8th and 10th day of the cure, which are indications that the allergic reaction of the body has reached its maximum. In 1936 the author had the opportunity to work with the paediatrician Gruenfelder on the *Nirvanol* treatment of chorea. A blood-count was done daily, and if the eosinophiles showed a rapid increase the drug was stopped. With a careful prescription, viz., 0.15 gm. *b.d.* for 4½ days, there was no accident in our series and the duration in 18 cases averaged 16 days. In 1933 Sutton and Dodge in America had cut down the duration to an average of 8.5 days by intravenous typhoid vaccine treatment. Diathermy of the brain has been applied in Russia.

A new prospect has been opened by the sulphonamides. Up to 1943 only

one investigation on the use of sulphonamide in chorea has been reported (in Russian, not available to the author). There have been, however, extensive trials in prophylaxis with sulphadiazine in American training camps (Coburn (1944), Holbrook (1944)). The intention was to prevent by prescription of short courses of the drug in small doses rheumatic relapses in the winter months, and the method proved successful. This success encourages a similar use in choreic children (until now the only preventive measure has been tonsillectomy), as recurrences seem to aggravate the sequelae. As penicillin comes to over-shadow the sulphonamides, this too might be considered. Though the use of penicillin has been discouraged in rheumatoid arthritis, no trial in chorea has as yet been reported.

There is, however, a regrettable gap in our knowledge: we do not know for certain whether choreics treated with more efficient drugs show less marked sequelae than the controls. It is to be hoped that this gap in medical science will be filled very soon.

In the *prophylactic line* the following procedure is proposed: after chorea periodical courses of sulphonamide and luminal should be given in order to avoid detrimental recurrences. Children who have had rheumatic fever or in whose families there is marked rheumatism or distinct neuropathy should be given prophylactic treatment in order to prevent chorea altogether. There would always be an experimental and a control group, and later on a follow-up would have to be done. Similar ideas, as far as the rheumatic child is concerned, were recently expressed by Hubble (1944) in a general survey on the rheumatic child. On October 30, 1944, the *B.M.J.* reported that "in view of favourable American reports the Education Committee of the L.C.C. have arranged that prophylactic treatment with sulphonamide shall be given to 100 selected rheumatic children attending supervisory centres." If all these tasks which are still left in the research line are fulfilled, something might be achieved which could save a great number of children from an undesirable development, physical and mental. Here lies a task for psychiatry through which it can make a further contribution in the field of social and preventive medicine.

VIII.

1. A series of 28 postchoreic persons who developed neurosis (23 Service, 5 civilian cases) were examined with regard to their symptoms and the causes underlying their neurotic state.

2. Five distinct groups of abnormalities (hyperkinetic, neurasthenic, psychasthenic, characterological, temperamental) were found, which regularly form a characteristic "postchoreic syndrome." These symptoms are present both in non-neurotic and in neurotic postchoreics, but they tend to develop more grossly in the latter.

3. These postchoreic abnormalities facilitate the development of neurosis. Brought under unusual stress postchoreics are unable to adapt themselves to the situation, and get overwhelmed by their somatic and environmental difficulties and emotional conflicts.

4. Hereditary factors predisposing the brain are found running in the families of children who acquire chorea, so that they start with a constitutional nervous deficiency from the beginning and are left with an even increased deficiency after their illness.

5. Prophylactic measures are proposed to protect as far as possible rheumatic children or children of rheumatic or neuropathic families against chorea and its sequels.

My thanks are due to the Medical Superintendent of Mill Hill Emergency Hospital for permission to use material of this hospital, and to the staff for their co-operation. I also thank the Medical Superintendent of the Holloway Sanatorium, Virginia Water, for permission to publish a case treated in the Sanatorium.

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PRELIMINARY TUBERCULOSIS SURVEY IN A MENTAL HOSPITAL.

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THE problem of tuberculosis amongst mental hospital patients is of importance from both the psychiatric and public health point of view. Most of the active methods of psychiatric treatment must be abandoned or discontinued when physical illness intervenes. The problem is even more far-reaching from the standpoint of public health. Wingfield, Trail, Banks and McDougall (1942) have estimated that there is probably a reservoir of 250,000 infectious cases recognized and unrecognized in England, Scotland and Wales, and several authors have pointed out that mental hospitals contribute a disproportionate number to this reservoir. Modern methods of mental hospital administration with parole and leave privileges applied to the maximum number of patients lend importance to the public health aspect, not only the patients themselves and hospital staff being menaced, but also patients' visitors and relatives and other contacts outside hospital. The incidence of tuberculosis in mental hospitals has been variously estimated at 5 to 10 times and the mortality in peace-time 8 or 9 times that of the general population. These figures are sufficient to justify all efforts to bring the problem under control.

Since the beginning of this century the seriousness of this matter has been recognized. In 1900 Harrington in America recommended separate provision for tuberculous patients in state hospitals for the insane. In 1909 Mott investigated the tuberculosis situation in all London asylums. He pointed out the difficulties of diagnosis, and estimated that 2 per cent. of the patients were suffering from active tuberculosis. In 1926 Klopp conducted an extensive survey in 44 states of America which revealed how unsatisfactory was the situation. A questionnaire was issued to 106 hospitals containing 188,339 patients; 5,951 or 3.1 per cent. of these patients were known to have tuberculosis, and for 4,512 of these special building capacity was available; 16 out of 106 hospitals made no provision whatever, 59 possessed specially constructed detached pavilions or buildings for isolation, 55 were taking chest X-rays of all suspected cases, but only one hospital secured chest X-rays of all new admissions. He estimated that 5 per cent. of the total beds available would be required for the treatment of tuberculosis.

The difficulties of clinical investigation and diagnosis were so great that little extensive work was done until the advent of improved technical equipment. Green and Woodall in 1931 surveyed the Fernald State School by tuberculin testing and X-raying 1,681 positive reactors. They found that 1.5 per cent. had definitely active and 3.6 per cent. significant pulmonary

tubercular lesions. In 1933 McGhie and Brink reviewed 1,209 patients and 278 staff in London Hospital (Ontario); 1,107 patients positive to tuberculin were X-rayed, 7.3 per cent. showed significant lesions, 3.7 per cent. were considered active and a total of 4.95 per cent. required isolation. Bogen, Tietz and Grace in 1934 carried out a tuberculin survey at Longview State Hospital, and reported that of 2,275 patients, 3.0 per cent. were clinically tuberculous. In 1936 Burns reported the results of Mantoux testing 11,517 patients and 2,430 staff in state hospitals, asylums and schools for feeble-minded and epileptics in Minnesota, and of X-raying the 82 per cent. positive reactors. 9.2 per cent. of the total group showed evidence of parenchymal infiltration, whilst 11.2 per cent. of positive reactors showed evidence of pulmonary disease. Harrison and Schein in 1937 surveyed by X-ray 2,186 ambulatory patients in Marcy State Hospital, and found that 3.6 per cent. of these showed evidence of pulmonary tuberculosis, although none had previously been suspected. Of the positive cases 46 per cent. had reached a moderate or severe stage of infiltration, and 66 per cent. had been at least 5 years in hospital before attention was called to the presence of the disease. They pointed out the serious implication of the high proportion of moderately advanced and severe cases from the point of view of infection, and concluded that routine fluoroscopy of patient populations is necessary for diagnosis and control. In 1940 Wicks surveyed 13,257 patients and 2,542 staff in mental hospitals in Ontario, and described 6.7 per cent. significant lesions requiring treatment and isolation amongst patients, and 7.0 per cent. parenchymatous infiltration definitely or probably arrested. These figures are exclusive of patients already under treatment. He suggested a comprehensive plan for control and treatment. Blalock, Funkhouser and Flanagan in 1940 surveyed 1,263 patients in Southwestern State Hospital by X-ray, using paper films. The incidence of pulmonary tuberculosis in some stage, other than healed primary disease, was 10 per cent.; 4.9 per cent. of their total patients were deemed to have active disease. They discussed treatment and methods of control. In 1941 Plunkett and Tiffany discussed a tuberculosis control programme for institutions in New York State Department of Hygiene, and pointed out that the cost of providing an X-ray service to all has been the principal deterrent in establishing a uniform tuberculosis control programme. Their plan fell into two main subdivisions: (1) to determine the extent of the problem, and (2) to take the necessary steps for control. Deegan, Culp and Beck in 1942 published a paper on the epidemiology of tuberculosis following the survey of 3,407 adult patients and 749 staff by X-ray in Willard State Hospital. According to their classification 2.2 per cent. were considered active, 4.6 per cent. inactive, 3.2 per cent. healed and 10.3 per cent. showed evidence of calcification—a total of 20.3 per cent. presenting X-ray evidence of infection. Study of 587 subsequent admissions showed 17 cases of parenchymal infiltration, 7 active, 2 inactive and 8 apparently healed. A second patient survey conducted in 1940 on 2,141 patients, who previously presented no evidence of tuberculosis, revealed 16, or 0.66 per cent. new cases. Blalock and Funkhouser in 1943 published a follow-up survey of 1,156 consecutive admissions on 14 in. × 17 in. celluloid plates, and concluded that although

incidence of tuberculosis is high among the mentally ill who have been in hospital for a long time, the incidence is approximately as high at the time when these patients are first admitted to hospital.

In this country there have been fewer reports of comprehensive surveys; Berrington and Greenwood in 1942 used the erythrocyte sedimentation rate as an indicator and X-rayed all above 14 mm. 348 X-ray films were taken, and they concluded that 8 per cent. of 1,100 patients showed X-ray appearances of active pulmonary tuberculosis. Snell, McMahan and Heaf reviewed 2,271 patients in Leavesden, 2,035 by mass radiography. Only 0.8 per cent. of the hospital population could not be included in the survey. They described 6 per cent. significant pulmonary lesions, and deemed 2 per cent. to 2.5 per cent. of these active. They pointed out that deformities were common and co-operation difficult. Investigation of patients with suspicious miniature films was thorough. The great majority of their patients were mental defectives, and the incidence amongst the numerically largest class, the imbeciles, was equal to that amongst the psychotics. A further survey by mass miniature radiography was published in the M.R.C. Memorandum Special Report Series No. 251. 1,564 patients, 89 per cent. of the total resident patient population of a L.C.C. Mental Hospital, were X-rayed. Newly discovered "significant" tuberculous lesions were present in 3.5 per cent. of the total X-rayed. Of these "treatment," or active cases, amounted to 1.3 per cent.; other cases under treatment raise the number of active cases in the hospital to approximately 2.8 per cent. The authors discuss the relation of phthisis to mental disease and to length of hospitalization. They point out the difficulty raised by uncertain psychiatric nomenclature, and conclude that only the mental defective group of patients had a noticeably higher-than-average incidence. They also note a rapid increase in the incidence of tuberculosis where hospitalization has been prolonged, suggesting that "the mental patients had not imported their tuberculosis but had contracted it within the hospital, presumably through contact with infective cases or through deterioration of resistance."

The methods of approach to the diagnosis of tuberculosis in this hospital have been unsatisfactory since the outbreak of war, when our X-ray plant was requisitioned. During the last 6 years patients requiring radiological examination have been conveyed to the local municipal hospital either by ambulance or by taxi—a costly and cumbersome procedure, which kept radiological examinations to a minimum. The choice of patients for radiography was made as follows: All patients who were clinically suspicious on admission or on annual physical examination, patients who showed weight loss at quarterly weighings and those who had questionable lung involvement during other illness, were kept under observation and examined radiologically if this was considered advisable. Patients under observation were put on morning and evening pulse and temperature charts and were weighed weekly. Sputum, if available, was examined by direct smear, and if negative by culture. Erythrocyte sedimentation rate and blood-counts were done. The Westergren method of sedimentation test was used. A fall of 5 per cent. in one hour or 10 per cent. in two hours was considered abnormal. Extensive use was made of

intradermal testing, using Tuberculin P.P.D. (Parke, Davis & Co.). The test was carried out with doses of two strengths—First Test Strength and Second Test Strength. Individuals who did not react to First Test Strength were re-injected 48 hours later with Second Test Strength dose. First Strength Test Dose contains 0.00002 mgm. of the Purified Protein Derivative, which corresponds to 0.1 c.c. of a standard Koch's "Old Tuberculin" or Tuberculin O.T. in the dilution of 1 : 25,000 (0.004 mgm. O.T.) to 1 : 50,000 (0.002 mgm. O.T.). Readings were taken after 24 and 48 hours. If no reaction occurred with First Test, 0.1 c.c. of Second Strength Test dose was injected intradermally. This dose contains 0.005 mgm. of P.P.D., which is 250 times the First Test Strength dose. The reaction in most instances has reached its maximum in 48 hours. The positive reactions were classified arbitrarily as follows :

1 + reaction consists of an area of swelling measuring from 5 to 10 mm. in diameter.

2 + reaction consists of an area of swelling measuring from 10 to 20 mm. in diameter.

3 + reaction consists of an area of swelling exceeding 20 mm. in diameter.

4 + reaction consists of an area of swelling and definite necrosis.

A doubtful reaction is one characterized by a trace of swelling measuring 5 mm. or less in diameter.

A negative reaction is characterized by the absence of redness or swelling at the site of injection. (Parke, Davis & Company Leaflet B-0475. J-3.3.44-10M.)

This haphazard method of selection produced results which were slow and uncertain. At the end of 1944 it was found possible to arrange for mass miniature radiography of our staff and patients. The unit in Bristol at that time was a fixed unit, and so it was necessary to convey our patients by bus. Two bus-loads of 30 patients attended each session assigned to us, and by the co-operation of the staff of the miniature radiography department with our nurses, it was possible to deal with 94.8 per cent. of the male patients and 95.6 per cent. of the females. At the time of the survey there were 1,240 patients in the hospital, 540 males and 700 females. 1,181 were radiologically examined by miniature film (512 male, 669 female); 20 males had been X-rayed within the previous 3 months and were not repeated and the remaining 8 were subsequently examined radiologically, so that 100 per cent. of the males are included in the survey. Of the females 7 had had chest X-ray within the preceding 3 months and were not included. The remaining 24 were mainly bedridden, contracted and feeble patients, whose average age was 70 years. Thus 96.6 per cent. of the females were examined radiologically. Of our 1,240 patients, only 24 or 1.9 per cent. were not so examined, and none of these showed any clinical signs or symptoms of pulmonary tuberculosis. As is to be expected, the number of patients whose positioning was poor, resulting in doubtful films, was large, 172 (77 male, 95 female) being reported "unco-operative," "probably right" or otherwise than "normal." These were subjected to the same routine examination as those who were recalled, and if there was any doubt as to their chest condition they too were sent for large

film. 84 patients were recalled (51 male, 33 female). We selected a further 29 patients (14 male, 15 female), so that 113 patients in all were examined on large film. The examination of these patients prior to large film consisted of physical examination, ward observation and routine laboratory investigation. Pulse and temperature charts were kept and patients weighed weekly. Erythrocyte sedimentation rate was done, and sputum examined by direct smear and by culture. As a result of these investigations patients were classified either as "normal" or as "requiring further observation." The latter group contained all the active and doubtful lesions, which were re-X-rayed in 3 months and again in 6 months before assessing cases of doubtful activity. In the following figures those patients X-rayed prior or subsequent to mass radiography have been included in the category into which they would have fallen had they been discovered by miniature film. The survey thus covers the entire patient population less 1.9 per cent. bedridden and senile.

Cases showing evidence of tubercle all stages amounted to 73 (46 male, 27 female), or 5.9 per cent. of the total patient population. Of these, 1.4 per cent. were deemed active (13 male, 4 female) and 4.5 per cent. (33 male, 23 female) inactive. There were 3 cases of pleural effusion, all males. 10 cases were considered doubtful and later shown to be non-tubercular. 86.9 per cent. of the total population was considered entirely negative.

TABLE I.—*Results of Chest X-Ray Survey of Patients in Bristol Mental Hospital.*

	Males.		Females.		Total.	
	No.	%.	No.	%.	No.	%.
Total number in hospital during survey	540	—	700	—	1,240	—
" " sent for miniature radiography	512	94.8	669	95.6	1,181	95.2
" " who had large film three months before miniature film	20	3.7	7	1.0	27	2.2
" " who had large film subsequently	8	1.4	—	—	8	0.65
" " examined radiologically.	540	100.0	676	96.6	1,216	98.1
" " not examined radiologically	—	—	24	3.4	24	1.9
" " with evidence of tubercle all stages	46	8.5	27	3.9	73	5.9
Active	13	2.4	4	0.6	17	1.4
1. Minimal lesions	1	0.2	—	—	1	0.08
2. Moderately advanced lesions	2	0.4	—	—	2	0.16
3. Far advanced lesions	10	1.9	4	0.6	14	1.1
Inactive	33	6.1	23	3.3	56	4.5
1. Minimal lesions	24	4.4	17	2.4	41	3.3
2. Moderately advanced lesions	9	1.7	6	0.9	15	1.2
3. Far advanced lesions	—	—	—	—	—	—
Doubtful lesions subsequently shown non-tuberculous	10	1.9	8	1.2	18	1.5
Pleural effusion	3	0.6	—	—	3	0.24
Non-tubercular lesions	21	3.9	25	3.6	46	3.7
Entirely negative	460	85.2	616	88.0	1,076	86.9

Since the survey 6 of the active male cases and 2 of the active females have died of pulmonary tuberculosis. One male considered normal during the survey has since died of miliary tuberculosis. The incidence amongst female

TABLE II.

Reference.	Place.	Number.	Method.	Active.	Inactive.	Total.
McGhie and Brink (1934)	Canada	1,209	Tuberculin testing and X-ray	3.7%	3.5%	7.3%
Bogen, Tietz and Grace (1934)	America	2,275	Ditto	3.0%	—	—
Burns (1936)	"	3,572	"	2.1% + sputum	Parachymal tuberculosis 12.6	—
Burns (1936)	"	11,517	"	1.9% + sputum	—	9.2%
Harrison and Schein (1937)	"	2,186	Fluoroscopy and X-ray	3.6%	—	—
Bialock, Funkhouser and Flanagan (1940)	"	1,263	X-ray paper films	4.2%	6.2%	10.4%
Wicks (1940)	Canada	13,257	Numerous methods	1.3%	5.4%	All required isolation 6.7%
Deegan, Culp and Beck (1942)	America	3,407	X ray 14 in. X 17 in.	2.2%	Inactive, healed 4.6 + 3.2 = 7.8	—
Berrington and Greenwood (1942)	England	1,100	Erythrocyte sedimentation rate and X-ray	8.0%	—	—
Bialock and Funkhouser (1943)	America	1,156	X-ray 14 in. X 17 in.	3.8%	7.4%	11.2%
Snell, MacMahon and Heaf (1943)	England	2,271	Miniature radiography	2.0%—2.5%	3.5%—4%	6.0%
M.R.C. Memo Special Report Series No. 251 (1945).	"	1,565	Ditto	1.5 + 1.3 = 2.8%	2.2%	5.0%
Bristol Mental Hospital	"	1,181	"	1.4%	4.5%	5.9%

TABLE IIIA.

	Number X-rayed.	Not X-rayed.	Active lesions.	Inactive lesions.	Total.
Mott (1909)	—	—	2.0%	—	—
Snell, McMahon and Heaf (1943)	2,271	0.8%	2.0%—2.5%	3.5%—4%	6.0%
Clark <i>et al.</i> (1945), M.R.C. Special Report No. 251	1,564	11.0%	2.2%	2.2%	5.0%
Bristol Mental Hospital	1,216	1.9%	1.4%	4.5%	5.9%

TABLE III.

	Number X-rayed.			Significant lesions.			% of total in category.			Active lesions.			% of total in category.		
	M.	F.	Total.	M.	F.	Total.	M.	F.	Total.	M.	F.	Total.	M.	F.	Total.
Under 1 year	54	79	133	2	3	5	3.7	3.8	3.8	2	2	4	3.7	2.5	3.0
1-5 years	126	128	254	17	11	28	13.5	8.6	11.0	3	1	4	2.4	0.8	1.6
Over 5 years	360	493	853	40	21	61	11.1	4.3	7.2	8	1	9	2.2	0.2	1.1
Total	540	700	1,240	59	35	94	10.9	5.0	7.6	13	4	17	2.4	0.6	1.4

TABLE IV.

	Number X-rayed.			Significant lesions.			% of total.			Active lesions.			% of total.		
	M.	F.	Total.	M.	F.	Total.	M.	F.	Total.	M.	F.	Total.	M.	F.	Total.
Schizophrenic reaction type	270	334	604	29	16	45	10.7	4.8	7.4	7	2	9	2.6	0.6	1.5
Affective reaction type	110	185	295	16	9	25	14.5	5.0	8.5	2	1	3	1.8	0.5	1.0
Organic reaction type	59	83	142	5	3	8	8.5	3.6	5.6	1	0	1	1.7	—	0.7
Mental defectives	51	66	117	5	4	9	9.8	6.1	7.7	1	1	2	2.0	1.5	1.7
Miscellaneous	50	32	82	4	3	7	8.0	9.4	8.5	2	0	2	4.0	—	2.4
Total	540	700	1,240	59	35	94	10.9	5.0	7.6	13	4	17	2.4	0.6	1.4

TABLE V.

Staff.	Males.			Females.			Total.		
	No.	%	Previously diagnosed.	No.	%	Total.	No.	%	Total.
Miniature radiography	91	100	3	79	100	94	173	100	173
Reballed for large film	3	3.3	—	2	2.5	—	5	2.9	5
Evidence of tuberculosis, all stages	3	3.3	6 (6.4%)	2	2.5	—	8	4.6	8
Active.	1	1.1	1 (1.1%)	—	—	—	1	0.58	1
Minimal	1	1.1	1 (1.1%)	—	—	—	1	0.58	1
Moderate	—	—	—	—	—	—	—	—	—
Severe	—	—	—	—	—	—	—	—	—
Inactive	2	2.2	5 (5.3%)	2	2.5	—	7	4.0	7
Minimal	1	1.1	2 (2.2%)	1	1.3	—	3	1.7	3
Moderate	—	—	2 (2.2%)	—	—	—	2	1.2	2
Severe	—	—	1 (1.1%)	—	—	—	1	0.58	1
Entirely negative	88	—	88 (93.5%)	77	97.5	—	165	95.4	165

patients is much lower than amongst males—a fact noted in all the papers quoted except that of Bogen, Tiets and Grace.

DISCUSSION.

From reports of hospitals where adequate investigations have been carried out and from mortality figures, it is certain that the incidence of tuberculosis in mental hospitals is many times higher than in the general population. This larger incidence in mental hospital patients makes its recognition, control and treatment an important section of any scheme for general tuberculosis control. Although the mortality from tuberculosis in this hospital is high, the wartime increase described in the M.R.C. Report of the Committee on Tuberculosis in Wartime has not been observed here. The average tuberculosis mortality during the three years preceding the war was 11.6 per cent. of the total deaths, whereas for the first five war years the average was 10 per cent. of the total deaths. Only in 1943, when the total death-rate was the lowest on record, did the proportion of tuberculosis deaths exceed the average figure for the three previous years. Overcrowding, blackout and wartime dietary have therefore caused no increase, either absolute or relative, in our total tuberculosis deaths or in our tuberculosis mortality rate. The number of new cases notified during the war years has remained approximately at the pre-war level. The results of this survey would therefore not seem to have been influenced by wartime conditions, and may be taken as a fair representation of the average position in the hospital.

Direct comparison of our results with those of other surveys is impossible owing to lack of uniformity in methods of investigation and of classification. Such comparisons as have been made are therefore approximate. With expansion of mass miniature radiography services, it is likely that much work will be done on tuberculosis in mental hospitals in the near future. It would, therefore, be advisable that a scheme should be devised whereby results and conclusions could be directly compared. Methods of investigation and classification will be more satisfactory if simple and comprehensive. Criteria of activity such as we have adopted appear satisfactory, and a simple classification into three grades of severity of radiological pulmonary involvement, although inadequate from a strictly scientific viewpoint, will serve usefully for administration and treatment, and will further allow fairly accurate comparisons with conclusions of other hospitals.

This arbitrary division into "grades of severity" will serve a useful purpose only when its limitations are recognized. For example, "inactive disease with far-advanced lesions," if not a contradiction in terms, is, at least, unlikely. But the absence of any uniformity in reports in the literature both in regard to criteria of activity and in assessment of the extent of the disease leads to endless confusing subdivisions.

Diagnosis.—The common practice in mental hospitals, as amongst the general population, of delaying diagnosis until symptoms have appeared is unsatisfactory. There are seldom symptoms and few of the classical signs until two to three years after radiological shadows are visible in the lungs (Fellows, H. H., 1934). Much later will these symptoms and signs become

apparent in indifferent and unco-operative psychotic patients. The ordinary methods of physical diagnosis apply in mental hospitals. Stethoscopic examination of the lungs is useless in a substantial proportion of cases, but it cannot on this account be dispensed with. Sputum examination, also, must often be omitted in mental hospital practice. We have been able to demonstrate tubercle bacilli in only 3 cases by direct examination of sputum, and have cultured them from the sputum of another case negative on direct examination. This might largely be overcome by concentration, direct examination and culture of stomach contents, but we have not considered this advisable because of laboratory staff shortages. This factor has also hindered the carrying out of other laboratory tests not of a positive value, e.g., blood-counts, culture of faeces, D'Amato's test. In other respects the clinical observation of mental hospital patients is essentially the same as in sanatorium practice. Pulse, temperature and weight recordings are equally useful, and we have found the erythrocyte sedimentation rate of value in assessing the activity and in following progress (Bower and Schein, 1935).

There is no doubt, however, that the diagnosis and control of tuberculosis ultimately becomes a radiological problem in mental hospitals. Plunkett and Tiffany have pointed out the cost of such a service has long been prohibitive, but transportable mass miniature radiography apparatus has provided a satisfactory answer. A primary survey is necessary to determine the extent of the problem and further yearly review of the patient population and staff. Unless all new patients are X-rayed, or all Mantoux positive admissions, these steps alone will prove insufficient. Many mental hospitals are either temporarily or permanently lacking in X-ray apparatus, and until such a lack is supplied the problem cannot be tackled satisfactorily. Following a "weeding-out" by mass radiography, routine examinations and laboratory investigations should be carried out prior to a large film being taken, and the final assessment of cases not ruled out by large film should be made in collaboration with a tuberculosis specialist. Further desirable steps in control will be discussed later.

Treatment.—Observation cases: Whilst under observation cases of doubtful activity were transferred to infirmary wards. On being deemed inactive they are redistributed according to their mental category, and they will again be radiologically checked at the end of a year.

Active cases: On the female side there has always been ample verandah space off the infirmary ward to cope with tuberculous female patients. On the male side some structural alterations were necessary. An open verandah contiguous to the male infirmary was converted so as to add 11 further beds to the verandah accommodation already available. This provided 15 sanatorium beds. A further 4 side rooms off the infirmary are reserved for cases of tubercle, and may be used for noisy or resistive patients and for those who require constant supervision. Patients are treated as far as possible along orthodox sanatorium lines, of which diet, rest and fresh air are the mainstays. We have not carried out artificial pneumothorax although we do not consider mental disease to be any contra-indication to this method of treatment, and we intend to initiate it when conditions permit (Blalock and Funkhouser, 1943).

Laundry, eating and drinking utensils are kept separate from those of other patients. Soiled clothes are conveyed separately to the laundry and undergo steam sterilization before being mixed with the general laundry. Distinctive crockery and cutlery is provided so that any mixing with ordinary ward crockery is impossible.

The determination of progress and estimation of when the disease is arrested is difficult. Serial X-rays and erythrocyte sedimentation rate are the main sources of reliable information, although a negative sputum in some cases may be of value.

The question of providing central sanatorium accommodation, where mentally ill tuberculous patients could be transferred from other hospitals, has often been discussed. Leonidoff (1938) has argued against such a proposition; others have been in favour of it (Klopp, 1927; Wicks, 1940). The difficulties in the way of accomplishing this are so great that we do not consider that a discussion of its relative merits is warranted. Sanatorium accommodation is so restricted for the general population that it is impossible to conceive an elaborate scheme being undertaken for mental hospital patients. When small numbers of patients are involved, a method of segregation of the active infective cases and of observation of the inactive cases, such as we have indicated, must serve as an alternative.

Comparison with other surveys.—In other surveys the total number of significant lesions reported, active and inactive, has varied between 5 per cent. and 11 per cent. as compared with our figure of 5.9 per cent. In two similar surveys carried out in England by mass radiography the incidence of significant tuberculous lesions has been 6 per cent. and 5 per cent.—figures closely approximating to our own. However, the number of active cases which we have found, 1.4 per cent. of all patients, is considerably less than in any other survey. Burns (1936) used the finding of tubercle bacilli in the sputum as a criterion of activity and described 1.9 per cent. of 11,517 patients as active, but such a criterion is not generally applicable in mental hospital practice. Our criteria have been strict, involving a lengthy period of observation after preliminary X-ray and examination by a tuberculosis specialist, coupled with laboratory and clinical investigation and radiological check-up in three and six months. This low incidence of 1.4 per cent. is difficult to explain, all the factors incriminated elsewhere being equally applicable to this hospital.

Length of hospitalization in relation to tuberculosis.—It has almost become an established theorem that the incidence of tuberculosis in mental hospitals increases with the length of hospitalization. Recent work has thrown doubt on this. Blalock and Funkhouser (1943) investigated 1,156 consecutive admissions and found evidence of tuberculosis, all stages, in 11.2 per cent. of cases, compared with 10.4 per cent. incidence in a primary survey three years previously. Our figures would allow a similar view. Of active cases an incidence greater than average occurred in those hospitalized for under one year. In considering the inactive cases, it must be remembered that the greatest number of discharges from hospital falls into the "under one year" category, next in order into the "one to five year" category. Discharge of cases resident over five years is more infrequent. Also, patients whose physical condition is poor are

less likely to be discharged than those who are physically robust. Thus any increase in the incidence of inactive tuberculosis amongst patients over one year in hospital may be accounted for by their already having been infected on admission. We have two patients in the "one to five year" category at present under treatment for tuberculosis, who remain in hospital on a voluntary basis, but whose mental condition would permit them to be discharged to a sanatorium could accommodation be found for them. Any conclusion arrived at in a primary survey can, however, give no true idea of the incidence of tuberculosis amongst admissions. Only complete investigation of all new patients can decide this. Future work on consecutive admissions will help throw light on this aspect of the problem, but unfortunately due to lack of facilities we have been unable to follow this course.

Mental disease in relation to tuberculosis.—As evidence accumulates, the assertion of a predisposition to tuberculosis amongst schizophrenics becomes more doubtful (Kretchmer, 1921). In endeavouring to correlate tuberculosis and mental disease the difficulties of psychiatric nomenclature considerably complicate the picture. We have adopted the broadest possible grouping of mental diseases, as suggested in M.R.C. Report on Mass Miniature Radiography of Civilians, but have felt it necessary to add a further group under the heading of "Miscellaneous." Into this group fall epileptics, paranoiacs, psycho-neurotics and others whom we consider could not properly be classified under the broad headings chosen. Although the numbers are too small to be statistically significant, the incidence of significant lesions in the schizophrenic reaction group is less than in the affective reaction group. Three of the 9 active tuberculous schizophrenics have been in hospital less than one year.

STAFF.

The question of tuberculosis amongst mental hospital staff has received much attention. McGhie and Brink in 1933 X-rayed all the nurses and 39 selected members of the male staff in 11 provincial hospitals in Ontario. They discovered 12 positive cases amongst the male nurses, 8 of whom had active disease. Three active cases amongst the male staff were physicians. Heinbeck in 1936 published several papers indicating the high incidence of tuberculosis amongst nurses. He maintained that negative tuberculin reactors were more likely to contract the disease than positive reactors and advocated vaccination with B.C.G. Burns (1936) reported that of 2,430 employees in State Institutions in Minnesota 1,380 were Mantoux positive, of which 91, or 3.7 per cent., showed X-ray evidence of parenchymal infiltration, and 16 had a positive sputum. Hilleboe (1937) pointed out that there was ample opportunity for cross infection amongst patients in mental hospitals, and stressed that many employees working amongst undiscovered tuberculous cases in mental hospitals have contracted the disease. Myers, Trach, Diehl and Boynton in 1938 discussed the question of legal action against hospitals by staff, and concluded that for the protection of the hospital, tuberculin testing and chest X-ray of all new patients should be available. In 1940 Wicks investigated 2,542 nursing, domestic and artisan staff in Ontario Mental

Hospitals, and described 0.6 per cent. active cases amongst them, excluding those already diagnosed. 3.9 per cent. had arrested tuberculosis and were still at work. Deegan, Culp and Beck (1941) investigated 749 employees at Willard State Hospital, 393 males and 356 females, and discovered 12 cases of clinical tuberculosis (1.5 per cent.), 9 of which were minimal, 1 moderately advanced and 2 far advanced. A second X-ray two years later revealed that 3 nurses (2 student nurses and 1 attendant) had developed minimal lesions. These had previously been normal; all were asymptomatic, but had been in contact with known tuberculous cases. Snell, McMahan and Heaf (1943) examined 224 employees, 105 males and 119 females; 37 males and 5 females refused examination. No new cases were discovered amongst the female staff. Of the 3 males who required further investigation, 1 had been notified previously, 1 was inactive, and 1 resigned before further investigation could be carried out. The Medical Research Council Memorandum on Mass Miniature Radiography of Civilians (1945) reports on a group of 198 employees, representing 43 per cent. of the total staff. This low percentage was largely attributed to the absence of any active propaganda to obtain volunteers. Amongst the female staff 4 persons were discovered with significant tuberculous lesions, and 2 of these were recommended for sanatorium treatment. These figures represent an incidence amongst the female staff of 3.4 per cent. significant cases and 1.7 per cent. treatment cases.

Daniels (1944), in an Interim Report of the Proffit Tuberculosis Survey, pointed out a variety of reasons to explain the high annual case-rate amongst nurses, particularly in Mantoux-negative entrants, but concluded that it was not possible to comment on the relative risk of nursing as an occupation. When more efficient methods of investigation of the general population are evolved, and more extensive investigations of nurses before and after their entry into the profession are carried out on a large scale, this comparison should be possible. The figures from most reviews are too small to be of much value individually, and only when a uniform and comprehensive scheme of investigation is in general use will the results be of statistical value.

In the Bristol Mental Hospital one year previous to miniature radiography one physician and two male nurses had had sanatorium treatment for pulmonary tuberculosis. Their number is added to those discovered at miniature radiography in assessing the incidence amongst the staff. Administrative, artisan and nursing staff were all informed of the facilities for miniature X-ray and advised to avail themselves of them. Without further propaganda 100 per cent. presented themselves for examination.

Of the males, 62 nurses and 29 administrative staff were X-rayed. Amongst the administrative staff no significant lesions were discovered. Three of the male nurses had significant lesions, and were subjected to a routine examination similar to that of the patients. One nurse had a minimal arrested lesion, one had an advanced arrested lesion, and one was found to have a minimal active lesion with a positive sputum. This latter was immediately admitted to a sanatorium. None of these men had stethoscopic signs of pulmonary tuberculosis. Of the females, 58 nurses and 21 laundry, domestic and administrative staff were examined. One sister had a minimal healed lesion, and one of the

domestic staff was discovered to have inactive advanced pulmonary tuberculosis for which she had previously been treated in a sanatorium. No active case of phthisis was discovered amongst the female staff, but since the survey one probationer nurse, negative on X-ray during the survey, has died of miliary tuberculosis.

The figures for tuberculous infection are higher amongst the male than amongst the female staff—a significant fact when the patient statistics are considered.

Plan for future diagnosis and control.—Wicks (1940) made recommendations which represent a satisfactory scheme for the early diagnosis and control of tuberculosis amongst mental hospital patients and staff. The following should have radiological examination of lungs :

1. All new patients as soon as possible after admission, preferably within one week.
2. All applicants for staff vacancies.
3. All employees who have not been X-rayed or have not had a negative tuberculin test.
4. All employees before resigning, proceeding on prolonged leave of absence or leaving for other purposes. Negative tuberculin reactors should be repeated before leaving.
5. All staff and patients with symptoms referable to the chest, or during any undiagnosed ill-health.
6. All patients for insulin, electrical convulsive or metrazol treatment.
7. At intervals of one year, all patients and all tuberculin positive staff. All who require further investigation to be repeated in six months.
8. No negative reactor should be allowed in contact with the disease or with patients isolated pending investigations. Negative reactors to be periodically checked.
9. Concise and complete lectures should be given to the nursing staff concerned with the management of the tuberculosis ward.

In order to carry out such recommendations with economy and satisfaction mass radiography services are necessary for primary survey and for yearly "combing," whilst an X-ray plant is necessary on the premises for early diagnosis and control of tuberculosis amongst newly admitted patients. With such systematic examination, an efficient system of segregation, and an enlightened nursing attitude, there is reason to hope that the high incidence of tuberculosis in mental hospitals may be reduced until it is as low as it is in the general population, and that the standard of treatment may be as high.

SUMMARY.

A primary survey of 1,240 mental hospital patients is reported and analysed.

The incidence of significant tuberculous infection is roughly similar to other such surveys. The incidence of active disease is considerably lower.

It is not certain that the incidence of tuberculosis increases relative to the length of hospitalization.

Relation of tuberculosis to mental disease and length of hospitalization is briefly discussed.

Recommendations for a scheme of diagnosis and control are quoted.

For permission to publish this paper I am indebted to Dr. R. E. Hemphill, Medical Superintendent, Bristol Mental Hospital.

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SEVEN HUNDRED AND FIFTY PSYCHONEUROTICS AND TEN WEEKS' FLY-BOMBING.

By W. LINDESAY NEUSTATTER, M.D., B.Sc., M.R.C.P., Major R.A.M.C.

FLY-bombing is not always concentrated, for isolated explosions may occur at any time. There are also numerous if uneventful alerts. Thus there is a state of continuous uncertainty which might be expected to affect psychoneurotics considerably. I therefore set out to investigate the reactions of my patients during approximately ten weeks' concentrated fly-bombing. There were 620 soldiers—9 male officers and 121 auxiliaries—a total of 750 cases, all stationed in the London district. They were referred to me for various psychiatric reasons, by no means on account of anxiety due to bombing; nor was referral on account of fear of bombs necessarily indicative of special apprehension on the part of the patient—in some cases indeed it obviously only indicated anxiety on the part of those making the referral!

All degrees of apprehension of flying bombs were witnessed; as some degree was almost universal I thought it would be most useful to place patients in the following groups:

1. Those who were severely apprehensive.
2. Those who were completely unaffected.
3. A residual group who came between these extremes.

PROCEDURE.

A questionnaire was drawn up designed to elicit symptoms attributable to fly-bombing. Ideally these should not have existed previously, but the practical difficulty is that the symptoms of apprehension do not materially differ from anxiety symptoms due to other causes. I therefore tried by careful questions and reference to available documents to establish that where symptoms were attributed to bombing they had either arisen anew, or that there had been an obvious exacerbation of symptoms previously existent. A list of the symptoms inquired into is shown in Table I.

CRITERIA FOR INCLUSION IN THE VARIOUS GROUPS.

Group I.

The presence of marked (*a*) objective signs or (*b*) one of the last three symptoms shown in Table I, either of which could be taken as indicative of severe anxiety; alternatively the presence of four of the first six milder symptoms. (In fact, of course, if the severe symptoms were present the others usually were too.)

TABLE I.—*Group I: Frequency of Symptoms Due to Fly-bombs in 55 Severely Apprehensive Cases.**Milder symptoms.*

Poor sleep	82%
Constant apprehension	78%
Poor concentration	78%
Restlessness	69%
Staying in in spare time	62%
Poor appetite	58%

More severe.

Nightmares	32%
Vomiting	24%
Enuresis	6%
Reported inefficient	62%
Reported panicking	52%
Physical signs of anxiety	52%

Group II.

Only cases were included who showed none of the criteria selected as indicative of anxiety in Group I.

Denial of all fear definitely requires substantiation. Lack of affectation in making the denial, failure to refer to the subject of flying bombs spontaneously and lack of devious attempts to secure a distant posting were taken as evidence of veracity. The type of patient who was not included is exemplified by the soldier who had developed headaches, "blackouts" and inexplicable shaking of the legs since coming to London, which he insisted were quite unconnected with bombing, but which he was sure would be improved by a return to his previous posting at Leamington, "where the air suited him better."

Group III.

As stated, this group was arrived at by exclusion.

Particulars of the past personality and the family history were also noted (see Table III), and their incidence in the three groups compared. Group III was not of particular importance in this respect, but as a matter of interest 30 random cases approximately the size of Group II were analysed.

The numerical results were tested by the χ^2 method, and when the chance probability fell below .05 a significant difference was assumed. Where it existed between two members of a pair of figures in a table each is marked with an "s." The figures in the Tables are expressed as percentages, to make comparison between different sized groups easier.

RESULTS.

The diagnoses of the cases made as far as possible on symptoms already present, irrespective of reactions to bombing, were: Group I, 50 anxiety states and 5 hysterias; Group II, 21 anxiety states and 7 hysterias.

TABLE II.

	Group I. Severely apprehensive.	Group II. Unaffected.
629 men	7·3%	2·3% s
121 women	7·5%	9·0% s
<hr/>	<hr/>	<hr/>
Total 750	7·2%	3·4%

Table I shows the frequency with which various symptoms occurred in Group I. As might be expected, the more severe the symptom the less often it occurs. Table II: It will be noted that a significantly greater number of women were completely unaffected by fly-bombing than were men. Table III: Significant differences exist between Groups I and II for nervousness and timidity, worrying disposition and for "total neurotic traits," i.e. a summation of the symptoms recorded, each of which can be regarded as an expression of psychoneurosis.

TABLE III.

	Group I. Much affected.	Group II. Unaffected. Percentages.	Group III.
<i>Past personality.</i>			
Nervousness and timidity	81 s	50 s	72
Worrying disposition	63 s	42 s	66
Solitary disposition	55	35	42
Obsessional personality	13	18	21
Phobias present	45	24	36
Total "psychoneurotic traits"	<u>320 s</u>	<u>168 s</u>	<u>300</u>
<i>Family History.</i>			
Mother nervous	61 s	35 s	36
Father nervous	36	35	24
Siblings nervous	52	28	30
Total parents and sibs nervous	<u>135 s</u>	<u>200 s</u>	<u>100</u>
Those in past raids	84	76	72
Nervous in past raids	64 s	7 s	42
(? Those in a past "incident"	49	35	45)

A significant difference between nervous mothers of patients in Group I and II existed, and also between the total of parents and siblings in these two groups. The fact that only in regard to mothers and not fathers was the difference significant is probably due to the patient's having been more aware of nervousness in the mother; it is not likely that nervousness is a sex-linked factor. The fact that there is a significant difference between the summative

results is to be explained by the overlapping due to the fact that one patient may have both a parent and a sibling nervous.

Apparently there was no significant difference between the figures of past incidents ; by these I refer to having either been in a building which was hit, or been subject to blast, to some form of physical injury without however having been seriously injured. Obviously the severity of the incident is of consequence and the term is very elastic ; the validity of these findings is discussed later.

It will be noted that experience of past raids was almost the same in all groups, while reactions in past raids were parallel to present results, i.e. there were significantly less nervous cases in Group II than Group I.

Certain of the past personality traits are, somewhat surprisingly, not significantly different ; solitariness is a striking case in point. I had always regarded it as a very important factor in psychoneurosis in the Army generally, for the man who is lonely, unsociable and friendless, who prefers a quiet evening to the public-house, obviously finds Army life far harder than his gregarious comrade.

Phobias differ little in the three groups. I have always regarded the phobic neurotic as nearer to the obsessional—a disorder which Millais Culpin classes as a minor psychosis—and psychoses do not increase noticeably in soldiers in action. This might furnish an explanation of the findings relating to phobias. (I saw a number of psychotics during these ten weeks not included in this series and they were markedly indifferent to the fly-bombs, with the exception of one case of schizophrenia, which showed itself within two days of a bad " incident.")

My term of obsessional personality requires comment. It is nowadays a somewhat abused term, the normally meticulous needlessly apologizing for their methodical ways on the grounds of being obsessional, while the exaggeratedly pedantic use the term as a euphemism to excuse themselves. The term is used here to denote the rigid over-meticulous over-conscientious type ; it does not imply the presence of obsessive compulsive symptoms to a morbid degree. (None of these occurred in the whole series ; I have seen very few of them throughout the war.) It is noteworthy that obsessional personalities appeared infrequently in my series, but findings based on a rather loosely defined concept of this kind are naturally subject to errors of individual judgment.

Officers.

All the officers were seen during the first month ; there was nothing of exceptional interest about them. One was the poor personality who broke down after two nights' bombing ; another an excellent officer, aged 48, who had seen much active service, but who after a week of grossly inadequate sleep had become emotional and unable to concentrate ; he recovered quickly with a few days' rest. All the rest had symptoms which had resulted from very near misses.

Disposal of Group I Cases.

(Disposals from Groups II and III were unconnected with bombing, and are therefore irrelevant.)

TABLE IV.—*Disposal of Group I Cases.*

Discharged Category E . . .	18
Referred to Hospital . . .	17
Returned to Unit . . .	20

Discharge was recommended in 18 cases, whose stability was already so precarious that further stress was intolerable. They either showed very severe subjective symptoms and/or physical signs of anxiety and/or behaviour detrimental to unit morale, e.g. one man on a sleeping-out pass actually bicycled 30 miles twice a day merely in order to reach a quiet destination at night.

Hospitalization.—17 cases were referred to hospital either for treatment prior to returning to their units, or for consideration of an annexure posting away from London, or as too bad to return to their units while awaiting a Medical Board.

The types of case selected for treatment were those with a reasonably good past personality, where fear of bombs was not the sole cause, but where personal factors were also present, e.g. an auxiliary had become extremely apprehensive of flying bombs, but only after three near misses, followed shortly by news of her fiancé's death, which obviously had played an important part in aggravating her condition. A soldier who had been through the 1940 raids quite unaffected had recently spent five months nursing a wife dying from carcinoma, and had then found himself entirely unnerved by the advent of the flying bombs.

Return to duty was effected in 20 cases. For these certain simple therapeutic measures were advocated: (a) Attention to sleep was essential. More important than hypnotics was to procure a feeling of security, and units were advised to see that the patients slept in maximum safety. (b) I also advised patients off duty not to hesitate to take reasonable precautions when danger was imminent. To the bold taking risks is exhilarating; to the timid it is mere bravado. Asking nervous individuals to remain stoically exposed where there is no necessity merely causes additional strain, increases the chances of breakdown, and lessens their ability to carry on in exposed conditions when duty necessitates this. (c) I also assured patients that a fear of imminent danger was by no means confined to themselves, and that even if they showed slight manifestations of fear, provided they carried on this was all that was expected. Such reassurance was designed to help overcome the feelings of isolation and self-reproach which often appeared to play almost as large a part in their condition as the actual fear of bombs.

These measures apparently succeeded, for only two patients reappeared who required discharge.

DISCUSSION.

Firstly it must be borne in mind that my classification of patients is open to the errors which inevitably result from a method of recording dependent on accepting the patient's own statements, though I attempted to check them from documents wherever possible.

Next, as this paper is concerned with the reactions of psychoneurotics to fly-bombing, it is necessary to emphasize that the cases in this series were already a psychoneurotic group. It should be stressed that there is no reason to believe that the individuals examined were anything other than a random sample from psychoneurotics in the Army. The reason for this is, (1) that I excluded the very few cases during this period who could not legitimately be regarded as psychoneurotic (e.g. one or two individuals of good personality who had temporarily broken down as a result of some particularly harrowing experience, and at the other extreme, psychotics). (2) When new symptoms or gross exaggeration of old ones clearly due to fly-bombing (see procedure) were excluded, the patients in this series in no way differed from the ordinary run of psychoneurotics who attended my out-patient clinic at any other time.

I would, however, stress that I was dealing with psychoneurotics in khaki; for the soldier derives both advantages and disadvantages through being in the services, which makes his case different from that of a civilian exposed to the same dangers. On the one hand, he has the benefit of being one of a group, but on the other hand he is separated from his home and family, has discipline, guards, night work and other duties which tell hardly on the neurotic.

Moreover, in London many soldiers, certainly the R.A.M.C., were faced with the difficulties arising out of doing what was really civilian work, with no opportunity for aggressive action, and having to concentrate on sedentary tasks with the doodle-bug roaring overhead. I can testify to the difficulty of this; it is not easy to pay adequate attention to the past gyrations of the patient's stomach while trying to ignore the present activities of one's own.

To sum up, this group can legitimately be regarded as an unselected sample of a population of service psychoneurotics, most of whom were engaged in occupations giving no rein to the pugnacious instincts in the face of danger.

To take some of the points in connection with the results for the different groups, Group III requires little comment; it represented the bulk of the patients—91 per cent.—and their reactions corresponded to those of the population generally, i.e. they were intermittently nervous, but their ordinary activities were not affected.

Group I.—Considering these patients were all psychoneurotics, the small number (55, i.e. 7·2 per cent.) who were in Group I, i.e. severely apprehensive, is noteworthy. So is the fact that only 35 of the whole series of patients required discharge or hospitalization.

Group II.—Perhaps more surprising still is the fact that 28 patients (3·7 per cent.) should be as far as one could elicit entirely unaffected by the fly-bombs. Further, these patients, as already pointed out, had also been very little affected by the original raids—which is either confirmation of these findings, or evidence that I had been deceived on both scores twice in my case-taking.

Some case-histories might be of interest at this juncture to illustrate the contrast between the patient's marked psychoneurotic symptoms and the small effect of bombing. The first case which comes to mind is that of an officer who had come to consult me about irritability, breathlessness and

intense sweating, symptoms which caused him a great deal of concern. During the interview a bell tolled, which was the somewhat doleful local warning of imminent danger, and I suggested that we should pursue the usual course of going into the corridor to get away from glass. The reply of the patient, whom I should have regarded as a definitely timid personality, was to say, with a charming smile, "By all means if you are worried."

Another patient, who had six close psychotic relatives, who was inclined to worry, whose manner was definitely schizoid, confessed a little shamefacedly that he actually found that raids stimulated him.

An obsessional over-conscientious, strictly disciplinarian sergeant, with severe functional headaches, had a flying bomb drop extremely close without being in any way affected. Another sergeant who suffered from night terrors and shouting in his sleep, and who once, as a youth, had fainted at the sight of blood, told how he had been through many London raids and seen many casualties without undue perturbation, had a very near miss from a flying bomb, but had no consciousness of feeling afraid of subsequent ones, and there was nothing to suggest he was.

I could multiply such examples, but I will conclude with the interesting history of an auxiliary who had recurrent attacks of a severe phobia of crowds which caused her acute suffering, and made life in the A.T.S. almost unendurable at times. Quite by chance I discovered that she had been on duty on a gun site which had been hit by a flying bomb three days previously. The incident had apparently made so little impression on her that I only discovered it through a passing reference on her part. Even after mentioning it I found it difficult to get her to attend to a matter which seemed so trivial to her compared to her fear of crowds.

It is difficult to offer a satisfactory explanation of these incongruities. As I stated earlier, psychotics are little affected by external events, and it is possible that the more psychoneurosis is determined by endogenous events, such as mental conflicts, the less the patient is prone to anxiety as a reaction to events in the outside world.

Finally the difference between the "unaffected" men and women is equally difficult to explain except by invoking the magic word "constitution." The difference in response to bombing in Groups I and II is presumably explicable on the same lines, being on the grounds of difference in past and family history; this is in keeping with most findings in this war and the last. However, a word of warning is needed that though constitution may be the fundamental determinant, experiences undergone by the patient are important precipitants. Maclay and Whitby (1941) show that the nearer the bomb the greater the after-effect. I found mild concussion appeared to interfere with the regression of anxiety in previously stable individuals (1942); hence in any given case due allowance must be made for experiences undergone by the patient, as well as constitution; a matter of some practical moment in assessing attributability. I attempted to compare the number of incidents experienced by patients in the various groups in this inquiry; the results showed about an equal number in each group. I tried to establish criteria so that the incidents would be comparable, but it was extremely difficult to do so satisfactorily, and as the results

were so at variance with clinical experience I am inclined to dismiss them as not accurate.

Morale.—In psychoneuroses resulting from enemy action there are two factors: (1) Somatic disturbances producing the unpleasant sensations of fear and inhibition to function ranging from inability to concentrate to being paralysed by fright; and (2) the individual's adaptation to these. The former are largely out of the individual's control, but as a colleague of mine suggested, a person of good morale might not be able to think clearly or act usefully, but would nevertheless remain at his post.

The psychoneurotic might be expected to have difficulties on all counts, for being intrinsically hypersensitive, he tends to over-react somatically, hence experiencing excessive anxiety, and consequently having a tendency to depression with fatigue. Hence in adapting he is actually called upon to overcome greater difficulties than the normal, and this should be borne in mind in judging his reactions. In my series of patients it is noteworthy that only six who could reasonably have been expected to carry on insisted they could not "stick it," and that only 35 out of 750 patients had to be taken off duty—findings which redound to the credit of a class of patients who are not the recipients of many bouquets! Naturally a number of others expressed the desire to leave London, but even the mental defectives, when appealed to, saw the necessity for remaining at their posts.

SUMMARY AND CONCLUSIONS.

750 psychoneurotics stationed in London district during 10 weeks' fly-bombing were studied and fell into three groups:

- (1) 55 who were seriously apprehensive.
- (2) 28 who were quite unaffected.
- (3) 667 who were moderately so.

Only 18 patients needed discharge, and 17 hospitalization on account of bombing. A significantly greater number of women were completely unaffected than men and significantly more neurotic traits occurred in the past and family history in Groups I and II.

Therefore, as only 7.2 per cent. of psychoneurotics were made seriously apprehensive by 10 weeks fly-bombing, it clearly had little effect on the group as a whole.

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A COMPARATIVE STUDY OF DISEASE INCIDENCE IN ADMISSIONS TO A BASE PSYCHIATRIC HOSPITAL IN THE MIDDLE EAST.

By M. SIMS, Capt. R.A.M.C.

[Received May 25, 1945.]

IN a previous investigation* it was found that the incidence of schizophrenia in a group of 627 British N.C.Os. was much lower than in the average O.R. admissions to hospital. Two questions at once arose: Why was the incidence of schizophrenia low? and How does the disease incidence of British N.C.O. psychiatric casualties compare with other groups admitted to this Base Psychiatric Hospital? The answer to the first may become apparent when we have found the answer to the second.

In this hospital we were fortunate in having a reasonable number of groups for comparison, as all the Allied and Dominion Armies, Navies and Air Forces, operating or resident in the Middle East, sent the bulk of their psychiatric casualties to us, and there was also a section for Prisoners of War (officers and other ranks). A table has been drawn up (Table I) giving the incidence of the diseases in the various groups. Diseases listed were: Anxiety states, hysterias, manic-depressive psychosis, schizophrenia, psychopathic personalities, mental deficiency and epilepsy. Although the group of psychopathic personalities accounted for about 10 per cent. of the total, they were far too diffuse a group for comparison. For example, emotional abnormality in the African native was a very different condition to that in the B.O.R. Again, the diagnosis of mental deficiency in all its grades was based on different standards, and except for English-speaking personnel, was too unreliable for comparison; in fact in the native groups—Mauritians, Africans and Arabs—a different standard was set for each race, and the question the psychiatrist had to answer was, "Is this man a mentally defective Basuto pioneer?" and not "Is this man a mental defective?" Epileptics were not admitted as such to this hospital, and those listed were cases which filtered through and therefore not a representative sample. These groups were omitted from the final table and there remained the four large groups—anxiety states, hysterias, depressions and schizophrenias—which accounted for the largest number of admissions.

In Table II the incidence of the disease has been expressed as a percentage for each group, and it can be readily seen that there is a wide divergence in incidence. For example, in some groups the percentage of anxiety state is high, while in others it is very low indeed. In twelve out of seventeen groups (and incidentally accounting for 92.5 per cent. of the total cases), when the anxiety percentage is greater than that of hysteria, then that of depression is greater than that of schizophrenia. This is a relationship which warrants

* Unpublished paper, "The N.C.O. as a Psychiatric Casualty."

TABLE I. Diseases. Totals and Percentages. Summary.

	Anxiety.	Hysteria.	Depression.	Schizophrenia.	M.D. and D.B.	Temp. ins. and psy. pers.	Epilepsy.	Total.
British officers	92	32	68	12 (7 P.)	—	40	1	245
	37.55	13.06	27.76	4.90	—	16.33	0.4	100.00
Allied whites	3	3	4	8 (1 P.)	—	1	—	19
	15.79	15.79	21.05	42.11	—	5.26	—	100.00
New Zealand E.F.	1	1	—	—	—	—	—	2
	50.00	50.00	—	—	—	—	—	100.00
R.A.F.	6	2	7	2 (1 P.)	—	3	—	20
	30.00	10.00	35.00	10.00	—	15.00	—	100.00
R.N.	11	1	9	3 (1 P.)	—	2	—	26
	42.31	3.85	34.62	11.54	—	7.68	—	100.00
Australian	1	—	—	1 (1 P.)	—	—	—	2
	50.00	—	—	50.00	—	—	—	100.00
U.D.F.	4	—	3	2 (1 P.)	—	—	—	9
	44.45	—	33.33	22.22	—	—	—	100.00
India	5	8	7	5 (1 P.)	—	7	2	34
	14.71	23.53	20.59	14.70	—	20.59	5.88	100.00
P.O.W.	2	1	5	5 (1 P.)	—	—	—	13
	15.39	7.69	38.46	38.46	—	—	—	100.00
<i>Other ranks:</i>								
B.O.Rs., N.C.Os.	260	148	79	27 (11 P.)	—	55	4	573
	45.38	25.83	13.79	4.70	—	9.60	.70	100.00
B.O.Rs.	974	688	231	164 (30)	P. 229	293	27	2,606
	37.38	26.40	8.86	6.29	(s. 93)	11.24	1.04	100.00
					8.79			
R.A.F. O.Rs.	37	53	39	56 (13 P.)	6	34	1	226
	16.37	23.45	17.76	24.78	2.66	15.04	.44	100.00
R.A.F. N.C.Os.	34	11	10	11	—	3	—	59
	40.68	18.64	16.96	18.64	—	5.08	—	100.00
R.N. O.Rs.	28	23	9	18 (7 P.)	2	11	2	93
	30.11	24.73	9.68	19.35	2.15	11.83	2.15	100.00
Africans	12	105	36	69	29	24	11	286
	4.20	36.71	12.59	24.13	10.14	8.39	3.85	100.00
Mauritians	48	56	9	20	10	4	1	148
	32.43	37.84	6.08	13.51	6.76	2.70	.68	100.00
Allied Europeans	10	28	24	118	32	6	4	222
	4.50	12.61	10.81	53.15	14.42	2.70	1.80	99.99
Colonial Palestinian (J.)	23	40	18	15	30	4	3	133
	17.29	30.08	13.53	11.28	22.56	3.00	2.26	100.00
" (A.)	2	23	8	7	12	5	—	57
	3.51	40.35	14.03	12.28	21.06	8.77	—	100.00
Cypriots	—	9	8	8	7	4	—	36
	—	25.00	22.22	22.22	19.45	11.11	—	100.00
Italian Ps.O.W.	7	20	35	77	12	29	—	185
	3.78	10.81	18.93	41.62	6.49	15.68	—	100.00

P., paranoid states.

TABLE II.—Summary by Groups of Patients Diagnosed in the Four Diseases, Anxiety, Hysteria, Depression, and Schizophrenia, with Percentages.

	Anxiety.		Hysteria.		Depression.		Schizophrenia.		Totals.
	Number.	%.	Number.	%.	Number.	%.	Number.	%.	
<i>N.C.Os.</i>									
British Army	260	50.58	148	28.80	79	15.37	27	5.25	514
R.A.F.	24	42.85	11	19.64	10	17.86	11	19.64	56
Total	284	49.83	159	27.90	89	15.61	38	6.67	570
<i>Other Ranks.</i>									
British Army	974	47.35	688	33.45	231	11.23	164	7.97	2,057
R.A.F.	37	20.00	53	28.65	39	21.08	56	30.27	185
R.N.	28	35.90	23	29.49	9	11.53	18	23.08	78
Total	1,039	44.78	764	32.93	279	12.03	238	10.26	2,320
<i>Europeans.</i>									
Allied	10	5.56	28	15.56	24	13.33	118	65.55	180
Palestinian (J.)	23	23.96	40	41.67	18	18.75	15	15.62	96
(A.)	2	5.00	32	57.50	8	20.00	7	17.00	40
Cypriots	6	—	9	30.00	8	32.00	8	32.00	25
Ps.O.W.	7	5.04	20	14.39	35	15.18	77	55.39	139
Total	42	8.76	120	25.00	93	19.37	225	46.87	480
<i>African.</i>									
A. natives	12	5.41	105	47.29	36	16.22	69	31.08	222
Mauritians	48	36.09	56	42.11	9	6.77	20	15.03	133
Total	60	16.90	161	45.35	45	12.68	89	25.07	355
<i>Officers.</i>									
British Army	92	45.10	32	15.69	68	33.33	12	5.88	204
R.A.F.	6	35.30	2	11.76	7	41.18	3	11.76	17
R.N.	11	45.83	1	4.17	9	37.50	3	12.50	34
Total	109	44.50	35	14.29	84	34.29	17	6.92	245
<i>Dominion.</i>									
N.Z.	1	50.00	1	50.00	—	—	—	—	2
Australian	1	50.00	—	—	—	—	1	50.00	2
U.D.F.	4	44.45	—	—	3	33.33	2	22.22	9
Indian	5	20.00	8	32.00	7	28.00	5	20.00	25
Total	11	28.95	9	23.68	10	26.32	8	21.05	38
<i>European.</i>									
Allied whites	3	16.67	3	16.67	4	22.22	8	44.44	18
Ps.O.W.	2	15.38	1	7.69	5	38.46	5	38.46	13
Total	5	16.13	4	12.90	9	29.03	13	41.94	31

further investigation, and while coincidence can play some part, it is hardly to be expected that it is responsible for the fairly general application of the above-mentioned findings. It is true that they depend entirely on diagnosis, and diagnosis in psychiatry has always been and still is a sore point, yet the labels were not given hurriedly, but after observation and treatment. Furthermore, the A.F.B. r83 (modified M.E.) gave a useful account by the C.O. of the man's general behaviour and response to training, and to this was added a note by his M.O. and a psychiatric report from the Area Psychiatrist. The man's conduct sheet also accompanied him and much of the information usually obtained by psychiatric social workers was thus to hand, and the whole considered by more than one psychiatrist (in most cases three) before a diagnosis was finally made. In spite of all this, the element of doubt was present in some cases, but that does not prejudice the value of the figures in the tables unduly.

In biological estimations, clear-cut entities are the exception rather than the rule, and with psychiatric cases, too, there will always be a large number that are mixed on their symptomatology. Particularly is this so in war-time, as was stressed by McDougall in the last war and widely confirmed in this. Of the four diseases under review, the distinction between anxiety states with depressive features and depressions is not always clear, and as Major Torrie has pointed out (*Lancet*, Feb. 19, 1944), the establishment of the diagnosis was often deferred until the response to convulsant therapy could be estimated, and even then the diagnosis was often a quantitative one. Hysterias were often confused with manneristic and katatonic schizophrenias, especially in non-British personnel, and here, too, the response to convulsant therapy often determined the diagnosis. The impression was gained that each of these pairs of diseases developed in a particular personality, and while this has found support as regards anxiety states and depressions (the "super-ego diseases"), it is not generally held with the other two, yet the overlap in the cases under review often did occur.

In view of the relationship of these conditions in the tables and the clinical impression gained, the percentage of anxiety was added to that of depression, and the total expressed as a fraction over the sum of the percentages of hysteria and schizophrenia for each group, i.e. $\frac{\text{percentage A and percentage D}}{\text{percentage H and percentage S}}$. A table (Table III) has been drawn up with this information, and it can be readily seen that there is a wide variation in the size of the fraction. It is much bigger in the British officer group, and gets smaller as we approach the non-European personnel. The lower the incidence of hysteria and schizophrenia the bigger the fraction, and it is interesting to speculate as to why there should be this variation of disease incidence in the various groups. It cannot be explained on racial grounds, for there are wide differences between the British groups, and the intelligence factor does not solve the problem either, for the R.A.F. O.Rs. show an incidence of mental deficiency of 2.66 per cent. compared with 8.79 per cent. in Army O.Rs., and yet the latter are placed higher in the list. Nevertheless, the influence of both race and intelligence has probably some bearing on the size of the fraction.

TABLE III.—Percentages of Incidence of Diseases showing in Decimals the Relationship of Grouped Figures for $\frac{A + D}{H + S}$

Group.	Total cases.	Anxiety.	Hysteria.	Depression.	Schizophrenia.	Index.
British Army, Navy and Air Force officers	245	44·50	14·29	34·29	6·92	3·71
British Army N.C.Os.	514	50·59	28·80	15·37	5·25	1·94
R.A.F. N.C.Os.	56	42·85	19·65	17·86	19·64	1·55
British Army, O.Rs.	2,057	47·35	33·45	11·23	7·97	1·41
Dominion officers	38	28·95	23·68	26·32	21·05	1·24
European officers	18	16·13	12·90	29·03	41·95	0·82
Mauritians	133	36·09	42·11	6·77	14·03	0·75
R.N. O.Rs.	78	35·90	29·49	11·53	32·08	0·75
Palestinian (Jews)	96	23·96	41·67	18·75	15·62	0·75
R.A.F. O.Rs.	185	20·00	28·65	21·08	30·27	0·70
Cypriots	25	—	26·00	32·00	32·00	0·47
Ps.O.W.*	139	5·04	14·39	25·18	55·39	0·43
Palestinian (Arabs)	40	5·00	57·50	20·00	17·00	0·34
African (natives)	222	5·41	47·29	16·22	31·08	0·28
Allied Europeans	180	5·56	15·56	13·33	65·55	0·23

* These were not admitted unless they had a psychotic diagnosis. Those who were neurotic were borderline cases.

There is one essential difference between the various groups which could account for the "scatter" in the incidence of disease, and that is the degree of selection. The British officer is selected with care, and the hysteric and potential schizophrenia is largely eliminated. Similarly the trial and error principle in use with Army N.C.Os. gives a reasonably low incidence of these diseases, although the degree of selection is not quite so high. The R.A.F. O.R., on the other hand, is used largely as a tradesman, and is selected mainly for his trade qualifications, and is not expected to show the same standard of military quality as the soldier. His first severe psychiatric traumata arrive when the complex business of overseas service with its inconveniences begin to assert themselves. The soldier, on the other hand, undergoes initially a more rigorous training, with earlier breakdown in the unstable. Also the wider use of Area Psychiatrist and Selection Boards has eliminated a large number of probable hysterical breakdowns and potential schizophrenics, or at least has prevented them from coming overseas, thus lowering the incidence of these diseases in troops in the Middle East.

The low factor groups show ample evidence of inadequate selection, and in some the complete absence of it. Allied Europeans were recruited from populations which were largely refugee. Proper selection was out of the question and physical fitness alone was all that was required, and even then the standards were often allowed to fall to an inadequate level. Others were recruited from the European colonies in the cities of the Middle East, and many of the shiftless and unstable sought a solution for their failure in civilian life by volunteering for service in the armed forces of their parent country. In the case of the African native recruiting was done by the heads of the villages, and one cannot help thinking that many a village undesirable was got rid of by a cunning and unscrupulous chief. (This suspicion was later confirmed by visiting welfare

officers who knew some of the patients as civilians.) The factors involved are too numerous and complicated to allow of any criticism of selection, and it is not the purpose of this paper to make any. For example, the incidence of hysteria among African natives is comparatively high, but when one considers that the best recruits were drafted into combatant units, which have acquitted themselves well in the Far Eastern theatre, and that only pioneer units were stationed in the Middle East, we are judging a sample of the material selected—and that an admittedly inferior sample. The relatively low fraction opposite the R.N. rating may be due to the continued battle stress to which these men are subjected compared with the spasmodic stress of their comrades in the Army.

There is another point which must be stressed. While in general there is a racial gradation in the figures obtained, these do not represent the incidence of mental diseases in these peoples as a whole, but merely among those selected for the fighting forces in the theatre of war served by this Base Psychiatric Hospital. For instance, there are very large numbers of African natives who do not develop hysteria, although subject to more strain than many admitted to hospital. The figures in the table merely indicate that among the psychiatric disabilities to which the African soldier in the Middle East is prone, hysteria is very common and anxiety is very rare.

Ps.O.W. are a special group, in that they were not admitted to hospital unless they had a psychotic diagnosis, and while this principle was aimed at, a few neurotics did filter through. This group, then, is less complete than the others, and the external factors, of course, are also different, but the high incidence of schizophrenia compared with that of depression is interesting.

Selection so far has been dealt with largely from the negative point of view—that is, the exclusion of the "H" and "S" cases—but this is only one side of the picture. If investigations are being confined to the four big disease groups, it follows that if the total percentage of schizophrenia and hysteria is low, then the sum of the remainder must be relatively high. This is an ordinary arithmetical relationship, but the difference in incidence has a clinical basis too. It can be said that officers rarely break down from schizophrenia and hysteria, probably because of careful selection, but it can also be stated that they are prone to anxiety states and depressions. It has been suggested that the relatively high incidence of hysteria and schizophrenia might be reduced by careful selection; can the high incidence of anxiety and depression be taken as evidence of good selection? Hardly, for with the best selection there should be no psychiatric casualties. Yet these people possess qualities which are very desirable in an officer—a high sense of duty and the capacity to give of their best—and as Eliot Slater has pointed out (*J. Neurol. Psych.*, 1943, 6, 1), breakdown in these people in many cases could not have been predicted and the prognosis was reasonably good. The type of personality which is favoured is one with well-marked super-ego qualities, and it would appear that good selection will inevitably include a large proportion of these people.

It has been stated above that with the best selection there would be no psychiatric casualties, but this is really a theoretical "best," for it would be impossible to gauge the breaking-point of many, and while they might not

TABLE IV.

Group.	Anxiety.	Hysteria.	Depression.	Schizophrenia.	Psych. pers.	Ment. def.	Miscellaneous.	Total.
British O.Rs. (D.)	273	64	20	23	61	52	10	593
" " (T.)	146	70	60	127	80	58	14	555
Army N.C.Os. (D.)	88	13	9	4	10	1	4	129
" " (T.)	53	13	17	15	13	4	5	120
Officers (D.)	37	4	7	4	1	—	—	58
" " (T.)	32	—	9	8	2	—	2	53
Africans (D.)	1	9	4	21	7	9	4	55
" " (T.)	11	32	18	54	19	25	8	167
Palestinian Jews (D.)	12	9	6	1	20	—	—	48
" " (T.)	6	4	2	5	8	3	—	28
Arabs (D.)	—	17	—	2	—	14	7	74
" " (T.)	1	11	—	2	34	6	—	43
Cypriots (D.)	3	7	1	4	7	4	—	27
" " (T.)	3	6	—	4	4	1	—	18
Mauritians (D.)	—	4	—	—	2	—	—	6
" " (T.)	—	6	2	3	2	1	1	15
Singalese (D.)	5	10	1	3	1	2	1	23
" " (T.)	—	8	—	7	9	—	—	24
Maltese (D.)	2	2	—	—	3	2	—	9
" " (T.)	1	—	—	—	1	—	—	2
Sudan Defence Force (D.)	—	—	—	—	—	—	—	—
" " (T.)	—	—	—	1	1	—	—	2
Royal Navy O.Rs. (D.)	8	—	2	5	5	—	2	22
" " (T.)	14	6	7	18	10	1	5	61
" " N.C.Os. (D.)	5	1	1	—	—	—	—	8
" " (T.)	7	1	1	2	—	—	—	11
" " Officers (D.)	—	—	—	—	—	—	—	—
" " (T.)	8	—	3	—	—	—	—	—
U.D.F. European	937	245	34	38	32	57	84	1,254
" Cape Corps	96	61	6	23	1	4	6	186
" Native	44	45	14	52	4	11	27	155
Greek Forces	32	51	27	49	7	10	16	192

(D.) direct admissions; (T.) transfers.

TABLE V.

	Anxiety.	Hysteria.	Depression.	Schizophrenia.	Total.	Index.
British O.Rs.	419	134	80	150	783	
"	53.51%	17.11%	10.21%	19.22%	100.00%	1.757
" N.C.Os.	141	26	26	19	212	
"	66.51%	12.26%	12.26%	8.96%	99.99%	3.71
" Officers	69	4	16	12	101	
"	68.31%	3.96%	15.84%	11.88%	99.99%	4.05
" Africans	12	41	22	75	150	
"	8.00%	27.33%	14.66%	50.00%	99.99%	2.09
Palestinian Jews	18	13	8	6	45	
"	40.00%	28.38%	17.77%	13.33%	99.98%	1.36
" Arabs	1	28	—	4	33	
"	3.03%	84.84%	—	12.12%	99.99%	0.031
Cypriots	6	13	1	8	28	
"	21.42%	46.42%	3.57%	28.57%	99.98%	1.33
Mauritians	—	10	2	3	15	
"	—	66.66%	13.33%	20.00%	99.99%	0.15
Cingalese	5	18	1	10	34	
"	14.70%	52.94%	2.94%	29.41%	99.99%	0.21
Maltese	3	2	—	—	5	
"	60.00%	40.00%	—	—	100.00%	1.5
Sudan Defence Force	—	—	—	1	1	
"	—	—	—	100.00%	100.00%	—
Royal Navy O.Rs.	22	6	9	23	60	
"	36.66%	10.00%	15.00%	38.33%	99.99%	1.07
" N.C.Os.	12	2	2	2	18	
"	66.66%	11.11%	11.11%	11.11%	99.99%	3.50
" Officers	8	—	3	—	11	
"	72.72%	—	27.27%	—	99.99%	—
Royal Greek Army	32	51	27	49	159	
"	20.12%	32.07%	17.00%	20.81%	100.00%	0.59
U.D.F.	937	245	34	38	1,254	
"	74.72%	19.54%	2.71%	3.03%	100.00%	3.43
" Cape Corps	96	61	6	23	186	
"	51.61%	32.80%	3.22%	12.36%	99.99%	1.21
" Native	44	45	14	52	155	
"	22.33%	22.84%	7.10%	26.39%	100.00%	0.59

become mentally ill through action, domestic trouble may precipitate the breakdown. Also, a complete absence of psychiatric casualties would mean that many suitable individuals were rejected on account of over-caution. An optimum casualty rate should be aimed at in the interests of "man-economy," but the type of breakdown appears to be just as important as the breakdown rate.

Again, it cannot be assumed that the groups with the low incidence of anxiety and depression are deficient in super-ego qualities and do not suffer from these diseases. This is shown strikingly in African native patients, who, although exhibiting gross hysterical and other dissociative behaviour when with their units, have become extremely well integrated as a group when tribal conflicts arose. They knew, almost instinctively, where their duty lay. It appears that their super-ego is attached to tribal customs and taboos, and some find it difficult to attach it to the fight against Hitlerism, or to the Atlantic Charter, especially when their contribution is mainly that of a simple labourer. For them the conflict hardly arises, the mechanism of dissociation coming quickly into play, with a conversion hysteria resulting.

All these cases were admitted between March, 1942, and July, 1943, thus taking in the active period of operations in the North African campaign. Further groups of cases were obtained from a second Base Psychiatric Hospital, which, however, did not start admitting cases till the campaign in North Africa was over and battle casualties were few. These have been presented in tables similar to the first set (Tables IV and V), except that it was thought advisable to split up each group into direct admissions and transfers from other hospitals, and the paranoid states (including paranoid schizophrenias) were treated separately from the schizophrenias and omitted from the final analysis. The period over which the cases were admitted was from July, 1943, to September, 1944, many of the British O.R. transfers coming from Psychiatric Units in India. There are some noticeable differences in incidence, e.g. the fewer cases of hysteria in B.O.Rs., but this I attribute to the relative absence of battle stress in these groups. However, the main theme holds in the majority of groups—that is, the anxiety, hysteria, depression, schizophrenia ratio—and an index has been worked out for each group.

The U.D.F. authorities, at the request of their psychiatrist, Major Alice Cox, kindly gave me copies of her carefully prepared quarterly returns. These cases were not all admissions to hospital, but a record of psychiatric consultations, many of which were, of course, admitted. The figures are, however, very interesting in that the incidence of anxiety states is very high in European personnel, and not uncommon in the coloured groups. This is probably because the cases concerned were psychiatric consultations and not admissions to hospital, the anxiety states being more amenable to out-patient treatment. It does show, however, that African natives are liable to suffer from anxiety states, although they may not all find their way into hospital.

I am also grateful to Capt. Phillipopolus, of the Royal Greek Army, who kindly gave me his figures for psychiatric casualties in the Royal Greek Navy, Army and Air Force from October, 1943, to September, 1944, including a few out-patients examined by medical boards.

CONCLUSIONS.

In a paper of this nature it is wiser to avoid drawing conclusions, for there is much that is speculative, and the "concrete" part of the paper rests entirely on diagnosis, and that is not a very constant factor. But the difference in the incidence of diseases in the various groups is too wide to be explained away by errors in diagnosis, and there must be some other factor or factors causing them. I have suggested that it is largely due to the degree and standard of selection and the psychiatric screening, although allowances may be made for undue stress in the case of the Royal Navy. When these standards have been high, the anxiety states and the depressions predominate, and when low the hysterias and schizophrenias predominate. The $\frac{A \text{ and } D}{H \text{ and } S}$ fraction may be used as a psychiatric index of selection, but how fine it is and how much importance can be attached to it is difficult to say. More comparative tables with larger numbers would be necessary before any real reliance could be placed on it.

Although there is an arithmetical relationship between hysteria and schizophrenia, there is not sufficient evidence in this investigation to show that there is any definite clinical relationship between the two, but it does leave the matter open for discussion, and the parallel between the hysteria and schizophrenia group and that of anxiety and depression is a tempting one to draw.

Explanatory notes on each group have not been given, it being thought advisable to present the comparative tables as a general picture and avoid particularization, although each group has its own quota of qualifying factors.

In general, then, it would appear that to discuss disease incidence among patients in a military psychiatric hospital without splitting them up into their respective groups might prove misleading.

SUMMARY.

A comparative study of disease incidence in patients admitted to military psychiatric hospitals has been made. The influence of the degree of selection and psychiatric screening on the various groups has been discussed.

I am grateful to Brigadier Barbour (Consultant in Psychiatry) for his helpful criticism and interest.

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A COMPARISON OF PROLONGED NARCOSIS AND CONVULSION THERAPY IN MENTAL DISORDER.

With a Note on a Centralized Treatment Unit for Both Sexes.

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A DISCUSSION of the use of prolonged narcosis in mental disorder might seem to be something in the nature of a valedictory address. The ease of application of electric convulsion therapy (E.C.T.), and the excellent effects of its use (1, 2, 3, 5, 11, 25, etc.), particularly in melancholia, have tended to overshadow the benefits to be obtained from an efficient narcosis clinic.

The following description of the results achieved by the same observer in over 400 cases, during a period from 1939 to 1942, using both forms of therapy in similar groups, indicates that the advantages of E.C.T. are its simpler technique and some saving in time. These are extremely important values, and make E.C.T. the treatment of choice in the absence of special indications for narcosis.

The comparatively complicated procedure of narcosis involves a double penalty, for besides the difficulty as such, the treatment is, because of this, much more frequently carried out inefficiently or incompletely, and this leads to false depreciation.

The dangers of narcosis are well known; those of E.C.T. are not yet so familiar. Besides excitement and violence (9), spasticity (46), memory defects (4), widespread brain changes, not as a rule of serious extent (33, 36, 41, 42), epilepsy (36), which may come on as late as two years after treatment (28), there is the problem of fractures in something less than 3 per cent. (44, 46), and deaths from various causes (32, 34, 35). Sometimes hyperpyrexia or status supervene several days after the completion of treatment (16), and such late complications suggest that delayed effects of E.C.T. may sometimes be missed.

The necessity for extreme caution in the presence of heart disease, high blood pressure, arteriosclerosis, pulmonary tuberculosis, syphilis, etc., is well recognized, but sometimes conditions which would have been judged contra-indications can only be diagnosed post-mortem (10). The danger of fractures is not great; the 1 to 2 per cent. of spinal fractures can be ignored in practice, and only the fractures of femur, humerus, etc., and occasional dislocations, occurring altogether in about 1 per cent. of cases, cause serious difficulty. With careful selection my own experience has been fortunate. In over 200 cases in this series there were no serious complications directly attributable to E.C.T., and in several hundred other cases the incidence of complications was minimal.

An attempt to produce extended unconsciousness without a fit (12) may lead the way to even safer treatment, but subconvulsive doses have been regarded as ineffective (15, 25).

Regarding the safety of narcosis, under the special conditions obtaining in these cases, more than 250 treatments were completed without a single threat to life.

There has been a tendency to modify the first over-optimistic impressions of E.C.T. treatment (18), and Impastato and Almansi, describing results in 2,377 cases, found only 63 per cent. of involuntional melancholias clinically cured, and 57 per cent. of other depressions (24). Petersen and Turner (40) provided evidence that E.C.T. is by no means a panacea for mental ills. This leads to the most frequent indication for narcosis, in failed cases with E.C.T.

INDICATIONS FOR NARCOSIS THERAPY.

1. Cases not responding to E.C.T. It has been pointed out that those who improve with E.C.T. are not necessarily those who would do so with narcosis (24), and I have treated several patients in whom an apparent cure was obtained with narcosis after the failure of E.C.T.

2. Cases of mania not controlled by moderate sedatives and a preliminary convulsion. Mania is generally agreed to be more resistant to E.C.T. treatment than melancholia. A narcosis almost always produces striking improvement. The danger of relapse is considerable, but the treatment should be followed up by E.C.T., the patient being quiet and amenable.

3. Cases of melancholia under the same conditions.

4. Acute anxiety states, with evidence of autonomic disturbances. Rarely as well for disturbed hysterics.

5. Acute agitation in obsessive-compulsive psychoneuroses. I have several times produced sufficient stabilization in such cases to make simple psychotherapy, aimed at persuading the patient to adopt a tolerant attitude to his neurosis, effective enough for satisfactory adjustment. A narcosis might sometimes be tried before a pre-frontal leucotomy.

6. Excited catatonics. These patients often react badly to E.C.T. (24, 37), whereas narcosis may produce a phase of comparative quiet, making possible a more general course of therapy.

7. In some cases of severe depression with arteriosclerosis, with or without high blood pressure. It may sometimes be considered that there is much less risk of a vascular accident with narcosis than with E.C.T.

8. Severe depression with thyrotoxicosis. This is largely a matter of opinion, since barbiturates have to be used cautiously in thyrotoxicosis, but I prefer narcosis to E.C.T. in such cases.

9. Melancholia with schizophrenic symptoms. Here again the choice is largely a personal one.

10. In occasional cases where prejudice or fear are strongly aroused by the thought of fits, narcosis may be acceptable.

In short, it is safe to say that prolonged narcosis is still an essential weapon in the armamentarium of the psychiatrist.

WAR EXPERIENCE.

Regarding the acute anxiety states mentioned above, the value of narcosis in the severe mental disturbances arising out of the terrifying experiences of war has been properly appreciated (6, 23, 26, 45, etc.), and a return of 70 per cent. of cases of acute anxiety and fatigue to full aircrew combat duty has been claimed (20).

Narcosis has also been successfully employed in the subacute mental states, including psychoneuroses, associated with service personnel (7, 19, 48, etc.), and I have seen good results in such cases, but on the whole have been disappointed. E.C.T. has also been used for such psychoneuroses, especially anxiety (24).

La Barre and Kettermeyer (27) showed that intravenous barbiturate inhibits adrenalin secretion following insulin injection. In their opinion this action depended on the paralysis of thalamic centres. It presents a possible explanation of the relief afforded by narcosis to terror reactions of various kinds.

THE CENTRALIZED TREATMENT UNIT.

Worthing and his colleagues (51) advocated in 1943 the use of a separate, centralized unit for insulin, metrazol and electric convulsion therapies, and stressed the paramount importance of highly trained medical and nursing staffs.

Such a unit was in use from the beginning of 1940 for the cases here reported, with the variation that prolonged narcosis was carried out in the same, separate villa. The sisters and nursing staff generally were highly trained and acquired very considerable experience indeed of the various techniques, gaining unusual skill not only in general nursing, but in gastric lavage, tube feeds and intravenous injections, first with insulin treatment, and later with narcosis. They formed a team selected from the best available in the hospital. The introduction of sleep treatment into what had been primarily an insulin unit was received coldly by the nursing staff at first, but quick and satisfying results soon generated considerable enthusiasm.

The villa in use consisted of a centrally heated building with large, airy rooms, containing adjoining male and female wards for insulin treatment and two wards for each sex for narcosis, one each for treatment, and for recovery from stupor. Each ward contained six beds separated by low canvas screens, which hid patients from one another, but permitted easy, simultaneous observation. The screens were particularly convenient for "mass" E.C.T. treatment. In addition there were two single rooms to meet occasional difficulties in management.

Although the bulk of the food was supplied by the main hospital kitchens, the building had its own kitchen, where milk puddings, fresh teas and other extras which mean so much could be prepared.

All patients were recent admissions to a mental hospital, and the majority were certified. Men and women shared common sitting and dining rooms, used the same garden and attended the same occupational therapy department.

The men's lavatories were on the ground floor, women's on the first floor. No sex difficulties were met, and the noticeably improved deportment and increased friendliness of men and women were pleasing features.

A doctor's consulting room was included, so that he could be within a few seconds' call while insulin therapy was in progress, but could otherwise carry on with interviews and psychotherapy. For narcosis during the remainder of the day, there was a doctor available at a few minutes' notice, not necessarily in the building.

Noisy, aggressive patients and those with clouding of consciousness were excluded. This selection accounts largely for the excellent results achieved, and made it clear that the dangers of narcosis are almost completely limited to restless, confused and toxic patients.

TECHNIQUE.

The drugs used were somnifaine (80 per cent. of patients), or a mixture of medinal and luminal (20 per cent. of patients). It is unnecessary to give details of management, which have been well described, with various modifications, on several occasions for somnifaine (30, 31, 39, 47) and for medinal and luminal (8, 49, 50).

Certain changes from previous procedures were inaugurated and deserve mention. The difference between night and day was ignored as far as narcosis was concerned, since the treatment was conducted in darkened rooms fitted with silent, rubber floors. A competent sister and adequate assistance were available throughout each twenty-four hours. Medication was given four-hourly, four of the nursing staff making a round from patient to patient for each dose, giving at least one pint of nutrient fluid at each visit, by tube where necessary, providing any attention required, and taking routine observations. A minimum of six pints of fluid were thus administered daily always with the patient propped up. The speed and competence of the staff were noteworthy, and no accident or complication attributable to their increased responsibilities ever occurred. The treatment was almost always pushed to a depth where tube-feeding became necessary. The average duration of tube-feeding in somnifaine cases was two days, and in medinal-luminal cases it was over six days—a striking difference, dependent on the slower excretion and destruction of the medinal and luminal and the heavier toxæmia in consequence. The giving of sedative at regular times, usually twice a day, was recommended by Menzies (31). I gave the barbiturate every four hours, because certain investigations led me to believe that the level of the blood barbiturate could be kept most even with this frequency. I still think this is so for somnifaine, but with medinal and luminal mixture four times a day should be sufficient.

Following test doses of 1 c.c. and 2 c.c. of somnifaine on successive days, the treatment was commenced with a prescription for $\frac{1}{2}$ c.c. to be given four-hourly, and this was steadily increased or varied as required, always moving by quarters of a c.c. Even with the stringent safeguards provided against noise, the average dose of somnifaine needed to provide up to 20 hours' sleep

daily was 7.3 c.c. and, of the mixture of 5 gr. of medinal and 1 of luminal to 1 drm., the average daily dose was 7.1 drm. I am unable to understand how satisfactory treatments are conducted with a dose of somnifaine rarely exceeding 4 c.c. (22, 29). During the emergence from narcosis medinal gr. 10 was given once or twice a day for a few days.

In the first 20 per cent. of cases, something over 50 patients, insulin 5 units was given with each dose of sedative. Its omission did not lead to any noticeable difference.

A few aseptic, necrotic abscesses developed when somnifaine injections were confined to the upper and outer quadrants of the buttocks, and although they were easily cleared up by one free incision and the breaking down of small pockets with the finger, it was found possible to avoid them altogether by spreading the injections. Until the staff became used to the different sites for injection 24 spots were marked on the skin with an indelible pencil, using the deltoids, pectorals, erectores spinae and lateral thighs as well as the buttocks, so that the same place was chosen only every four days.

No special psychotherapy beyond the simple encouragement of the ordinary doctor-patient relationship was employed.

The E.C.T. treatment followed the usual lines of gradually increasing the dose in time or intensity of current in order to produce fits with minimal dosage. The patient, in loose, warm clothes, lies on a bed fitted with a spring mattress. No restraint was practised, but a careful watch was kept for dangerous movements. The spine was never X-rayed, but excluding this possibility of error, there were no complications. One severe, chronic case of rheumatoid arthritis took the treatment without difficulty.

THE COURSE OF TREATMENT.

The narcosis was remarkably smooth and there were no deaths or serious complications. Deaths occurring within two years of the treatment are briefly mentioned later. One may repeat that it is clear from this that deaths from narcosis are confined to those excluded from this series by being noisy, violent or confused.

Sleep averaged 18.4 hours daily for the whole series, the treatment lasting on an average 11.8 days, of which 7.4 days had 18 or more hours' sleep. No patient was under treatment less than 6 days, but treatment was terminated if there were any signs of danger developing. Fifteen per cent. gained weight, but there was an average loss of 1.5 lb. during treatment. On rare occasions the loss or gain was astonishing—up to one stone.

There were slight rises of temperature on odd days in 50 per cent. of cases, the incidence rising steadily from the first day to the fifth, making a plateau to the ninth, then diminishing in proportion to the frequency of the termination of treatment.

Eighteen patients vomited on 36 days, averaging two days each. The standard treatment was gastric lavage before feeds, and this was always effective. Occasionally the foot of the bed was raised and $\frac{1}{100}$ gr. of atropine injected.

Two minor collapses were managed by ordinary anti-shock treatment and

intravenous picrotoxin (14). Abdominal distension and retention of urine were rare and gave no difficulty. Restlessness was infrequent. Treatment was suspended three times because of sore throat, while jaundice, phlebitis and blood in the stools occurred once each.

RESULTS OF TREATMENT.

Results of treatment in abnormal conditions are often difficult to assess, especially when many recoveries would occur without specific therapy. Efficacy depends a great deal on the belief and confidence of the physician; even in such profound aberrations as melancholia and schizophrenia, the patient responds to the tacit assumption of cure implied by active and time-consuming attention on the part of doctor and nurses, and this measure of response would be evoked by injections of sterile water accompanied by a complicated ritual. This fact notwithstanding, I do not think there can be reasonable doubt that treatment as here described produces amelioration and shortening of the malady in a large proportion of cases.

In the following tables E. = E.C.T. treatment, or, in 20 per cent., azoman or cardiazol. (Fits averaged 9 per patient treated, but sometimes 15 or 20 were given.) N. = narcosis. I. = insulin.

MELANCHOLIA.

The information at my disposal does not make it possible to differentiate involuntional melancholias. If this were possible, doubtless the results with E.C.T. in such cases would show up very favourably (21, 38, etc.).

As the average age of 147 cases of recent melancholia treated was 47.9 years, involuntional cases were almost certainly well represented. Almost all were under certificates of insanity. Discharge from hospital was roughly the equivalent of clinical cure. At the very least certification ceased to be necessary and suicide was no longer a danger.

I am unable to state the relapse rate, but as far as I know readmissions within a few years were very infrequent.

TABLE I.

Treatment.	Number of patients.	F.	M.	In hospital.
E. only . . .	42 . . .	42 . . .	0 . . .	3.9 months.
N. only . . .	56 . . .	36 . . .	20 . . .	4.5 "
E. after N. . .	5 . . .	5 . . .	0 . . .	6.5 "
N. after E. . .	7 . . .	4 . . .	3 . . .	6.9 "

Twelve further cases, most of which had both treatments, remained chronic psychotics, and three of these died within two years of treatment. Fitzgerald (11) reports a reduction in hospital from 6-9 months to 2-3 months with E.C.T. This may not include the further month usually recommended for E.C.T. cases, to guard against relapse.

TABLE II.—*Melancholia with Complications. All treated by Narcosis, three having had E.C.T.*

	No.	F.	M.	Age.	Disch.	In hospital.
Plus schizophrenic symptoms	12	10	2	41	9	4·8 months.
Plus arteriosclerosis	8	4	4	55	6	2·8 „
Plus hyperthyroidism	5	5	0	46	5	3·3 „

One man was a post-encephalitic. Several cases of melancholia included in Table I had thyroid extract as well as other treatment. Altogether 90 per cent. of 147 acute cases were discharged.

TABLE III.—*Extra Cases Treated with E.C.T.*

	Number.	Improved.	Disch.	Deaths.
Chronic melancholia (over two years)	6	1	1	1
Senile dementia with depression	5	0	0	3
Epilepsy with depression	5	0	0	3
General paralysis with depression	3	2	0	1

The deaths were within two years, and apparently not related to treatment.

MANIA.

There were 36 cases, 30 women and 6 men; at least 7 were recurrent. The average age was 46·0.

TABLE IV.

Treatment.	Number.	In hospital.
E. only	5	3·6 months.
N. only	19	5·2 „

Five more were discharged, three with narcosis after E.C.T. and two with E.C.T. after narcosis. The average time in hospital of this group was 11 months.

Of the seven who became chronic psychotics, three died within two years. They had all had narcosis and four had had E.C.T. The deaths were from senility and pneumonia and apparently unrelated to treatment.

Together, 80 per cent. of patients with mania recovered with narcosis or E.C.T., or both.

SCHIZOPHRENIA.

One hundred and sixty-six cases, many recurrent. Patients treated only with insulin are omitted, as are six schizophrenics with "manic" excitement, given a brief narcosis as a prelude to insulin.

Fifty-four were unimproved, although three left hospital, 31 after E.C.T. or narcosis, or both, as well as insulin, the others after narcosis or E.C.T. only. The discharge rate was nearly 70 per cent., but the standard of "cure" was

TABLE V.

Treatment.	Number of patients.	Time in hospital.
E. only	38	4.8 months.
N. only	33	6.5 "
N. after E.	7	4.8 "
E. after N.	11	4.8 "
E. after I. and N.	3	7.0 "
I. after E. and N.	20	5.3 "

not as high as with melancholias, many of the schizophrenics or paraphrenics having residual symptoms. Eight patients had had T.A.B. vaccine intravenously. Eleven of the chronic patients died within two years of treatment.

Among the patients of this group treated by narcosis only, age appeared to make little difference.

TABLE VI.

Age.	Number.	F.	M.	Av. age.	In hospital.	Discharges.
Under 30	25	23	2	24	5.1 months	15 (60%)
Over 30	24	21	3	45	7.9 "	18 (75%)

I believe insulin to be the best available treatment for schizophrenia, but E.C.T. and narcosis should be available for successive trial.

Treatment in failed cases was most frequently abandoned for mental deterioration, but occasionally for physical deterioration. It is possible that a too vigorous programme of treatment impairs vitality. There were 25 deaths among 368 of these selected new admissions within two years of treatment. This is a subject for future investigation.

One hundred chronic schizophrenics, for whom treatment by special means had been abandoned, were given E.C.T. for the first time and 27 were discharged. This is a most deceptive figure, as in only two or three was improvement sufficient to approximate to a cure. As a rule arrangements were made by relatives, which happened to post-date treatment. Delayed recoveries are known, of course, without treatment.

Taken together, one gains the impression from these results that the cure rates for narcosis are as good as those for E.C.T. The latter has pride of place because of its technical advantages, but although resistant cases often defy all forms of treatment, every now and then a patient recovers with one form of therapy where the other had proved ineffective. It is impossible to say, of course, how often a repetition of the same treatment would have been equally efficacious.

If the views of Gellhorn (13) and Quastel (43) are correct, that all forms of "shock" treatment, insulin, narcosis, E.C.T., depend on cerebral anoxia for their action, it is not surprising that total results are very much the same, when one form of treatment is compared with another.

PSYCHONEUROSES.

Cook and Ogden (5) have reported good results with convulsion therapy in hysteria, as well as in melancholia. I cannot confirm this, but results are difficult to assess. Patients were voluntary admissions and almost all left hospital.

Of 10 chronic psychoneurotic depressions treated with narcosis, nine went home after an average stay in hospital of nearly 11 months; one died several months after treatment.

Of 16 mixed, rather chronic psychoneurotic reactions, neurasthenic, hysterical, or hypochondriacal, treated by narcosis, two after E.C.T., all returned home in an average time of 4.1 months.

Of 12 hysterics and neurasthenics treated with E.C.T. only, all went home in one to two months. The improvement rate was about 30 per cent. for both kinds of treatment, and on the whole results in the psychoneuroses were disappointing.

CONCLUSIONS.

1. Some modifications in the technique of narcosis, increasing safety and effectiveness, are mentioned.
2. The success of a centralized treatment unit for recent admissions in a mental hospital, where both sexes share common dining and sitting rooms, etc., is described.
3. The essential nature of prolonged narcosis as one of the treatments available for mental disorders is advanced.

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ELECTRICAL CONVULSION THERAPY IN 500 SELECTED PSYCHOTICS.

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ALTHOUGH the electrical treatment of mental disorders is still in the empirical stage, its use is well established. Certain features and principles of treatment have been elucidated in the published reports, and all are agreed that it is specific for melancholic states.

The evaluation of the scope and usefulness of E.C.T. would be enhanced by the comparative study of case material from various clinics, but much in the published reports is not strictly comparable because of the unavoidable variation in the assessment of diagnosis and the degree of recovery. In our case material collected over a period of five years we have endeavoured to present the facts with a minimum of subjectivity by limiting our observation as far as possible to measurable data. In order to reduce the variable factor of diagnosis, some 700 psychotics treated with electrically induced convulsions have been reconsidered and 500 selected for analysis after carefully excluding the overlapping types, particularly those cases presenting features of both affective and schizophrenic psychoses. The selected cases can therefore be regarded as classical examples clearly separated into the two large groups of biogenetic psychoses—schizophrenic and manic-depressive, including involutional melancholia.

Further subdivision of the depressives was made on the basis of such objective and easily comparable factors as sex, age, body build and recurrency of attack. In addition we have taken notice particularly of the therapeutic results in the reactive as compared with the endogenous types.

It is true that other factors, such as heredity, duration of illness and the prepsychotic personality may also influence the outcome, yet they have not been considered in the present study because of the difficulty in obtaining reliable and measurable data.

The 500 selected cases varied in age from 13 to 71 years, and since the bulk of them were female melancholics, it was thought advisable to make a simple, objective and easily comparable subdivision of these cases into five groups according to the following age-periods :

- (1) Up to 25 years—adolescents.
- (2) 26 to 40 years—adults.
- (3) 41 to 50 years—involutionals.
- (4) 51 to 60 years—preseniles.
- (5) 61 and over—seniles.

In the assessment of the results of treatment and their arrangement into statistically acceptable grades we are inevitably faced with the effect of subjective bias in the standard of remission, especially when, as in our cases, a follow-up has not been made. We have therefore limited the range of results to three grades—recovered, improved and unimproved.

Under recovery are placed those patients discharged from hospital with a full remission of psychotic symptoms. The term improved is applied to those in whom there was a partial remission of symptoms, whether discharged or not. The unimproved constituted the failures remaining in hospital with little change in their condition.

The number of returns to hospital has also been determined without prejudice to the recoveries, since the majority of returnees were fresh attacks. On the other hand, it is felt that five years is too short an interval to permit the use of the term complete recovery. It would appear, however, that the most we can expect from E.C.T. is a shortening of the current attack, for there is little evidence that the treatment has any effect on the incidence or frequency of further attacks.

The fact that E.C.T. will often cut short or abort an acute phase of a psychosis is in itself a fundamental therapeutic contribution which at the same time improves the chances of recovery.

The shortening of the sojourn in hospital is another important point. Apart from the economic gain, it will have a favourable effect upon the whole attitude of the patient towards himself and his morbid condition.

The predominance of females in our case material is due to a deliberate selection of the more recoverable melancholic states, which are relatively more frequent in the female sex and constitute nearly 50 per cent. of the admissions. Social-environmental conditions play an important part in precipitating depressions in females, as was shown by Thorpe (1939) in a series of cases under the title of demolition melancholia. Much worse upheavals have occurred during the war period, producing reactive depressions in predisposed individuals.

TREATMENT.

There are few practical difficulties in the application of electrical convulsion therapy, and we have endeavoured in all cases to give the minimum stimulus producing a convulsion. Leaving the voltage unchanged at 100, the shock is given for a duration of 0.3 sec., increasing to 0.5 sec. if no convulsion is produced. It was seldom found necessary to go beyond this if a good and firm electrical contact was made between the skin and the electrodes.

Far more important is the question of the spacing and the number of applications to be made in any particular case, as each patient needs a plan of treatment depending upon the type, intensity of the mental disorder, the physical condition, age and the individual reaction to treatment.

In many melancholics improvement is evident after one or two shocks, and in these cases 10 convulsions were considered to be the minimum, given three times weekly for two weeks, then twice in the third week, followed by once weekly. In our experience treatment should not be suspended if no

improvement ensues after 4 to 6 convulsions. In exceptional cases of melancholia 60 to 70 convulsions were induced with eventual recovery with no symptoms of ill effect.

In general it was found that mania and schizophrenia required a longer and more intensive course of treatment than melancholia, the prevailing tendency being to give up too soon.

In mania it was often found necessary to reduce the spacing of treatment to once daily, yet in spite of this some cases remained in a mild hypomanic condition with a tendency to relapse as soon as a treatment was omitted. In a few cases a dramatic recovery was obtained by giving 6 to 8 treatments during the first two days, followed by a maintenance dose two to three times weekly for four weeks.

In a typical and responding case of schizophrenia recovery would ensue only after at least 25 treatments.

In these series of cases psychotherapy was not attempted, but it was noticeable that the presence of improved patients in a ward soon creates an atmosphere of optimism amongst the patients and staff, which, after all, is the basis of successful psychological approach.

RESULTS.

Melancholia.

Table I illustrates the distribution of 300 cases of melancholia in females arranged according to their age-groups. The figures on the right of the case-numbers indicate in a downward direction the number and percentage of cases recovered, improved and unimproved.

A recovery-rate of 80 per cent. was obtained for the whole group with little variation between the age-groups with the single exception of the presentiles, which gave the relatively low figure of 65 per cent. The latter, however, was balanced by the surprisingly high recovery-rate of 86 per cent. in the senile group. But if the involuntions and presentiles are considered together they will include most of the agitated depressions typical of this period, and this will give a recovery-rate of 73 per cent., which, as one would expect, is slightly lower than the rest.

A general recovery-rate of 80 per cent. is very satisfactory, although it

TABLE I.—*Melancholia in Females.*

Age.	-25. Adolescents.	26-40. Adults.	41-50. Involuntions.	51-60. Presentiles.	61- Seniles.	Total.
Number	26 21=81% 5=19% 0=	114 95=83% 15=13% 4=4%	67 55=82% 9=13% 3=5%	57 37=65% 15=26% 5=9%	36 31=86% 2=5% 3=9%	300 239=80% 46=15% 15=5%
Recurrent types	2 0	4 1	10 3	7 6	4 0	42 24%
Alternating types	0 2 0	1 2 0	2 1 0	1 3 1	1 0 1	12 62% 13 15%
Pyknosomatic type	2 0 4 5 1 0	4 22 1 0 22 0	1 11 5 1	4 0 8 3 1	2 1 5 0 1	23 80% 63 15% 5%
Puerperal cases	5 2 0	23 0 22 0	17 0	12 0	6 0 1	93 7% 29 0%

must be again emphasized that the group is a selected one, and that cases with the less favourable schizoid, obsessional or paranoid features have been deliberately excluded.

The results of E.C.T. in the recurrent melancholia are shown to be less favourable than in the primary attack, although the numbers are too small to draw definite conclusions, and similar observations could be made regarding the group of alternating states. It was also of interest to find that melancholics of pyknosomatic pattern showed no advantage over the other body types.

The best results were obtained in the puerperal depressions with a recovery-rate of 93 per cent. It was found that in general, the reactive depressions were more resistant to E.C.T. than the endogenous types, although this did not prejudice the ultimate prospect of recovery. Melancholics with signs of senilitas praecox belonged as a rule to the group of failures. From a separate calculation, comparing the results in agitated and retarded types of depression, little difference could be found, although we might expect the former to be more resistant to treatment.

The number of male melancholics in our case material is comparatively small, but their psychosis was often more intense and of longer standing than in females, and most of the patients belonged to the presenile age-group. Nevertheless, out of 39 cases selected, 60 per cent. recovered, 30 per cent. improved and 10 per cent. remained unimproved.

Mania.

The number of female cases of mania was not large enough to split up into age-groups, but they were much more resistant to E.C.T. than depressions. Out of 65 cases treated, 53 per cent. recovered, 27 per cent. improved and 20 per cent. remained unimproved.

In the puerperal manias the percentage of recoveries was almost as good as that found in puerperal melancholias, but in these cases there is a danger of complications arising when sepsis is present as was found in one of our patients.

In six cases of mania in males the results were similar to that in the females.

Schizophrenia.

The number of schizophrenics treated with E.C.T. is relatively small, and only recent cases have been selected for this report. Cases of longer duration than two years have been excluded, as it is common experience that they are very refractory to treatment. Table II illustrates the results obtained in 90 patients, half of each sex, and subdivided into simple, hebephrenic-catatonic and paranoid types. The results were about the same for both sexes, and of the total 90 cases, 24 per cent. recovered, 18 per cent. improved and 58 per cent. remained unimproved. The prospect in the simple type was even less

TABLE II.—*Schizophrenia.*

Types.	Number.	Recovered.	Improved.	Unimproved.
Hebephrenics and catatonics	63	27%	14%	59%
Simple	17	12%	23%	65%
Paranoid	10	30%	30%	40%
Total	90	24%	18%	58%

promising than in other types. It was common to obtain a symptomatic recovery in states of stupor or excitement, although a state of stupor may be changed to one of excitement after a few treatments.

DURATION OF STAY IN HOSPITAL.

We have calculated the duration of stay in hospital of 280 female melancholics discharged as recovered or improved after E.C.T., counted from the first day of treatment to the day of discharge. The average length of this period was found to be three months. However, this estimation, although statistically correct, could be reduced to 10 weeks for the great majority of patients if we exclude our relapsing cases, which constituted about 5 per cent. of the total, and who remained in hospital for over one year under periodical treatment.

If, in contrast, we quote Batt's (1943) calculation of 40 weeks for the average stay in hospital for nearly 200 untreated melancholics, the financial saving in our patients is almost £40 per head.

When the duration of stay in hospital is further analysed according to the age-groups, it is found that the adolescents and adults were discharged in 10 weeks, the involuntions in 11 weeks, the preseniles in 16 weeks and the seniles in 12 weeks. It is noteworthy that the seniles showed a rapid as well as a higher recovery-rate.

In the group of discharged manias the average duration of stay in hospital was 17 weeks, which is a markedly larger period when compared with melancholics, as might be anticipated from the greater resistance to treatment of the former.

STABILITY OF RECOVERY.

It is generally agreed that E.C.T. does not increase the liability of relapse in the manic-depressive, provided the treatment is adequate to suppress the current attack, for it is well known that some cases will relapse quickly if too few treatments are given.

In our case material we have selected 234 female melancholics discharged during the 3-year period between January 1, 1942, to January 1, 1945, and found that of these, 32 had been readmitted by August 1, 1945. This constitutes a recurrency of 13.5 per cent., which is similar to Batt's (1943) finding of 13 per cent. in 100 depressive psychoses treated with E.C.T. Since in our cases we were not able to carry out a follow-up, we cannot say how many patients have had mild recurrent attacks not necessitating admission to hospital.

COMPLICATIONS.

Complications arising directly from the use of E.C.T. have never been serious enough to bring the treatment into disrepute and, provided due care is used in the assessment of the physical risks in a given patient, the procedure can be regarded as reasonably safe. The complications which may arise can be considered under the heading of pulmonary, cardiovascular, skeletal and cerebral.

We have not thought it necessary to do a routine X-ray of the chest before treatment, but a careful physical examination was always carried out, and

except in schizophrenia, there seems to be little risk of actuating a latent pulmonary tuberculosis. In our material of some 700 cases we cannot recall any instance where clinical tuberculosis occurred after E.C.T., although we cannot speak for all the discharges.

Pulmonary embolism is said to be a rare complication, and we were unfortunate enough to have one example. The patient was a puerperal mania, aged 38, admitted eleven days after parturition. There were no clinical evidences of infection, and the mental state was so acute that it was decided to try the effect of E.C.T. Over a period of eleven days a convulsion was induced on seven occasions with benefit, but six days after the last convulsion she was found to have blood-stained sputum and a mild pyrexia. A blood examination showed anaemia with a normal leucocyte count, but in culture there were found haemolytic streptococci. She died six days later, on the 36th day after childbirth, despite the administration of sulphonamide. The autopsy revealed a small infarct of the lung, pelvic venous thrombosis, and evidence of a low grade puerperal infection. In this case one cannot exclude the possibility of E.C.T. mobilizing a thrombus in the pelvic veins, although the patient had been actively maniacal all the time.

Cardiovascular complications have not occurred in our series of cases. Vertebral fractures, on the other hand, have been encountered by all investigators, although such injuries may be symptomless. We have X-rayed only those cases in which backache was complained of, and in eight cases compression fractures of the lower dorsal vertebrae were revealed, but in no case was there any noticeable after-effect. Henderson *et al.* (1943) in a series of 260 patients encountered four instances of vertebral compression fractures—an incidence very similar to ours. We have not used any physical or chemical method of restraint to prevent fractures apart from wrapping a sheet round the trunk and arms to prevent injury to the shoulders, but there is no evidence that this has been effective. Other types of fractures in our series were limited to three instances of injury to shoulder, one a dislocation, one a fracture, and in one case a fracture of the scapula. Our total fracture incidence of ten cases in about 1,000 patients treated is low compared with the figure of 3.9 per cent. given by Cook (1944) as the average from five sources. Details of the vertebral fractures are shown in Table III.

TABLE III.—*Vertebral Fractures.*

Sex.	Age.	Vertebrae.
M.	35	D 7, 8
M.	40	D 6, 7
M.	47	D 5
M.	60	D 5, 6
F.	25	D 12
F.	42	D 6, 7
F.	50	D 4
F.	59	D 6, 7

Cerebral complications, such as persistent confusion, have not been a serious problem in our cases. Transient memory disturbances have occurred, and in a few instances a Korsakoff syndrome was noticed, but we have not seen any memory defects remain.

DISCUSSION.

Our results in melancholia are in general agreement with those of other observers, and serve to confirm the particular value of E.C.T. in depressive states.

Fitzgerald (1943), in 150 cases of both sexes, reports 78 per cent. recovery and 10 per cent. failures. Kalinowsky (1943) achieved 86.6 per cent. "recovered and much improved" in 136 cases of melancholia. In 100 females suffering from depressive psychoses Batt (1943) obtained 87 per cent. successes and 13 per cent. failures. Henderson *et al.* (1943) report 64 per cent. recovery in the involuntional group and 46 per cent. in other depressions, but the rates for patients who "in some way benefited by the treatment" are 80 and 74 respectively. Mayer-Gross (1945) obtained 80 per cent. "recovery and improvement" in 49 cases of melancholia over the age of 60 years, which is lower than our figure of 91 per cent. for a similar age-group, but it is possible that our cases were of more recent origin. In a comparative study of 70 melancholics treated with E.C.T. and 68 without, Tillotson and Sulzbach (1945) report 80 per cent. improvement under shock treatment and 50 per cent. in the control group.

Our recovery-rate of 80 per cent. would by comparison appear to represent the maximum possible achievement, but since it refers to cases specially selected for purity of diagnosis the recovery-rate would no doubt be somewhere in the region of 70 per cent. in a series of consecutive cases.

Our recovery-rate of 53 per cent. for states of mania is much less than that obtained by Kalinowsky (1943), who states that his results are now "as good as those for the depressive phase" provided the patient is given adequate treatment. On the other hand, Epstein's (1943) estimation of 38 per cent. recovery in 13 cases seems too low, and is perhaps due to the smallness of his case material and more cautious treatment.

Our unfavourable results in a selected group of schizophrenics (24 per cent. recovery) agrees with Epstein's (1943) 16 per cent. recovery and Reznikoff's 27.6 per cent. remissions, but Kalinowsky and Worthing (1943) in a series of unselected cases obtained a recovery-rate almost as high as in the affective psychoses. Their figures of 67 per cent. remissions and 11 per cent. improved in cases under six months' duration and 56.8 per cent. and 20.3 per cent. for cases up to one year duration seems unduly high, and might be accounted for by a variation in the estimation of remissions. We agree with these authors that the early paranoid type often respond well, but unlike them we found the simple type of schizophrenia most refractory to treatment.

The dangers and complications of E.C.T. have not been formidable in our total series of some 1,000 cases with the single exception of a pulmonary embolism in a puerperal mania.

Deaths due to electrically induced convulsions have been very few, and Napier (1944) described five cases which he considered to be the only deaths in England and Wales, to which may be added a case of cerebral fat embolism after E.C.T. recorded by Meyer and Tear (1945). In none of these cases was pulmonary embolism a cause of death, but our case serves to emphasize this

particular danger whenever there is reason to suspect the presence of venous thrombosis in a patient, particularly in a case of puerperal psychosis. Jacobs (1943), in a special study of psychoses following childbirth, states that though a careful consideration of physical contra-indications is essential, convulsion therapy need not be delayed until the end of the physiological puerperium; however, it would seem advisable not to apply this therapy within a month of delivery.

With the latter observation we are in entire agreement, for although pulmonary embolism is ordinarily a rare occurrence during the puerperium, it is liable to occur in anaemic and infected patients as a result of some sudden movement or exertion.

SUMMARY.

Five hundred selected cases of melancholia, mania and schizophrenia treated with electrically induced convulsions have been specially studied and the results assessed.

In a group of 300 female melancholics a recovery-rate of 80 per cent. was obtained and a further 15 per cent. improved. Patients were discharged after an average of three months' stay in hospital, but 13 per cent. of the discharges returned to hospital sooner or later over a period of three years and six months.

Mania is more resistive to E.C.T. than melancholia, and no more than 50 per cent. recovery-rate could be obtained.

Puerperal melancholia and mania showed a very high recovery-rate, but one case of pulmonary embolism is recorded as a complication of E.C.T. given in the early puerperium.

Schizophrenics were disappointing, with only 24 per cent. recovered, but this is partly compensated by the symptomatic value of the treatment for the intercurrent episodes of stupor and excitement.

Electrical convulsion therapy to be effective requires individual adaptation to a given case and should be prolonged in the more resistive psychoses.

A plan of subdivision of melancholias according to age-groups is suggested in order to facilitate comparative evaluations of the results of treatment in various clinics.

Skeletal complications occurred in 11 instances out of about 1,000 patients, and 8 of these have been compression-fracture of the dorsal vertebrae.

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AUTONOMIC ACTIVITY AND INDUCED CONVULSIONS.

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SINCE the influence of the autonomic nervous system on epileptic phenomena became the subject of intensive investigations, several contradictory reports have been published. Williams and Russell (1941) and Williams (1941) found that parasympathetic overactivity (induced chemically and registered by electro-encephalography) increases epileptic activity. Darrow (1944) reported opposite results, his observations being based on electrically induced parasympathetic overactivity on animals. He registered his observations by electro-encephalography. Cohen, Thale and Tissenbaum (1944) induced convulsions for therapeutical purposes by administering the parasympathomimetic drug, acetylcholine, and Chatfield and Dempsey (1942) observed the production of fits in cats, when giving acetylcholine and prostigmine together. Though the results were contradictory, the main aim of all these investigations was to establish the cholinergic neurohumoral changes in relation to epilepsy. But, as Williams pointed out, it is impossible to say whether the results are due to a direct central action, are consequent upon changes in the pH or of a respiratory or a circulatory nature. The investigations described in this paper were devised to re-examine these problems clinically. They were based on the hypothesis that if cholinergic overactivity enhances epileptic cerebral activity, the convulsive threshold of the brain should be lowered after administration of anticholinesterases, in particular prostigmine.

METHOD AND RESULTS.

Twenty-five psychotic women ageing from 21 to 50 were chosen; diagnostically they represented a mixed group of chronic psychotics, mainly schizophrenics and psychopaths. They had all received insulin, continuous narcosis or convulsant treatment 12 to 36 months prior to the present investigations. First their threshold to electrically induced convulsions was ascertained by determining the minimal convulsant dosage (MCD). This was again repeated after the investigations had been carried out. The convulsant threshold of the patients on the Ediswan electro-shock apparatus was between 68-95 on the voltage and 0.25-0.55 on the time dial. None of the cases responded with any convulsive phenomena to the subconvulsive dosage (SD) of 55 volts and 0.18 sec. time.

The patients then received $2\frac{1}{2}$ mgm. of prostigmine by rapid intravenous injection. After completion of the injection the S.D., which was standardized to 55 volts and 0.18 sec. time, was applied 50 seconds, 2, 3 and 5 minutes later. After 2, 3 and 5 minutes there was an instantaneous twitch, or a momentarily

dazed attitude, but no fit followed when the S.D. was applied, though the "muscarine action" activated through the prostigmine, especially the circulatory effects, were noticeable. In about 7 minutes after the injection the motor effects of the prostigmine made their appearance in the form of muscular fibrillation, twitchings, increased reflexes and prolonged responses to tap contraction; the S.D. was then reapplied.

It was found, in 9 out of 25 cases, that is to say in 36 per cent., patients responded with a typical fit to the S.D. in 7-10 minutes after $2\frac{1}{2}$ mgm. intravenous prostigmine. It seemed that this response was comparable to the degree of the fibrillation and the allied motor effects of the prostigmine injections. In other words, in most of those who responded to the subconvulsive dosage, the "motor" effects of prostigmine were marked. These effects could be observed in about 7 minutes following the prostigmine injection, and usually decreased after 15 minutes.

In another series of investigations atropine was given together with the prostigmine, to eliminate the "muscarine effects" activated through prostigmine. A combination of $\frac{1}{100}$ gr. of atropine with $2\frac{1}{2}$ mgm. of prostigmine (intravenously) produced only 3 typical fits in 10 cases when S.D. was applied; combination with $\frac{1}{50}$ gr. of atropine produced only 4 typical fits in 10 cases. Finally, on 10 occasions $\frac{1}{100}$ gr. of atropine was given alone, followed within 7 minutes by the M.C.D. The fit produced was always considerably delayed (60 to 120 seconds); no fit was observed when the S.D. followed in 7 minutes the $\frac{1}{100}$ gr. of atropine.

The procedure was repeated on the same group of patients but with phrenazol. Firstly the minimum convulsant dosage of phrenazol was ascertained; this lay between 5.0 and 10 c.c. of phrenazol. As before, $2\frac{1}{2}$ mgm. prostigmine were given intravenously, followed in 7-10 minutes by a rapid injection of 3 c.c. of phrenazol. It was found that 13 out of 25 cases, that is to say 52 per cent., responded with a typical fit, but one control also gave a positive result. No fits occurred either 3 or 5 minutes after the prostigmine was given, and as observed before, there was a fair parallelism between the grade of fibrillation, increased reflex, etc., and the fits. Table I shows the responses as summarized above. It also illustrates that the positive electrical reactions more or less coincide with the positive phrenazol reactions, with a majority of the latter.

Finally, the prostigmine and E.C.T. and then the prostigmine and phrenazol combination were applied to 25 epileptics. Three weeks prior to the investigations their routine anti-convulsant treatment was decreased; it was then found that the average M.C.D. for electrical or chemical means was somewhat lower than in the non-epileptic series. Ten cases of the 25 had a lowered threshold for the prostigmine and E.C.T. combination, and 13 out of 25 cases for the combination of prostigmine and phrenazol.

COMMENTARY.

Thus in a number of cases a fit has been produced by subconvulsive doses of E.C.T. or phrenazol, following prostigmine medication. Similar results were seen, though more frequently, in a series of epileptic patients. There

TABLE I.

No.	E.C.T.		Control S.D.	Atropine.		Phrenazol.		Control S.D.
	M.C.D.	Prost. + S.D.		$\frac{1}{2}$ At. + S.D.	$\frac{1}{2}$ At. + Prost. + S.D.	M.C.D.	Prost. + S.D.	
1	70 : 2	Fit	—	o	o	5 c.c.	Fit	—
2	80 : 2'5	—	—	..	..	9 c.c.	—	—
3	80 : 3	Fit	—	Fit	Fit	7 c.c.	Fit	—
4	70 : 2	"	—	o	o	6'5 c.c.	—	—
5	75 : 2'5	—	—	..	..	10 c.c.	—	—
6	70 : 2	—	—	o	o	5'5 c.c.	Fit	—
7	68 : 2	—	—	..	..	7 c.c.	—	—
8	75 : 2'5	Fit	—	Fit	Fit	5 c.c.	Fit	—
9	70 : 2'5	—	—	..	..	5'5 c.c.	"	Fit
10	90 : 4	—	—	..	..	10 c.c.	—	—
11	80 : 2	—	—	..	..	5 c.c.	Fit	—
12	95 : 4'5	—	—	..	..	7 c.c.	—	—
13	85 : 3'5	—	—	..	o	5'5 c.c.	Fit	—
14	75 : 2	Fit	—	Fit	..	6'5 c.c.	"	—
15	95 : 5	—	—	..	..	8 c.c.	—	—
16	95 : 5'5	—	—	..	..	10 c.c.	—	—
17	80 : 2'5	—	—	..	..	5'5 c.c.	Fit	—
18	90 : 3'5	—	—	..	..	8 c.c.	—	—
19	70 : 3	Fit	—	Fit	Fit	7 c.c.	Fit	—
20	80 : 2'5	"	—	o	o	10 c.c.	—	—
21	95 : 5	—	—	..	..	7'5 c.c.	—	—
22	90 : 4'5	—	—	..	..	6 c.c.	Fit	—
23	70 : 2	Fit	—	o	o	5 c.c.	"	—
24	95 : 5	—	—	..	..	9 c.c.	—	—
25	70 : 2	Fit	—	o	..	5'5 c.c.	Fit	—

seems therefore to be some evidence that prostigmine lowers the convulsive threshold in accordance with Williams's conclusion, namely that parasympathetic over-action increases epileptic activity. In this sense the results oppose Darrow's conclusion.

The above reported experiments do not, however, prove that the seat of action is a central, cerebral one, though it is suggested by several points. First, that the intensity of motor reaction to prostigmine was on the whole best shown by those cases in which there was a lowered convulsive threshold to the convulsants. Secondly, though atropine diminished the obtained positive results, it did not abolish them, or in other words, when the muscarine effect of the cholinergic over-activity was eliminated the lowered convulsive threshold was still noticeable. The fact that some positive results were still obtained after atropine may be interpreted as the result of some central action. The delay of convulsions after atropine medication alone seems similarly to favour the supposition that the antagonistic effects of the atropine-prostigmine combination are not only peripheral. Finally it may be added that in Cushing's and Henderson and Wilson's experiments, centrally activated parasympathetic responses were immediately abolished by intraventricular atropine injections, evidently owing to central action of the atropine (Fulton).

Watterson and McDonald (1939) inhibited induced convulsions by drugs such as carbaminoyl-choline (carbachol) and acetyl- β -methylcholine, attributing the results to cerebral vasodilation. Darrow interpreted his experiments similarly, concluding that acetylcholine in the brain, liberated through parasympathetic overactivity, prevents vasoconstriction locally, thus counteracting epileptic

activity. It is, however, to be noted that the clinical effects of high acetylcholine concentrations are predominantly circulatory, whilst smaller concentrations, in accordance with Williams' findings, exert their influence on neural elements not involving the vasal mechanisms. Reitman and Richards (1945) demonstrated that induced fits can be prevented in 60 per cent. of cases when cerebral vasodilators are applied, and the writer also found (hitherto unpublished) in a corresponding percentage of cases that the convulsive threshold is lowered when cerebral vasoconstrictors are given; neither the vasodilators, nor the vasoconstrictors were of parasympathomimetic nature. The percentage of cases in which the convulsive threshold was lowered by prostigmine, compared with the above quoted results, is well below the percentage affected by direct action on the cerebral vessels. These findings may therefore be suggestive of a different mechanism for the prostigmine effects, which are probably neural.

Clinical investigations cannot give conclusive evidence in regard to the autonomic nervous system in particular, but they test the autonomic balance by registering the homeostatic tendencies of the organism to a specific autonomic stimulus. All one is therefore able to conclude is, that by disturbing the autonomic balance in favour of the parasympathetic system, the convulsive threshold becomes lowered in a percentage of cases. Finally the usual coincidence of a positive response with a relatively low convulsive threshold does not encourage the use of prostigmine as a therapeutic measure in high threshold cases.

SUMMARY.

1. 2½ mgm. of prostigmine lowered the convulsive threshold to E.C.T. in 36 per cent., and to phrenazol in 48 per cent. of 25 cases.
2. Similar investigations in epileptics did not yield a markedly higher percentage of fits than in normal cases.
3. The results, together with control experiments, may be suggestive that prostigmine has a central neural effect in its reduction of the convulsive threshold for E.C.T. and phrenazol.

I wish to express my thanks to the Medical Superintendent, Dr. E. Cunningham Dax, for his helpful criticisms.

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AGEING AND SENILITY: A MAJOR PROBLEM OF PSYCHIATRY.*

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THE psychiatric aspects of ageing are a major problem in any country which, like our own, has a low net reproduction rate and a high standard of social responsibility: the proportion of old people in the community steadily increases, so that they provide an increasingly high proportion of our mentally infirm population who must be cared for. But it is not only senile dementia and the other senile and presenile psychoses described in textbooks that make up the problem: less conspicuous failings which may accompany old age also call for attention if the social and preventive sides of our work are to be given due weight. Therefore it is psychiatric aspects of ageing rather than senile psychoses alone that are intended by the title of this paper.

Senile psychoses are, however, the obvious index of the problem; they show in plain figures what it costs to have an increasing elderly population, without any lessening of the incidence of the mental disorders of the elderly.

In 1881, 11·2 per cent. of the resident population of the institutions for "idiots or imbeciles and lunatics" under the supervision of the Commissioners in Lunacy in England and Wales was aged 65 and over. By 1891 the proportion had risen to 12·1 per cent. (males 9·6 per cent., females 13·2 per cent.); by 1894 the males aged 65 and over were 10 per cent. and the females 13·4 per cent. of the institutional population. Thereafter the figures (excluding institutions for defectives) are:

TABLE I.

	Males. %.	Females. %.
1907	11	15
1913	11	15
1931	14	19
1935	14	20
1938	15	21

If the age-group be extended backwards by ten years, to cover all patients aged 55 years and upwards, the proportion they bore to total patients of all ages resident was:

TABLE II.

	Males. %.	Females. %.
1907	27·6	33·8
1913	28·2	34·7
1931	33·7	41·7
1935	34·9	43·2
1938	35·9	44·9

* A Paper read at the Annual Meeting of the Royal Medico-Psychological Association held on September 5, 1945, at 11, Chandos Street, W.1.

These figures indicate that mental hospitals, like the larger world, have a more and more elderly population as the years go by, and that before long the majority of the women who are patients in mental hospitals will be over 55.

This rise in the proportion of elderly residents entails many administrative readjustments, and some changes in the orientation of nurses and occupational therapists, as well as doctors. But its causes are not obvious. The Commissioners of 1897, presenting their Special Report to the Lord Chancellor on the alleged increase of insanity, said that "while in the general population there has been a considerable increase in those ages in which the greatest liability to attacks of insanity is known to prevail, namely, from 20 to 45, there has been a marked diminution in the ratios (of patients to general population) among the insane at those ages, and a large increase in the numbers and ratios at the more advanced ages, the obvious inference being that accumulation and not fresh production has been the most influential factor." This can be construed as saying that the rise in the number and proportion of elderly patients in the mental hospitals and institutions was due to an increased expectation of life in those admitted at earlier ages. But an alternative and more tenable view would attribute it to an increased incidence of insanity among the elderly, or perhaps to an increased number of elderly people in the general population. To this the Commissioners had indeed drawn attention two years before. Pointing to the increase in yearly admissions of insane persons of all ages between 1869 and 1893, they comment: "This continuous increase has been attributed in part to the reception in recent years of more cases of mental decay resulting solely from old age. . . . The ratio of what we may term *old age* admissions (persons 60 years and upwards) to total admissions has risen since 1878 until, in 1893, it was 2·2 per cent. higher than in 1883 . . . again, the tables [show] a gradual, but continuous advance in the proportion admitted whose insanity was attributed to this cause (old age)."

I have dwelt on this report of 1895 because it shows that fifty years ago the chief features of this problem of the senile psychoses were in evidence—a rising proportion of old people among the residents in the mental hospitals and a rising proportion of old people being admitted to them. There were some other features then also stressed to which I shall refer later.

Since the number of persons resident in a mental hospital depends not only on the frequency of occurrence of mental illness, but also on the number of the available beds, and the duration of stay or of survival after admission, as well as on the age at which initial admission occurred in the surviving unrecovered and unrecoverable cases, it is clear that it is, as a crude figure or proportion, of very little value in determining the incidence of mental illness or in predicting its future prevalence, especially in the higher age-groups. The admission-rate is a more trustworthy guide. But there are several ways of determining and interpreting this rate. The Commissioners in Lunacy in 1897 had paid regard to the proportion of older persons among persons of all ages admitted. In other words, they were not, for this statistic, concerned with the size of the population at risk, nor with excluding from the total of admissions those persons who were being admitted for the second or third

time, perhaps even during the same year. By 1909 the Commissioners were drawing attention to the former of these considerations: "Another fact of interest is that the age-distribution of the insane admitted into care, from 25 years and upwards, shows a higher proportion in age-periods 45 to 54, 55 to 64, and 65 and upwards, than the distribution at the same periods amongst the general population," from which it can be inferred that the proportion of the older people in the general population who have to be admitted to a mental hospital is higher than the proportion of younger people who need this. Since, however, some at any rate of all old people admitted will have been previously admitted on several, perhaps many, occasions during their lives, the Commissioners' observation might indicate only a natural effect of certain mental illnesses tending to relapse or recur, and might not tell anything about an increase in the proportion of old people in the general population who had to be admitted because of a senile psychosis. This is at last explicitly recognized in the Report of the Board of Control for 1924: "it is a close examination of fluctuations in this ratio (ratio of admissions to the population), especially when analysed in age-periods and with particular reference to 'first attack' admissions, that is important in relation to the actual incidence of mental disorder, a matter we are at present investigating." Unfortunately I cannot discover in any subsequent reports the results of that investigation, and as the reports of the Board of Control, after the disruption produced by the war of 1914-1918, never reverted to the admirable form in which they had previously appeared, the analysis of first attack admissions age-group by age-group could not be carried out from the published figures. May I say, in passing, that though the Board have very kindly supplied me with the figures I wanted, and have been most helpful, I believe it would be not only in the public interest but to the advantage of psychiatry if the figures published by the Board each year could be presented again in a form more in keeping with the requirements of vital statistics. National data about morbidity in this country have after all been restricted until recently to infectious diseases and mental disorders—the two certifiable groups of illness: such full material as the Board has would be invaluable if published regularly and analysed in a manner comparable in some respects to that of the Registrar-General when dealing with mortality statistics.

Before going on to examine the proportion which first attack admissions bear to the general population of the higher age-groups, the proportion of "first attack" to "not first attack" admissions can be briefly shown. A third group is composed of cases in which it is unknown whether this is the first attack, or the illness is a congenital one (obviously of little relevance in the elderly). In the three age-groups 45-54, 55-64, 65 and upwards one finds that, if the first admissions in each age-group and each year be taken as 100, the proportionate numbers of the "not first attacks" and "unknown" cases were as shown in Table III, p. 153.

It is plain from these figures that the proportion of "first attack" to other admissions is changing, and is, of course, different in the different age-groups. Consequently any conclusions drawn about first attack cases from data regarding all direct admissions might be deceptive, yet such conclusions are some-

TABLE III.

45-54 Age-group.

	Males.					Females.				
	1907.	1913.	1921.	1931.	1937.	1907.	1913.	1921.	1931.	1937.
First . . .	100	100	100	100	100	100	100	100	100	100
Not first . . .	38	34	34	37	47	58	46	47	50	55
Unknown . . .	6	10	8	7	7	7	4	6	6	5

55-64 Age-group.

First . . .	100	100	100	100	100	100	100	100	100	100
Not first . . .	35	33	29	38	44	49	48	49	49	58
Unknown . . .	9	7	7	7	6	4	9	4	5	4

65 and Upwards Age-group.

First . . .	100	100	100	100	100	100	100	100	100	100
Not first . . .	19	20	22	26	30	29	23	23	33	37
Unknown . . .	6	3	4	4	3	8	2	3	4	4

times put forward. Why the proportion of "not first attack" admissions should have increased particularly since 1931 I cannot see, unless it is the result of a bolder policy of discharge and a more optimistic view of recovery which has led to more readmissions of relapsed patients. I think this explanation is supported by the fact that the rise is not limited to the older age-groups; for admissions of all ages there is a conspicuous advance in the 1937 proportion of "not first attack" admissions.

TABLE IV.

All Ages.

	Males.					Females.				
	1907.	1913.	1921.	1931.	1937.	1907.	1913.	1921.	1931.	1937.
First . . .	100	100	100	100	100	100	100	100	100	100
Not first . . .	31	28	29	32	40	43	37	37	41	48
Unknown . . .	18	18	15	11	10	12	11	11	9	7

It is not easy to account for the disparity between men and women, of all ages as well as of the higher age-groups in respect of proportion of first to "not first" attack admissions: as it is not, however, necessary to the main theme I forbear to speculate on it here.

The "first attack" admission-rate expresses the number of such admissions per 100,000 of the population at risk—that is the most reliable index of incidence we have. That is not, however, the figure that I have calculated, because (1) among the "unknown" admissions referred to there may well be some "first attack admissions" which I have omitted: Slater, for what seem to me insufficient reasons, included all the "unknown" group, and

TABLE V.

Age-groups.	Population (estimated).		Resident in mental hospitals.		First attack admissions.		First admissions per 100,000 general population.		First admissions per 100,000 at risk.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Under 15	5,663,920	5,654,021	761	425	25	11	.44	.195	.44	.195
15-19	1,693,711	1,721,461	1,097	916	245	307	14.5	17.9	14.5	17.9
20-24	1,538,431	1,712,214	2,396	2,092	558	584	36.2	34.1	36.4	34.1
25-34	2,899,804	3,198,584	9,344	8,610	1,467	1,616	50.6	50.5	50.7	50.7
35-44	2,391,988	2,568,336	12,335	13,190	1,684	1,704	70.4	66.3	70.7	66.7
45-54	1,732,989	1,875,472	11,638	14,132	1,382	1,571	79.9	83.7	80.3	84.4
55-64	1,109,286	1,240,145	8,877	11,588	999	980	90.0	79.0	90.8	79.7
65+	893,667	1,049,934	5,893	9,328	880	1,064	109.5	101.3	110.3	102.2

(2) the population at risk is not the total general population, but only those not already resident in a mental hospital: and although the number resident for age-groups covering a stretch of ten years (and more, in the case of the over 65's) is known, it would be necessary to divide this into single-year age-groups, and make some other estimates to obtain the precise number of the population at risk. Moreover, I have worked out for a single year, 1913, the proportion of first admissions to total population, and to total population minus those of the given age-group resident in that year, and the difference between the two rates is too small to be a matter for concern in this inquiry; it may therefore be assumed that, for our purpose, the rate may be calculated for the total population (which is, in any case, only an estimate for any intercensal year).

The distinction perhaps should be emphasized between "first admissions" and "first attack admissions." It is the latter I am presenting. The first admissions would be more numerous, since they would include persons whose recurrent illness had not in previous attacks called for admission to a mental hospital. If we are seeking a measure of the true incidence of illness occurring for the first time in a particular age-group of the population it is first attack admissions that we must consider, but this, of course, gives us only a minimal figure, since many of those affected may not be admitted to a mental hospital. If, on the other hand, we were concerned only with the administrative questions implicit in predicting mental hospital admissions, it would be all first direct admissions and not only "first attack" ones that would be valuable to us.

Table VI and the graphs which follow show the absolute rise for persons over 65—and the incidence-rate per 100,000 of the general population, for the age-groups 35-44, 45-54, 55-64, 65 and over, during the thirty years 1907-1937 (omitting the war-years, for which figures are not available).

TABLE VI.

(Males.)

Year.	Age-group.	First attack admissions.	Population.	Incidence-rate per 100,000.
1907	35-44	1,566	2,179,875	72
	45-54	1,320	1,578,910	84
	55-64	972	1,016,546	95
	65+	821	751,953	109
1908	35-44	1,624	2,227,137	73
	45-54	1,312	1,613,663	81
	55-64	964	1,037,417	93
	65+	875	769,151	114
1909	35-44	1,601	2,262,658	71
	45-54	1,289	1,639,913	79
	55-64	1,031	1,052,807	98
	65+	833	782,299	107

TABLE VI—(continued).

(Males.)

Year.	Age-group.	First attack admissions.	Population.	Incidence-rate per 100,000.
1910	35-44	1,669	2,304,694	72
	45-54	1,251	1,670,889	75
	55-64	953	1,071,221	89
	65+	879	797,708	110
1911	35-44	1,575	2,336,508	67
	45-54	1,303	1,694,333	77
	55-64	985	1,085,156	91
	65+	852	809,370	105
1912	35-44	1,701	2,367,176	72
	45-54	1,385	1,715,708	81
	55-64	1,017	1,098,508	93
	65+	916	796,066	115
1913	35-44	1,685	2,391,988	70
	45-54	1,381	1,732,989	80
	55-64	1,000	1,109,286	90
	65+	874	803,667	109
1914	35-44	1,798	2,394,718	75
	45-54	1,490	1,734,889	86
	55-64	1,038	1,110,477	93
	65+	944	827,732	114
1920	35-44	1,531	—	—
	45-54	1,359	1,872,917	72
	55-64	1,008	1,320,887	76
	65+	918	937,737	98
1921	35-44	1,495	2,496,375	60
	45-54	1,403	2,133,179	66
	55-64	1,130	1,382,843	82
	65+	996	980,230	102
1922	35-44	1,511	2,494,089	60
	45-54	1,461	2,163,635	67
	55-64	1,070	1,418,800	75
	65+	1,016	1,000,200	102
1923	35-44	1,510	2,488,900	61
	45-54	1,429	2,192,100	65
	55-64	1,105	1,458,200	76
	65+	1,060	1,026,600	103

TABLE VI—(continued).

(Males.)

Year.	Age-group.	First attack admissions.	Population.	Incidence-rate per 100,000.
1924	35-44	1,312	2,491,331	53
	45-54	1,247	2,224,589	56
	55-64	1,037	1,498,500	69
	65+	958	1,044,800	92
1925	35-44	1,358	2,480,000	55
	45-54	1,268	2,246,300	56
	55-64	1,092	1,536,100	71
	65+	989	1,064,400	93
1926	35-44	1,359	2,471,261	55
	45-54	1,338	2,264,764	59
	55-64	1,129	1,583,100	71
	65+	980	1,104,700	89
1927	35-44	1,284	2,463,100	52
	45-54	1,359	2,278,400	60
	55-64	1,160	1,629,200	71
	65+	1,032	1,127,800	92
1928	35-44	1,285	2,461,488	52
	45-54	1,309	2,286,097	57
	55-64	1,161	1,674,400	69
	65+	985	1,164,300	85
1929	35-44	1,252	2,468,900	51
	45-54	1,237	2,281,200	54
	55-64	1,218	1,717,100	71
	65+	1,003	1,178,800	85
1930	35-44	1,165	2,475,500	47
	45-54	1,295	2,287,600	57
	55-64	1,094	1,751,400	62
	65+	942	1,220,300	77
1931	35-44	1,310	2,512,356	52
	45-54	1,381	2,302,873	60
	55-64	1,250	1,765,509	71
	65+	1,040	1,272,847	82
1932	35-44	1,414	2,539,200	56
	45-54	1,384	2,301,800	60
	55-64	1,369	1,808,800	76
	65+	1,025	1,316,300	78

TABLE VI—(continued).

(Males.)				
Year.	Age-group.	First attack admissions.	Population.	Incidence-rate per 100,000.
1933	35-44	1,393	2,552,100	54
	45-54	1,381	2,301,600	60
	55-64	1,318	1,834,900	72
	65+	1,062	1,344,800	79
1934	35-44	1,344	2,580,500	52
	45-54	1,400	2,305,900	61
	55-64	1,351	1,863,400	72
	65+	1,061	1,384,100	77
1935	35-44	1,520	2,632,300	58
	45-54	1,417	2,314,300	61
	55-64	1,304	1,891,600	69
	65+	1,136	1,427,300	80
1936	35-44	1,524	2,698,300	56
	45-54	1,415	2,328,500	61
	55-64	1,443	1,839,400	78
	65+	1,139	1,464,500	78
1937	35-44	1,599	2,772,800	57
	45-54	1,461	2,340,500	62
	55-64	1,448	1,938,400	75
	65+	1,187	1,501,100	79
(Females.)				
1907	35-44	1,524	2,336,965	65
	45-54	1,313	1,706,964	77
	55-64	834	1,144,343	73
	65+	897	986,887	91
1908	35-44	1,554	2,388,816	65
	45-54	1,421	1,745,112	81
	55-64	930	1,165,637	80
	65+	879	1,011,275	87
1909	35-44	1,551	2,428,085	64
	45-54	1,367	1,774,070	77
	55-64	918	1,180,750	78
	65+	900	1,030,362	87

TABLE VI—(continued).

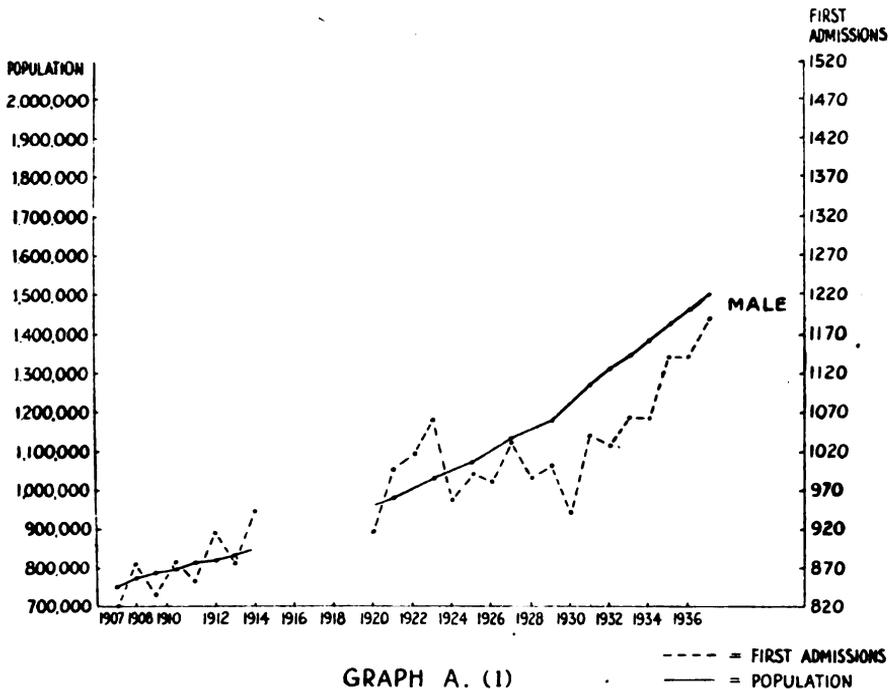
(Females.)

Year.	Age-group.	First attack admissions.	Population.	Incidence-rate per 100,000.
1910	35-44	1,619	2,474,355	65
	45-54	1,463	1,808,146	81
	55-64	902	1,199,237	75
	65+	848	1,052,439	80
1911	35-44	1,687	2,509,373	67
	45-54	1,381	1,833,936	75
	55-64	931	1,213,229	77
	65+	986	1,069,146	92
1912	35-44	1,689	2,541,959	66
	45-54	1,518	1,856,903	82
	55-64	939	1,228,123	76
	65+	1,062	1,040,061	102
1913	35-44	1,704	2,568,336	66
	45-54	1,569	1,875,472	84
	55-64	982	1,240,145	79
	65+	1,065	1,049,934	101
1914	35-44	1,830	2,571,224	71
	45-54	1,522	1,877,518	81
	55-64	992	1,241,485	80
	65+	1,057	1,093,211	97
1920	35-44	1,720	2,827,516	61
	45-54	1,660	2,108,274	79
	55-64	1,006	1,397,728	72
	65+	1,125	1,195,063	94
1921	35-44	1,782	2,850,034	63
	45-54	1,718	2,287,098	75
	55-64	1,072	1,529,885	70
	65+	1,097	1,310,875	84
1922	35-44	1,838	2,866,000	64
	45-54	1,860	2,327,300	80
	55-64	1,179	1,569,000	75
	65+	1,221	1,331,200	92
1923	35-44	1,819	2,878,400	63
	45-54	1,912	2,375,800	80
	55-64	1,237	1,610,400	77
	65+	1,188	1,362,800	87

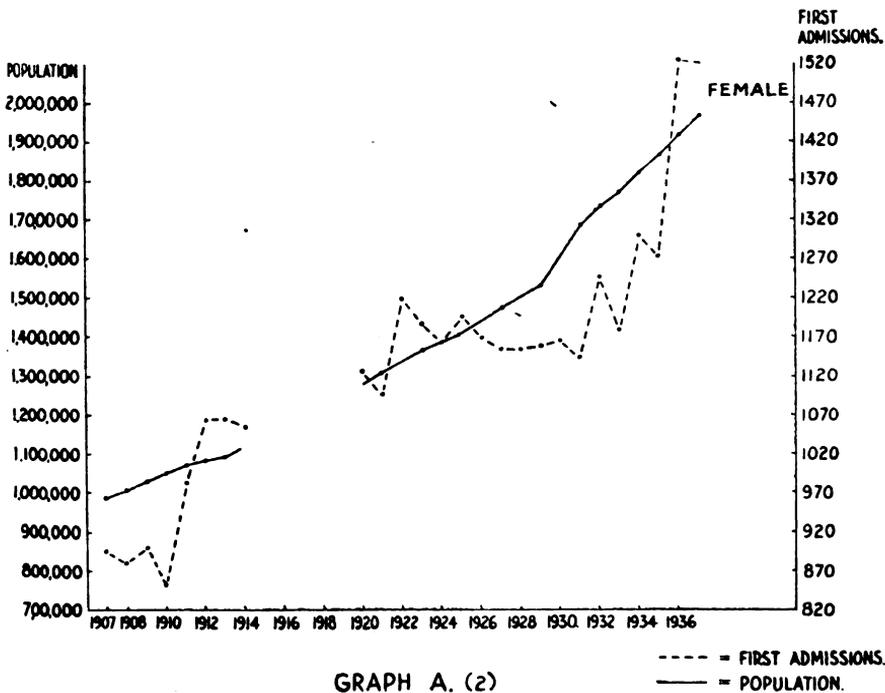
TABLE VI—(continued).

(Females.)

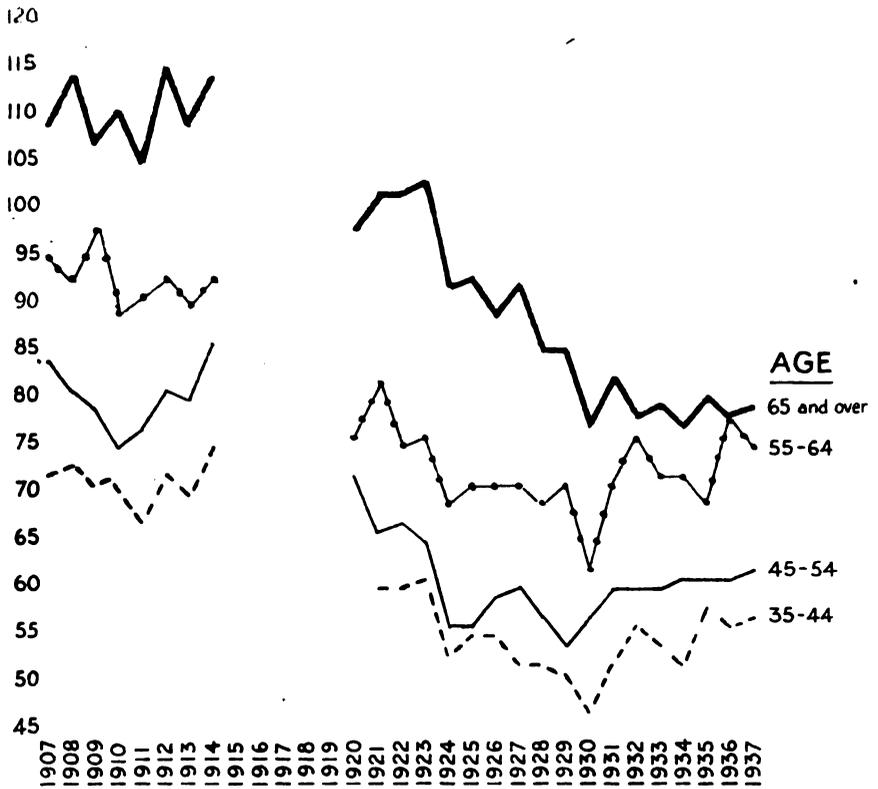
Year.	Age-group.	First attack admissions.	Population.	Incidence-rate per 100,000.
1924	35-44	1,615	2,889,900	56
	45-54	1,651	2,430,600	68
	55-64	1,148	1,655,900	69
	65+	1,164	1,382,100	84
1925	35-44	1,564	2,896,700	54
	45-54	1,850	2,476,277	75
	55-64	1,214	1,696,000	72
	65+	1,198	1,403,400	85
1926	35-44	1,584	2,903,400	54
	45-54	1,824	2,514,600	73
	55-64	1,244	1,748,700	71
	65+	1,169	1,451,400	81
1927	35-44	1,637	2,914,100	56
	45-54	1,787	2,551,800	70
	55-64	1,244	1,801,600	69
	65+	1,154	1,477,800	78
1928	35-44	1,634	2,924,700	56
	45-54	1,829	2,586,400	71
	55-64	1,274	1,855,800	69
	65+	1,156	1,524,300	76
1929	35-44	1,514	2,947,500	51
	45-54	1,852	2,609,900	71
	55-64	1,373	1,904,000	72
	65+	1,160	1,536,200	76
1930	35-44	1,482	2,968,200	50
	45-54	1,737	2,641,800	66
	55-64	1,213	1,949,900	62
	65+	1,167	1,585,000	74
1931	35-44	1,712	2,954,236	58
	45-54	1,905	2,632,703	72
	55-64	1,394	1,959,919	71
	65+	1,144	1,690,362	68
1932	35-44	1,742	2,987,400	58
	45-54	1,989	2,647,800	75
	55-64	1,485	2,018,200	74
	65+	1,249	1,740,100	72



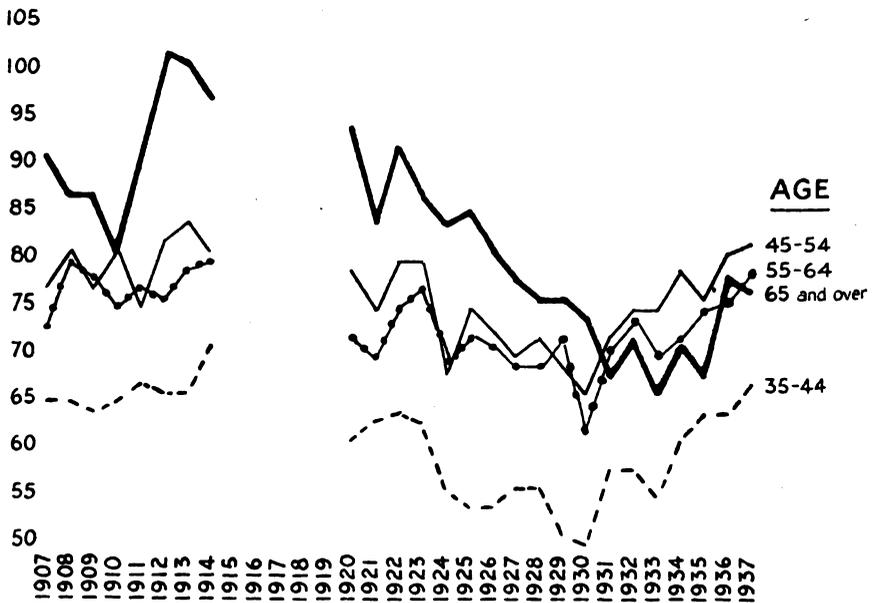
GRAPH A. (1)



GRAPH A. (2)



GRAPH B.



GRAPH C.

TABLE VI—(continued).
(Females.)

Year.	Age-group.	First attack admissions.	Population.	Incidence-rate per 100,000.
1933	35-44	1,671	3,011,500	55
	45-54	2,012	2,673,400	75
	55-64	1,443	2,064,500	70
	65+	1,180	1,775,400	66
1934	35-44	1,870	3,039,200	61
	45-54	2,118	2,692,700	79
	55-64	1,509	2,110,400	72
	65+	1,302	1,823,200	71
1935	35-44	1,961	3,072,500	64
	45-54	2,075	2,715,500	76
	55-64	1,629	2,159,600	75
	65+	1,273	1,875,700	68
1936	35-44	2,001	3,113,700	64
	45-54	2,206	2,738,900	81
	55-64	1,746	2,285,200	76
	65+	1,530	1,926,000	79
1937	35-44	2,105	3,150,400	67
	45-54	2,254	2,759,800	82
	55-64	1,774	2,246,400	79
	65+	1,522	1,973,400	77

The most striking features here are the difference of trend in men and women, and the remarkable fall in incidence among the men.

Taking the men first, it is evident that after 35, anyhow, the older men are, the higher the incidence of first attack mental disorder among them, and that this was more obvious in 1907 than in 1937. It was more obvious then because by 1937 the gap between the incidence among the 55-64 age-group and that among the 65's and over had been narrowed: the incidence among the over 65's had fallen in the thirty years from 109 to 79, whereas the incidence among the 55-64 group had declined less steeply, from 96 to 75, that among the 45-54's from 84 to 62, and among the 35-44's only from 72 to 58 per 100,000.

Among the oldest group who are our concern, the fall began during, or perhaps just after the war years and then continued until 1932, after which the rate became steady. Such a decline might be due to a general diminution

in the available beds or some other factor causing the incidence for the total population of all ages to become apparently less when calculated on the basis of mental hospital admissions. Omitting the few children under 15, the incidence of all first attack direct male admissions was, in 1907, 62 per 100,000 of the general population over 15, and it oscillated between that figure and 59 until the war: in 1921 it was 55, and has been in that neighbourhood (mostly below it) since. So the decline is a general phenomenon, not a peculiarity limited to the older age-groups.

The striking fall in incidence among the over 65's between 1921 and 1931, continuing after the corresponding war or post-war drop for other age-groups had in most cases been stabilized, is not merely interesting in itself, but startling when compared with what has been observed in the United States. Before considering this, it is necessary to examine the incidence among women.

Here the situation is different. The incidence among the 65 and over group has fallen below the 1907 level it is true, but appears latterly to be rising, as are the incidence-rates for the other three age-groups presented. This tallies with the trend of the incidence-rate for all first attack admissions of women over 15: the rate was 57 in 1907, remained at 57 or 58 until the war, was 55 in 1921 and 52 in 1927, but by 1932 it was up to 56, and by 1936 to 62. Women, in spite of a fall in the incidence-rate which appeared during the post-war decade, are now showing much the same incidence-rate, or a higher one, than in 1907, with the exception of the over 65's, whose incidence is climbing as high as it was in the anomalous year 1910, but is still below the general pre-1914 level for that age-group.

These findings confront us with three related problems: why do women differ in this respect from men? Why has there been in the group over 65 a strong tendency for the incidence of first attack admissions to decline? And what are the causes that led to a universal decline in the incidence for all age-groups over 35 during, or for some years after, the 1914-1918 war?

It would be impossible now to enter upon the discussion of these important questions. I shall limit myself to the second, and say plainly that I think the fall in what we are calling incidence among the over 65's is due to the retention in public assistance institutions of many people who should—and would thirty years ago—have been admitted to a mental hospital.

This explanation is not a new one. Its converse was put forward by the Commissioners in Lunacy towards the end of the last century: "The upward progress . . . not in numbers only but in case of first attack out of proportion to the population seems *prima facie* to indicate the increase of insanity which has been alleged, and we must now inquire if there are any circumstances which modify its apparently significant influence. It must be remembered that the admissions which we are now considering include only those into Institutions (Asylums, Hospitals and Licensed Houses) and single care, and have no reference to workhouses, the admissions into which are not notified to us. . . . The census returns . . . give one person of unsound mind to every 329 of the population in 1871, one to 307 in 1881, and one to 298 in 1891. The percentage had, therefore, increased out of proportion to the population, but at each of the three decennial periods there

was a wide discrepancy between the numbers reported to the census authorities and those registered in our department, showing the existence of a reserve from which might be drawn a constant supply of new cases to be registered as suffering from first attacks on admission. That this process has been, and is, actually in operation may be at least inferred from the fact that whereas, as already shown, the proportion of insane to population has steadily increased in the census returns, the balance of difference between the numbers of unregistered and registered lunacy has not only actually decreased from 12,264 in 1871 to 10,588 in 1891, with a rising population, but its percentage to the census numbers shows the large reduction from 17·7 to 10·8 per cent.

"It appears, therefore, to be obvious that unregistered has been transformed into registered lunacy to an extent which must be at least an important factor in the question which forms the subject of this enquiry.

"As regards workhouses, . . . it will be seen that for many years past a progressive change has been constantly going on in the distribution of officially known pauper lunatics. While the ratio of those in County and Borough Asylums has been steadily augmenting, there has been an almost equally steady diminution in the ratio of those in workhouses and residing with relatives or others. Thus in 1859 the numbers in County and Borough Asylums were 15,291; those in workhouses, 7,963; and those with relatives or others, 5,798; giving percentages under the three heads of 49, 25 and 18 per cent., while in 1896 the numbers in County and Borough Asylums were 62,716; in workhouses, 10,906; and resident with relatives or others, 5,924; giving percentages of 71·7, 12·5 and 6·7 per cent. respectively. As in the cases of those in workhouses and with relatives or friends no statement was made to our department whether they were the subject of first attacks or not, it is more than probable that a large proportion of them were admitted into Asylums to swell the percentage of those who were stated to be suffering from first attacks, and so far to convey the impression that theirs were true cases of newly-occurring insanity.

"Without being able to assert definitely that the disproportionate growth of such cases . . . may not in part have arisen from some actual increase of the disease insanity, the facts above stated at least warrant the assumption that much of the apparent increase in first admissions has been due to the gradual absorption by official registration of an unregistered reserve, and to the redistribution of those already registered, but not yet classed as cases of first or occurring insanity." It seems that of late years the reverse process to this has been taking place.

The 1911 Census was the last in which the form included a question whether any of those in the house were mentally disordered: therefore the material on which the Commissioners based their main argument has not since then been available. But if such data as those published by the L.C.C. are examined, they point in the direction I have mentioned. Thus in 1932 the summary statistics of "principal disease or condition treated" in patients who were discharged from or who died in an institution (other than mental hospitals and other specifically psychiatric places) show that during the year 5,348 conditions were cared for in the Public Health Institutions (which would, it

seems, include the observation wards), and 7,714 cared for in the Public Assistance Institutions. Now in the category of mental diseases are listed 1,058 of the 5,348 in the hospitals, and 1,346 of the 7,714 in the Public Assistance Institutions. A further 566 in the Public Health Institutions are listed as "Senile Decay and Senile Dementia"; and a further 908 receive this label in the Public Assistance Institutions. The figures for the Public Health Institutions are so closely related to admissions to Tooting Bec, etc., that it would be a mistake to read much into them: but it is clear that in what used to be called the "workhouse" two-sevenths of the residents are recognized as mentally disordered, and to an eighth of the residents the specific diagnosis "senile decay and dementia" is applied. This is, moreover, in London, where facilities for classification and appropriate disposal are at an exceptionally high level.

It is unsafe to draw conclusions from such figures as I have just quoted unless one has first-hand knowledge of the institutions and of the manner in which the statistics have been collected; as I lack this I will only point to the probable bearing they have on the apparent decline in incidence of "first attack admissions" among people over 65. I have had the opportunity during the past year of visiting a number of public assistance institutions in England and Scotland in which elderly people were being cared for, and I gained a strong impression that there were many demented old people in these places: this impression was confirmed in some of them by the doctor attached to the institution and by the matrons or sisters in charge who had been mental nurses.

It is a moot point whether harmless old people with perhaps gross but unobtrusive mental impairment should remain in a public assistance institution to which they are accustomed rather than be removed to a mental hospital. On the whole, it seems undesirable that they should, at any rate until public assistance institutions and infirmaries make in general much better provision for the nursing of senile demented than at present, and until local authorities take the enlightened view which was expressed by the Metropolitan Asylums Board in 1924: "For some years past the Board has had in mind the need for some change in the method of dealing with poor persons who, at an advanced age, require institutional care and treatment on account of mental infirmity. Hitherto the Board has had no power to receive such cases, except those expressly certified to be insane, and although the class of aged persons referred to cannot be regarded as insane within the ordinary meaning of the term, there has been no ready means of securing for them the care and attention they needed, without certification. . . . The matter is by no means trivial . . ." The instrument which the M.A.B. then obtained from the Minister of Health does not unfortunately seem to have been the precursor of many such enactments establishing smaller places elsewhere which would be similarly entrusted with the valuable and specific duties for which Tooting Bec was set aside in London. It must be remembered, in this connection, that Tooting Bec is not listed as a mental hospital, nor are the patients admitted there counted in the Board of Control's statistics. If, for example, the 549 patients (214 men, 335 women) directly admitted to Tooting Bec in 1932

had been added to the first attack admissions in the table, the incidence-rate for men would rise from 78 to 94, and that for women from 72 to 91.

In view of these considerations, it can, I think, safely be assumed that the incidence of mental disorder among the elderly is considerably higher than the figure derived from mental hospital admissions alone, and that many elderly people with fairly gross mental impairment are in public assistance and similar institutions. The administrative and economic reasons for this had operated for years before 1939, but altering the situation, so far as alteration would be proper, has of course been made much more difficult by the material effects of the war.

It is instructive and startling to contrast the figures I have been showing with those published in the U.S.A. In New York State the rates of first admissions in 1940-41 per 100,000 general population were :

TABLE VII.—*Rates of First Admissions to all Mental Hospitals in New York State, 1940-41, per 100,000 Corresponding General Population by Age and Sex.*

Age-group.	Males.	Females.	Both sexes.
0-14 . . .	10	4	7
15-19 . . .	64	53	59
20-24 . . .	106	82	94
25-29 . . .	111	101	106
30-34 . . .	119	106	112
35-39 . . .	128	120	124
40-44 . . .	130	115	123
45-49 . . .	134	130	132
50-54 . . .	158	149	154
55-59 . . .	178	151	165
60-64 . . .	227	177	202
65-69 . . .	291	242	266
70 and over . . .	541	478	506
All ages . . .	122	110	116

Tietze's comment on this is, "The table presents a familiar picture. The rates increase with age steeply and almost uninterruptedly. . . . The male rate exceeds the female rate at all ages, the excess ranging—beyond the age of 15 years—between 3 and 29 per cent." He calls it a familiar picture, but it is not the one we are familiar with: the rates are astoundingly higher than ours, especially in the 65 and over age-groups, and the sex difference is the reverse of ours in 1937. In Massachusetts it is much the same story, as may be plainly seen in Age Graph 8 in Dayton's "New Facts on Mental Disorder." Here again the admission-rate is much higher than ours, it has increased steadily in the higher age-groups during the inter-war period, and it is the men who have the higher admission-rates. There can be little doubt that the reasons for this extraordinary difference from the English trends are to be found in the social environment of the two nations. Economic fluctua-

tions, social legislation, public and private attitudes call for detailed study if we are to explain the differences. It is then a roundabout road we have traversed, bringing us by way of mental hospital statistics to a point where we must look closely at the polity in which we live. Miss Goldschmidt will be dealing with some broad aspects of this ; but a satisfactory answer to the questions raised by these figures would demand much more study of extra-personal influences on the process of ageing than has hitherto been devoted to them.

Before quitting the American figures, which differ so much from ours, I think there are two lessons we can learn from them. One is that administrators are prone to take an unduly simple view of the matter if a rise in admissions of aged people is forced on their attention, and that they delay over-long to profit by the lessons which a continuous study of the statistics and the questions raised by the statistics could teach them. It was only in 1944, through a special Commission appointed to survey the New York Department of Mental Hygiene, that recognition was given in that State to the truth that the care of the aged who were being admitted in such large numbers to the mental hospitals involved much more than the mental hospitals: "it is closely related to the problem of the care of chronic illness, a field of social responsibility almost as much neglected to-day as mental illness was a hundred years ago." The rise of family care for such patients is another activity in which, as Miss Crustcher's book so well shows for New York State, much might be done. The difficulties of family care have often been stressed, and indeed over-stressed, to the neglect of those positive and organized efforts which are necessary to make family care a success in a modern Western community.

What do the figures we have been looking at portend? According to the very conservative estimate of the Registrar-General, persons over 65 will in 1951 form 11.6 per cent. of our whole population, and by 1971 they will form 17 per cent. of it. In his forecast he does not give separate figures for men and women. I have assumed that the proportion of males to females over 65 will continue to remain fairly constant, and have taken the proportion at the last census, which yields for the 5,511,000 whom the Registrar-General forecasts for 1951, 2,365,000 males and 3,146,000 females. Similarly, of his 7,863,000 in 1971, 3,375,000 will be males and 4,488,000 will be females. On the 1937 incidence-rate this means that in 1951 there will be 1,870 male and 2,420 female first attack admissions of people over 65 ; in 1971 there will be 2,670 male and 3,460 female first attack admissions.

A similar calculation for the 45-65 age-group yields 4,450 male and 5,440 female first attack admissions in 1971. Altogether, therefore, the number of first attack admissions of persons over 45 will in 1971 be 16,020, which is only 3000 less than the total first attack admissions for all ages in 1937 (19,160). That is an arresting thought.

Dr. Kuczynski and other authorities censure the Registrar-General's estimate as too optimistic : but if their criticisms are just they would affect only the proportion of young and old people in the community, not the total number of persons who will be over 45 in 1971 (who are, of course, already born) : therefore the number of persons at risk in these age-groups will be

approximately as he forecasts, apart from any changes that may occur in expectation of life during the next quarter century. But, on the other hand, I have given reasons for believing that the incidence-rate based on admissions to mental hospitals for the over 65's affords a misleadingly low figure, and that the amount of mental infirmity in this age-group is far more than any available figures in this country reveal. If we provide special psychiatric facilities, whether separate (as at Tooting Bec) or in appropriate institutions, such as the mental hospitals or the infirmaries attached to public assistance and similar establishments for the aged and the chronic sick, then the number of first attack admissions in the higher age-groups will be undoubtedly much above the figures just given for 1971, high though these were.

I think it is pretty clear where all this leads. We must regard the mental disorders of the elderly as likely to be responsible within the next thirty years for the bulk of the patients admitted to mental hospitals. It is, of course, not possible to forecast the number of beds that will be required for patients of the higher age-groups, since that will depend not only on first attack admissions of the elderly but also on readmissions, and on the size of the younger population at risk and the success of measures designed to restore the patients' fitness for ordinary life in the community, or if that is impossible to prolong their lives within the institution. To calculate the bed needs, it would be necessary to ascertain, not merely the expectation of mental disorder in the general population (as has been done by Malzberg, Tietze, and others in the United States, and in this country by Slater), but also the expectation of mental hospital stay, both figures calculated for the individual mental disorders.

This brings up the objection to some of the figures I have presented, that they are not analysed according to individual disorders, and that it is therefore wrong to assume that the mental disorders coming on for the first time and leading to admission after the age of 65 are necessarily senile. This objection would have weight if we could define senile disorders otherwise than as organic disorders occurring in the senium. There is not the time now to enter into the clinical questions raised by the issue of diagnosis and terminology. It is an issue of great importance; because it is in a mess, the delimitation of the clinical problems for study is needlessly difficult. Dementia, deterioration, decay, senility and presenile psychoses are terms used without precision, and such a distinction in diagnosis as between arteriosclerotic psychoses and senile psychoses becomes the occasion of statements and disputes which are at bottom due to a semantic, not a medical difficulty. Until the clinical issues here involved are cleared up, I think the pathologists will find it hard to correlate their findings with the morbid clinical features or to provide a sure basis for nosological accuracy. The psychologists are labouring to provide a measure of some aspects of the impairment common in old age, but are some way from being able to measure dementia, far less to detect it. But the clinical psychiatry of old age still offers rewards even to the despised descriptive method. The clinical is probably now the most neglected field in the study of the psychiatry of ageing. Such an investigation as that which W. H. Gillespie undertook is as illuminating and perhaps more urgently needed than

some of those expositions of psychopathology or physical treatment to which scores of papers are devoted every year. I would therefore plead for a greater interest in the straightforward clinical aspects of mental disorder as seen in the aged. It is the preliminary, or the complement, to study of that normal process of ageing, which proceeds at such varying rates and in such varying forms in different people. Normal ageing is the centre of our problem : in it, and in the social influences that bear upon it, probably lies the main answer to our question : what causes senile aberrations and how can they be prevented or delayed ?

I have not succeeded in covering as much of the general problem as I had hoped. There are so many aspects, so many stimuli to investigations that no one can go far without being beguiled into a side path. There is now a welcome activity in regard to the mental disorders and related problems of ageing, betokened by the studies we are to hear about to-day and work like that of Dr. Post in Edinburgh and Mr. Raven in Dumfries. But it is doubtful whether there is a wide enough recognition of how fascinating the problems are, and how pressing the theme. It touches at every point the knowledge, and exposes the ignorance, which make up our current psychiatry.

THE PSYCHOLOGICAL ASPECTS OF AGEING AND SENILITY.*

By MARGARET DAVIES EYSENCK, B.A.Toronto, M.A.Lond.

PERHAPS the earliest adumbration of modern interest in problems of old age was Quetelet's important two-volume work on *Man and the Development of his Faculties* in 1835 (55). In this book appeared for the first time data of a kind since become very familiar: ages when various crimes are committed, when literary masterpieces are written, ages of admission to hospitals for the insane, and so on.

A decade later, in 1846, a physician by the name of Caldwell (10) wrote a book on the effects of age on human constitution. He contrasted mind and body, saying of the former: "There is reason to believe . . . that, in the same individual; the mind or spirit of the infant, the mature adult, and the centenarian is identical. No doctrine other than this is compatible with the creed of mental immortality." As Bird, who quotes this passage in his excellent chapter on the "Social Significance of Age," remarks, "We recognize in this exposition the influence of wishful thinking. A desire for mental immortality seems to have handicapped a recognition of mental life as the functioning of physical structures" (3).

Little was added to our knowledge during the next 90 years, but in the last dozen years or so interest in the psychological problems of age has revived and some 250 research papers and articles of varying quality have now appeared. In addition several symposia (35, 37, 42) have been held, and the publication of Cowdry's (12) volume on *The Problems of Ageing*, as well as of the books by Bühler (8), Lawton (36) and Pressey (54), indicate the general interest in the subject. These studies have been reviewed by several writers (7, 29, 33, 41, 45, 57, 58, 75), and no attempt will be made in this short paper to duplicate their efforts.

I shall attempt here merely to set out the conclusions most securely established, and to point out some of the methodological difficulties which make generalizations in this field particularly hazardous.

The first part of the paper will deal with the differential decline of intellectual ability in old age, and the methods suggested for studying and measuring deterioration. The second part will deal with changes in the orectic field, that is with respect to instincts, emotions and derivatives of these, such as interests, hobbies, adjustment, aspirations and so forth. In conclusion, some principles underlying the studies hitherto conducted in this field will be critically considered.

There is by now little doubt that the average performance on general tests of intelligence of old people is considerably lower than that found for younger adults.

Apart from a few isolated earlier small-scale inquiries, the results of the extended testing of American Army Officers (76, 77) in the last war provided

* A Paper read at the Annual Meeting of the Royal Medico-Psychological Association held on September 5, 1945, at 11, Chandos Street, W.1.

the first quantitative estimate of this loss, a 30 per cent. decline in scores being observed from the early 20's to the late 50's. In general, the peak performance on the Army Alpha Test (30) was reached at about 18 years, followed by a slight deterioration until about the 40-year-old period, after which deterioration became more rapid. This conclusion has been reduplicated by other investigators with surprising regularity. In the Stanford Later Maturity Studies, summarized in Cowdry (12), in which the Otis Test rather than the Army Alpha was used, ability was found to be maximal at 18, remain fairly level to 45, declining most rapidly after 70. The loss over the whole range averaged about six or seven months per decade. The correlation between age and intelligence for about 2,000 adults, aged 20 to 95, was found to be approximately — 0.5. This rate of loss based on comparisons of different age-groups was confirmed by retesting a small sample after two years' interval, when the decline theoretically expected was found to have taken place (43, 44).

The first test of adult intelligence to take into account this decline of mental ability was Wechsler's Bellevue Scale (74). He found that ability declined at the rate of about one year of mental age per decade, and standardized his test on that basis. At the age of 60 scores are only 85 per cent. of what they are at 30.

The decline of mental ability found in these and other tests is a differential decline in two senses of the word. In the first place different abilities decline at different rates, and in the second place, the same abilities decline at different rates in different persons. To take the latter point first, Gilbert (22) has shown that decline, both on the total battery of tests and on nearly all the 33 separate tests she used, was less at the upper levels of intelligence than at the lower and average levels. Thus, it would appear that rate of decline of intelligence is correlated with actual amount of intelligence originally present; or, in other words, the greater an individual's intellectual endowment, the less he deteriorates, or the longer he retains his full mental ability. This conclusion is a fitting counterpart to the fact that intelligence continues to increase for a longer time in the bright than in the dull child, the dull reaching his maximum early, the bright reaching it relatively late.

As regards the fact that different abilities decline at different rates, it has been found by many investigators that in marked contrast to most other types of intelligence tests, scores on vocabulary tests show little decline with increasing age, and may, in fact, increase up to the age of 50 or 60, to remain relatively stationary thereafter. Correlations between the Army Alpha or the Otis type of intelligence test and age are universally negative, whereas small positive correlations are often found between vocabulary and age. Vernon (70) has shown that after the age of 12 mental age on the Binet Test falls progressively behind vocabulary age. This tendency towards divergence after the age of 12 is reached indicates that while total test ability slows down and presently comes to a standstill, vocabulary ability goes on growing long beyond the age of 12. Vocabulary is not the only test to be relatively unaffected by old age. Other tests depending largely on retention and learning, such as general information tests, for instance, spelling tests, etc., also fail to show any decline. In opposition, we find the most rapid decline with age in those tests which are

comparatively pure measures of Spearman's "g," that is, the ability to deduce relations and correlates.

Two points of interest arise in connection with the intelligence test findings : (1) Are there qualitative changes—that is, is the performance of old subjects, in addition to being lower in quantity, different in character to that of younger subjects? Piaget suggested that a difference of a qualitative kind occurred at about the age of 8 in children, and it seems reasonable to investigate whether a similar change occurs in old age. (2) Does the organization of mental capacities change with advancing age? We have seen that changes take place in the organization of mental capacity as the child grows into adulthood. It seems possible that similar changes take place as adulthood changes into senility.

On both points some evidence is available from my own studies on the mental reactions of senile dementia cases. These present, as is well known, an exaggerated picture of the usual psychological developments due to old age, although it must not be assumed necessarily that they do not also show certain reactions peculiar to their particular disorder.

With respect to the possibility that there are qualitative changes in intelligence in the older subjects as compared with the younger ones, it was found that with regard to the type of error made, the reasons for these errors and the order of difficulty of the problems, the senile dementia patients agreed so closely with normals that the conclusion would appear to be justified that qualitatively identical ability was being tested throughout (19).

With respect to the organization of mental capacity, 20 psychological tests were given individually to these senile dementia patients and repeated after four months. Test-retest reliabilities were established, intercorrelations run between the tests, and a factorial analysis carried out on the resulting matrix. The factorial analysis showed the existence of a general factor and three group factors, concerned respectively with speed tests, memory tests, and tests of physical strength and agility. The general factor presented a picture of mental organization of the patients differing greatly from that found in normal adults. The detailed findings could best be interpreted in terms of the theory of fluid and crystallized ability, which will be discussed presently. Altogether, the results left little doubt that mental organization is profoundly changed by advancing age (20).

The desire of older adults to learn and their ability to do so are points of interest in a consideration of the psychological implications of mental deterioration in old age. It was reported in 1926 (31) that in the United States there were at least five times as many adults engaged in formal educational study as there were candidates for degrees in all the colleges and universities in the country. Any tutor of adult classes will at once comment that such classes include a larger number of young adults than old. One reason for this is very simple : There are more young adults in the population. Bird (3) gives a table indicating that for the students enrolled in Adult Education Classes in Minneapolis, their ages approximate very closely to the proportion of the same ages in the population as a whole—surely a surprising and interesting fact, showing that the older person retains a *desire* to learn.

Starting from the fundamental fact of adult willingness to learn, Thorndike

and his co-workers (68, 69) have made extensive investigations into adult ability to learn. To summarize their findings: "Ability of adults to learn within the age range of 20 to 45 years shows a slow but steady decline. The decrement at the close of this period is approximately 15 per cent." Thorndike also found that older people, average age 47, did not learn as well when the materials seemed useless or devoid of intrinsic interest.

Superiority in learning abilities lies with young adults as a group; but, as in all such comparisons, the importance of individual differences must be borne in mind; adults around 50 years of age may frequently succeed better than the average young adult, and even adults 60 to 70 years of age may be expected to learn as well as the average 12 or 13-year-old child.

Another important finding is that by Sorenson (60), who gives experimental support to Thorndike's contention "that learning itself may prevent decreased learning ability," for he found adults who had continued their studies able to learn well, up to the age of 50, although often the older adults had compensated for a decrement in learning ability by spending more time in study.

Bird (3) supplies an excellent conclusion on the subject of the learning capacity of older adults: "Older people develop false notions about age. They confuse inability to achieve at the pinnacle of success with an assumed inability to perform satisfactorily at a level perhaps only slightly lower. Thus feelings of inadequacy arise, to be followed by the more outright feelings of inferiority. Too frequently there follow open expression of condolence and the consequent fixing of the false notion that adults cannot learn very much."

After this brief consideration of higher mental abilities we may next turn to what are called "motor abilities." Possibly the most frequent test of these is reaction time, which can be given under varying conditions of complexity. Simple reaction time studies reveal slower responses, beginning at about the age of 20 and continuing to lengthen through the life span. In these tests, too, as in those of mental ability, although an individual has slowed down, he may excel at the relatively advanced age of 70 the average of the population. Miles found approximately 25 per cent. of people of 70 years to be as quick in reaction time as the average of his total group. Among Miles' numerous experiments on reaction speed was one which showed maximum performance for the age-group 18 to 29; decline in reaction speed was relatively small in middle maturity, but for the age-group 70 to 89 it had fallen nearly 30 per cent. (46). "Generally the loss seems greatest when movement is reduced to its purest form, and least when perception and comprehension must precede the moment of making the reaction" (3).

Other types of tests have validated the general belief that young people as a group show greater strength, swiftness, precision of movement and steadiness of motor control than is generally characteristic of old people. Curves showing the development and decline of these abilities indicate fairly rapid improvement up to the age of 20, then a slow decline to the age of 50, after which age the decline becomes much more marked. In fact these curves duplicate almost exactly the growth and decline of general intelligence, showing a correlation of -0.5 between age and psycho-motor activity (46).

It might be assumed that lengthening of reaction times and slowing down

of psycho-motor responses would be likely to increase the accident rate of older workers; however, it has been shown that disabling injuries were only about two-thirds as high for workers at 50 as they were for workers under 30. Even for workers over 60 the rate was still lower than for workers under 20 (32). These observations indicate the difficulty inherent in much theorizing on the basis of results on rather simple tests of ability; before deductions can be made from such tests to real life situations the relative influence of test-ability on the one hand and social learning and experience on the other must be known.

Perceptive ability has been studied extensively, particularly with relation to the diminution of acuity in old age. Sensations of pain (13), so-called vibratory sensibility (51), taste sensations (1), as well as the higher senses, that is, hearing (23) and vision (21), all show decreases with age similar to those observed in the psycho-motor field. In addition to experiments on simple sensations and perceptions, it has also been shown that perception is not as prompt in the old as in the young and that its span is shorter (46). Again, it must be emphasized that in actual life-situations, for example, in industry, such defects of old age are often compensated by experience and persistence.

In the correlational study, mentioned earlier, on the results of the tests given to senile patients, the motor tests correlated far more highly with intellectual performance than they do in children and younger adults, indicating the presence of a factor of general deterioration.

The fact that various mental, motor and perceptual abilities deteriorate at different rates has been used in attempts to measure the amount of intellectual deterioration, on the principle that the abilities least deteriorated, such as, for instance, old skills either with words or handling of materials, will give some idea of a person's original standard, whereas a mental test involving novel material will give a measure of his present ability. The difference, therefore, between the score on the old materials and the score on the new will roughly indicate a person's deterioration. In the main the tests used have been vocabulary for the old skills and speeded tests of mental ability for the new (2, 22).

Several criticisms must be made :

(1) Vocabulary tests standardized in terms of our present-day average knowledge of certain words almost certainly fail to do justice to the word knowledge of people whose vocabulary was laid down at least a generation ago.

(2) It is generally accepted that one's vocabulary is an index of education rather than of original mental endowment, and, therefore, a precarious touch-stone to apply.

(3) Speeded tests may not give an accurate idea of the old person's intellectual power. Gilbert (22) recognized the fairness of this criticism of the use of the Babcock Scale, and rescored some of the tests, omitting the timing factor; she did, indeed, still find that the older subjects did worse than the younger, but their performance was considerably better in comparison when speed was disregarded. It seems somewhat more practical to give unspeeded tests to the older subject, as in most tasks confronting him in his profession and in ordinary life speed is not of such paramount importance, particularly

as in his work he will be dealing with familiar material. While it has been shown in children, adolescents and younger adults that there is no separate speed factor in intelligence, my own Factor Analysis shows that one cannot extrapolate from such studies that no such speed factor is active at other ages, and unless that point is experimentally settled one can ascribe little scientific validity to these deterioration scores.

Lorge goes so far in his criticism of the use of speeded tests on older adults as to say, "Contaminating power with speed measurements among older adults obscures the true relationship of intellectual power to age. Reported facts of mental decline as a concomitant of age are, at the least, exaggerated" (40).

The view that speed and ability are relatively separate concepts, at least in more mature subjects, has given rise to the practice of abolishing time limits for intelligence tests given to adult subjects, as is done for instance by Thorndike in his C.A.V.D. Test and by Raven in the original form of the Matrix Test. The emergence of this speed factor in older subjects has been used by Cattell (11) in conjunction with two other experimental findings as the basis of his theory of fluid and crystallized ability.

These two other facts are, first, Spearman's principle of diminishing returns (61), that is, the general finding that the saturation of almost any performance with the general factor of intelligence becomes less as higher levels of general ability are reached. Sub-tests of a type which correlate from 0.6 to 0.8 among children correlate to the extent of only 0.3 to 0.4 among adults. The second series of facts derives from data on mental capacities and brain injury, and has been summarized by Hebb (28), to the effect that a localized brain lesion produces in children a generalized impairment more noticeable than any specific functional loss, whereas in adults a corresponding injury produces more specific loss of powers and less obvious loss of "g."

Taking together these data, that is, the emergency of a speed factor in adult life, the diminished "g" saturation of adult intellectual performances, and the differential effect of brain lesions in children and adults, we arrive at Cattell's hypothesis which he has set out in the following manner:

"Adult mental capacity is of two kinds, the chief characteristics of which may be best connoted by the use of the terms 'fluid' and 'crystallized.'

"Fluid ability has the character of a purely general ability to discriminate and perceive relations between any fundament, new or old. It increases until adolescence and then slowly declines. It is associated with the action of the whole cortex. It is responsible for the intercorrelations, or general factor, found among children's tests and among the speeded or adaptation-requiring tests of adults.

"Crystallized ability consists of discriminatory habits long established in a particular field, originally through the operation of fluid ability, but no longer requiring insightful perception for their successful operation.

"Intelligence tests test at all ages the combined resultants of fluid and crystallized ability, but in childhood the first is predominant, whereas in adult life, owing to the recession of fluid ability, the peaks of performance are determined more by the crystallized abilities" (11).

I believe that this hypothesis has considerable heuristic value, and that it accounts adequately for the great majority of experimental results in this field.*

As the cognitive aspects of ageing can best be understood with reference to Cattell's scheme of fluid and crystallized ability, so orectic changes can best be summarized by reference to Bühler's (9) concept of life pattern. Through an analysis of 300 biographies of people of various ages and professions, she reached the conclusion that the life pattern of her subjects showed a period of expansion, of stability and of restriction which paralleled the biological curve of growth and decay, though lagging somewhat behind. She noted five main phases in this life pattern: the first in early life showed non-specific activities, that is activities which have a preparatory or provisional character predominating; the second phase is one of "specification and definiteness in work when abilities are applied to real tasks"; the third phase is one of testing results and accomplishments, followed by the fourth phase, wherein striving for the desired success dominates the life pattern; and the fifth phase is one of looking back on life. It may be doubted whether this list represents any great improvement on Shakespeare's Seven Ages of Man; however, what is important is Bühler's recognition on the basis of empirical evidence of a certain consistency of life patterns, enabling us to test her conclusions by suitable experiments.

Direct studies of instinctual changes with age are comparatively rare, those of the sex drive being the only ones available (14, 15, 26, 50, 67). These bear out the popular impression of a gradual decrease in sexual activity from the late teens and early 20's to middle age and beyond. However, indirect studies of other drives, as mirrored in the aspirations and activities of people, are more plentiful. Studies of personal problems and wishes show an increased concern with spiritual and philosophical values in the aged, concomitant with the waning of sexual and social interests (64, 66, 66).

Studies of vocational accomplishments (made most frequently in connection with the lives of famous scientists, musicians, soldiers, statesmen, writers and so forth) suggest that the drive for vocational accomplishment is strong in the 30's and 40's, when quantity as well as quality of work is most outstanding. Several investigators have found the average age of maximum achievement, that is production of masterpieces, to be close to 40, while others place it nearer to 30 years (16, 39, 56).

These results are paralleled in studies of more humble folk, in whom the desire for vocational advancement gives way to desire for security as age increases, and generally in later maturity concern over job and materialistic matters seems to lessen and interest shifts to matters of philosophy, religion and culture (4, 59, 62). Many detailed studies of such shifts in interest have been carried out, showing frequently an almost circular change in interests. Thus Strong summarizes his large-scale studies in vocational interests by pointing out that "interests change rapidly from those held at 15 years to

* A similar distinction has been suggested by Brody, who contrasted ability to acquire knowledge in early life with "the products of ability which are the keys to success in later life." (7)

those held at about 25, and then shift in the reverse direction much more slowly from about 25 years to about 55 years" (63). However, similarity of interests among adult age-groups is much more marked than one might have expected; age differences are much less pronounced than occupational or sex differences, correlations between 20 and 60-year-olds running around + 0.8 or higher (63, 72).

One general conclusion, however, can be drawn, namely, that increased age brings with it a general withdrawal from most types of activity (6). This has been shown in several studies by means of questionnaires, personal interviews, time budgets and similar methods. In a representative study made in the United States for the National Recreation Association (78), those between 46 and 60 years of age checked about 42 per cent. fewer activities than those from 21 to 26; with the exception of musical and educational activities, all types of activity decreased in frequency of participation. Age trends in reading activity are not striking; it seems probable that reading, especially non-fiction reading, is liked slightly more by older people (25). On the other hand older groups tend to visit the cinema less frequently (73), and Lazarsfeld (38) has shown that on the whole people under 40 listen to the radio more than those over 40.

With respect to political and moral attitudes and opinions, age appears to be less influential than has hitherto been assumed (24, 27, 49). Although on the usual type of questionnaire older people are usually found to be more conservative than younger ones, showing more disapproval of communism, birth control, free love, extra-marital sex relations, and other modern tendencies, it should be remembered that a direct comparison of a group of young people with a group of old people may easily mislead the incautious investigator to ascribing to the age factor results properly due to changes in social environment (17, 18, 48). This difficulty will be discussed in greater detail later.

Closely connected with studies, direct or indirect, of instincts and emotions is work on adjustment and neuroticism (5, 52, 53, 71). Much of this has been carried out by the use of questionnaires, and the conclusions drawn must be viewed rather critically. Results seem to indicate early maturity and old age as the periods of greatest stress. This conclusion is borne out by an analysis of the years designated in retrospect as the happiest by a number of people, 50 per cent. approximately giving the age from 25 to 45 years as the happiest period (34, 47).

In conclusion we may discuss briefly certain principles underlying the investigations summarized earlier. Strictly speaking, to say that a certain change is due to age, or takes place with advancing age, would make it incumbent upon us to show, first, that the quality we are studying is present in the same individual at an early age and absent at a later age, or vice versa; and secondly, that this change cannot be accounted for by any other cause except advancing age. Not a single one of the 250 or so studies hitherto conducted fulfils these conditions. The procedure commonly adopted has been that of comparing a group of young people with a group of old people with respect to the incidence of the variables under consideration, assuming that such differences as were statistically significant between the two groups were due

to the difference in age, and arguing from that that similar changes could be observed in the ageing individual. The fallacy of thus confounding age differences with age changes hardly needs elaboration, and has indeed been remarked upon by several writers.

One particular aspect of the foregoing is the problem of education. When a comparison is attempted between two widely differing age-groups, it is next to impossible to equate their educational attainments; first, because teaching methods and matter taught have altered radically in the generation or so dividing the groups; and secondly, and even more important, is the fact that some form of higher education is being given to an ever-increasing proportion of the population, with the result that in a random sample of the two age-groups, University or Secondary School education would be possessed by far fewer of the old group than of the young.

A further difficulty which arises is the selective factor of survival. If we assume, as is indeed quite probable, that the more intelligent tend to live longer than the less intelligent, then a comparison from the point of view of intellectual ability between an old and a young group, even if carefully matched on the basis of social class, education and other factors, would still give a very misleading picture of the actual intellectual differences due to age. Intelligence, of course, is not the only selective factor in survival; the same problem becomes apparent in all other spheres. In our present state of ignorance of the exact correlation between these factors and survival in our society, little more can be said here than to indicate the problem. Its solution must await considerable expansion of psychological research.

In brief, we may conclude that such studies as are available are merely exploratory; further advance will be possible only when large-scale longitudinal follow-up studies are conducted in a manner designed to reveal the intellectual, emotional, physiological, temperamental and attitudinal changes occurring during an individual's life, thus giving us a detailed picture of his life pattern.

In spite of these criticisms, it is probable that such extensive studies will confirm the main facts which emerge in the literature, namely, the differential decline at a positively accelerated rate of mental, perceptual and motor abilities, from a peak period in the early 20's, and a general withdrawal of libido from the outer world concomitant with this mental decline.

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SOCIAL ASPECTS OF AGEING AND SENILITY.*

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THE object of my study was an attempt to discover what social factors might be said to contribute to either mental health or mental ill-health in old age. I studied the histories of four groups of 50 aged in four different settings which in retrospect might be said to form a spectrum. That is to say that each subsequent social background seemed to be more conducive to normal ageing than the preceding one. The actual sequence of the whole investigation, for technical reasons, was, however, as follows: In the first place I made contact with patients in Tooting Bec Mental Hospital; as a second group I chose people in a Club for Old Age Pensioners in Streatham; thirdly, I visited old people living by themselves in Fulham; and finally, I interviewed a group who are living on an Estate at Mill Hill, the Estate being maintained by the Society of Linen and Woollen Drapers. In all but the last sample I studied the cases of 25 men and 25 women.

I shall talk in greater detail about the first of these groups, and give my general impressions of the findings of the three remaining samples. The method of study employed in the Tooting Bec group differs in one essential point from that used with the aged living in the ordinary community. As the majority of the mental patients were too ill to give information themselves, their life-histories had to be pieced together from such heterogeneous sources as wives, husbands, relatives, landlords, relieving officers, hospitals and public assistance institutions. In the three other groups the old people themselves were the sole informants. The Tooting Bec sample consisted of 50 patients consecutively admitted during the period between November and December, 1943. The investigation was begun almost immediately after admission, and the cases were followed up for four months. With the exception of one younger man, the ages ranged from 65 to 87 for the men and from 68 to 91 for the women. Fifteen cases had been diagnosed as suffering from uncomplicated and 15 from complicated senile dementia, 13 from arteriosclerosis and hypertension, 6 from confusional states and 1 from pellagra. Twenty men and 12 women had evidence of generalized arteriosclerosis.

The basis for the inquiry was the scheme for social histories in use by psychiatric social workers. For obvious reasons more detailed data were available only for the later years of life. I followed up the progress of the patients with the help of the nurses, personal interviews and observation.

The basic assumption of the inquiry was that apart from organic cerebral changes incident to old age, social influences operate which are directly related

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to senility and senile psychoses. The data were analysed with reference to a schedule, the items of which represented my hypotheses regarding the importance of certain social factors. The social factors which are dealt with in the following account are :

1. *Social integration* as it is affected by (a) war conditions, (b) by a general change of attitude of children towards their parents, (c) by temperament and character, and (d) by excessive consumption of alcohol.
2. *Previous occupation and present activities.*
3. *Financial security.*
4. *Diet.*
5. *Infirmities, and the incidence of social integration.*
6. *Nationality of patients.*
7. *The effect of air raids on physical and mental health, and the effect of air raids which resulted in change of habits and accommodation.*
8. *Critical occurrences not due to bombing.*
9. *Previous mental history.*
10. *Ultimate social failure.*

Now to the first item of the schedule, namely *social integration*. It was assumed that old people, like every other age-group, have basic needs which, if they are not satisfied, lead to mental ill-health. The most important of these seemed to me to be normal human contacts and the feeling of being a useful member of society. This was termed social integration. Social integration was taken to have been achieved in cases in which at the time of the onset of the mental illness husband and wife were living together, or if widowed, they lived with children or relatives. In the case of single women and men, they were considered to be socially integrated if they formed part of the unit in which they found themselves. Non-integration, on the other hand, was supposed to be present if single women lived by themselves, against their own wishes. 36 per cent. of the women were single, 8 per cent. married, 8 per cent. separated and 48 per cent. widowed. 24 per cent. of the men had remained single, 28 per cent. were living with their wives, 8 per cent. had been separated for long periods of time and 40 per cent. were widowed.

I distinguished three categories of integration. Only 20 per cent. of the women patients and 28 per cent. of the men patients could be considered as socially integrated. 12 per cent. of the men and 12 per cent. of the women were to a limited extent integrated into the life of the community. They were tolerated by their children with whom they lived, but did not enter into the young people's activities. (More detailed descriptions and examples of the patients investigated can be found in an article by A. J. Lewis and H. Goldschmidt* in *The Sociological Review*.)

Among 68 per cent. of the women patients and 60 per cent. of the men, social integration was to a large extent lacking. Before their admission to Tooting Bec Hospital they were either living alone or in Public Assistance and

* Lewis, A. J., and Goldschmidt, H., "Social Causes of Admissions to a Mental Hospital for the Aged," *The Sociological Review*, 35, Nos. 3 and 4, July-October, 1943.

other Institutions, and in lodging-houses of the Rowton House and Salvation Army variety. It should be noted that patients do not enter Public Assistance Institutions with enthusiasm. This is partly due to the popular conception about them, but is also based on the knowledge that their social activities would be curtailed and restricted, even though a group of contemporaries would be living under the same roof. Hence they only enter Public Assistance Institutions when no other alternative is available, when in fact their integration in the community outside is non-existent.

The adverse effect of the War on social integration was demonstrated in only two cases. 32 per cent. of the women and 28 per cent. of the men who lived by themselves might conceivably have lived with their children. The majority of the children, who were of the working class, did not consider that they could be expected to support their parents, in view of the higher cost of living of this generation. This attitude seems to indicate a growing tendency for the aged not to be supported by their own families, and it is a matter for further investigation whether the facilities provided by the community for the care of its aged can compensate for the loss of the emotional satisfaction of being part of a family unit. I will discuss this point further when I talk about the Club in Streatham.

Another very important factor which adversely affects social integration is character and temperament. Of 15 men living alone, 10 had personality difficulties, and of 17 women, 12 showed similar defects of personality. Such difficulties, besides preventing a successful integration into the family, may also, according to some authorities, point to a tendency towards senile psychosis.

Some of the cases were known to have consumed alcohol to an immoderate degree. Their children were ashamed of their parents' weakness, and were not willing to have it known that there was a close relationship between them.

In 17 cases of men and in an equal number of women little or no interest was shown in their welfare by other people. It would seem, therefore, that social integration was markedly absent in the group studied.

We now come to the second item—*previous occupation*. It was thought that it might be found that physical disability comes on sooner in manual workers than in the more privileged classes of the population. The majority of the male workers in our sample had pursued occupations in the lower income class; 9 who were unskilled had worked as carmen, stevedores, dustmen, navvies and the like; 12 semi-skilled workers had been employed as shop-assistant, publican, etc., and 4 skilled workers as clerks and foremen. Our findings did not indicate that there was a relationship between the age of retirement and the skilled or unskilled nature of the work.

A further possibility was that termination of active work often leads to impaired mental and physical function. There did not seem to be a close association between the beginning of the mental illness and the date at which the individual ceased work, except in three cases. These three patients seem to have suffered in facing the fact that they had to make way for people younger than themselves.

The men's activities and interests after they had given up full-time employment were then examined in the light of the hypothesis that to maintain

mental health, every person must at all times have some form of worthwhile activity. Only 20 per cent. of the men had performed certain duties, but none of them had belonged to any club or taken part in social or religious activities. Only one man was known to have gone to the cinema. 72 per cent. of the women had been employed in some form or other of domestic service, and all but two, who had been in Public Assistance Institutions for long periods, remained active in their homes until their admission to Tooting Bec Hospital. Three had been interested in Church activities. It was apparent, therefore, that after regular work had ceased, the majority of the patients had no other activities to take its place.

The next basic need investigated was *financial security*. The criterion of insecurity was that an individual's income at the outset of the mental illness was considerably less than during the previous decade, or that he or she had been entirely dependent on the support of another individual, a dependence which they were known to have resented. For all the patients the difference between their working income and the old age and supplementary pensions was negligible, as they had been earning small wages. Nevertheless, the change from earned to unearned income created a difficulty, mitigated, no doubt, by the fact that the pension was theirs by right and would continue whatever happened. 20 per cent. of the women were financially insecure, and 40 per cent. had no income other than old age and supplementary pensions. Economic difficulties were present in two of these cases. 36 per cent. of the men were financially insecure, and half of these had felt keenly their dependence on others. 20 per cent. of the men, apart from those in pensionable employment, had made some provision, albeit inadequately, for their old age. Taking the group as a whole we find that 25 per cent. were financially insecure.

Closely linked to financial security or insecurity is the individual's *diet*. Of the six patients whose diet was deficient, four reported that this was due to a shortage of money, and two, it appeared, had deteriorated mentally to the extent of neglecting to feed themselves. Two of the women showed signs of malnutrition.

The question of the patients' *infirmities* was considered to be another important factor in the possible causation of their mental illness. 28 per cent. of the women were either totally blind or had progressive loss of sight, and 20 per cent. of these were not socially integrated. The effect of this infirmity on their personality was very considerable.

Three of the women had had a hemiplegia, two were epileptics, four were severely handicapped by deafness and two by arthritis. With the exception of two, all of these lived alone.

The proportion of infirmities to non-integration among the men was somewhat more favourable. 20 per cent. of them were blind or nearly blind, and 12 per cent. of these had been adequately cared for. The same was true of the seven men who had hemiplegia. Only one of the three men who had become deaf had no one to look after him.

It is reasonable to consider foreign nationality amongst the aged, as having results similar to an infirmity. This is particularly noticeable when communication of ideas is made almost impossible because of language difficulties.

One patient of Greek nationality showed this "infirmity" to a marked degree. The stress caused by the non-acceptance of the foreigner in the English community was an even greater difficulty in five patients. Prior to their entry into the Mental Hospital some of these had been compelled to live in Public Assistance Institutions, away from their own small community which spoke their own language. We find, therefore, that 66 per cent. of the total number had an infirmity other than their mental illness.

With regard to *the effect of War conditions*, three men and three women seemed affected by the raids, but all the three women had previously been treated in mental hospitals. Injuries sustained during bombing had indirectly led to admission in three instances. The dislocation due to the loss of home and other changes caused by bombing were a disturbing factor in 12 per cent. of all cases.

It will be realized that as the investigation took place in the fifth year of the War, when London was relatively free from air raids, fewer factors directly connected with the War had affected the conditions of the patients. Other "critical occurrences" had included change of accommodation not due to bombing, loss of spouse and close friends of similar age.

Before discussing the ultimate social failure which made admission to Tooting Bec Hospital imperative, I want to refer briefly to the *previous mental health* of the patients. As already mentioned, three women and two men had previously been treated in mental hospitals. Defects of personality reported by the relatives of the patients on numerous occasions fell into two categories, the domineering and the over-timid personality. 52 per cent. of the men and 56 per cent. of the women had shown one of these characteristics, and it became plain that the majority had been ill-adjusted and difficult people. Many of the patients had been of a distorted and psychopathic personality the greater part of their lives. As they grew older those around them noticed the usual signs—poorer memory, garrulousness, a tendency to reminisce and so on. There was no appreciated need to intervene in the patients' affairs until they did something which indicated gross psychological deficiency and it became evident that they could no longer be tolerated in a normal society. Various social lapses were responsible for the decision to place them in a mental hospital. Six patients (4 women and 2 men) who previously lived in Institutions became a nuisance by getting into each other's beds. Nine men and two women caused annoyance to neighbours by accusing them of murdering someone, by damaging property, shouting and shifting furniture in the night. Wandering, often coupled with restlessness at night, was responsible for the admission of eight men and eight women. Three men and one woman had attempted or seriously threatened suicide; in some instances this was associated with homicidal inclinations. Four patients got into trouble for indecent behaviour. Violence was reported in five cases. In the case of one other man who had been punished for trespassing on a number of occasions, the final misdemeanour was defrauding the railway of his fare. While on remand he was found to be suffering from cerebral arteriosclerosis. 28 per cent. of the male patients died within 6-25 days of their admission to the Hospital, and 12 per cent. of the women died within 3-46 days. Of the 32 per cent.

of the male patients whose condition improved greatly in Hospital, 20 per cent. had been living alone; so had the three women who improved appreciably. 24 per cent. of the men improved slightly, and of these 20 per cent. had been living alone. Of the 40 per cent. of the women in this category, 16 per cent. had been socially integrated. The condition of four men and nine women remained stationary or deteriorated. Two men left hospital again during the study; one of them had not improved, and one woman who was discharged had at that time no symptoms. It follows, therefore, that it would be a mistake to infer that because patients are admitted to Tooting Bec Hospital, the prognosis must invariably be unfavourable. In some cases the improvement, especially in their social attitudes, is such that they are enabled to leave hospital and to resume their lives outside.

The setting of the next group of aged, which I studied in the Darby and Joan Club for Old Age Pensioners in Streatham, seemed to me to provide one answer to the question of "how to add life to years as well as adding years to life." The sample was similar to the Tooting Bec group, not only in social and occupational status, but in many social, material and psychological privations, which in some degree face all ageing people in a changing society. In this sample and in the two subsequently studied I tried to obtain information on the social and medical history, as well as statements on the old people's attitudes towards social aspects of ageing and old age proper. I shall not be able in the time at my disposal to discuss the findings in detail, and will therefore only refer to the characteristics of each sample.

The Club consists of 1,100 members and is open six days a week. It provides meals and has facilities for recreational and occupational activities. I visited the Club fairly regularly for about five months, and came to the conclusion that the concept of social integration as defined in the Tooting Bec study must be broadened, to include integration into a community such as is presented by the Club. In many instances where family relationships were either strained or non-existent, the emotional cross-currents which it was possible to develop in the Club seemed to compensate and more than substitute for family ties. The beneficial effect of the Club atmosphere was particularly noticeable in those few cases in which there was evidence of a certain amount of mental deterioration combined with personality difficulties, the latter being largely responsible for lack of integration in their homes. The Club had obviously had a delaying effect in the one case in which a mental breakdown occurred during the study, necessitating admission to Tooting Bec Mental Hospital. When I visited the man in Hospital he at once identified me as the lady who had catechized him, and said he longed to be back at the Club.

People in the Club can function on their own level, and are not compelled to compare themselves constantly with people of a younger generation. I must state here that the Club members had at first been reluctant to join because of the effort needed to make new contacts, but they soon perceived that the Club provided what they needed most, the background for a satisfying way of life in which they could find self-expression: That this Club fulfils a real need was exemplified by the conduct of many members, but one case seems to me particularly relevant :

A lady, aged 85, severely handicapped in walking by an inoperable hernia, which was very noticeable, and further enfeebled by heart trouble, made her way to the Club regularly every day, in rain, hail or snow, and during the flying bomb attacks, which were particularly fierce in this neighbourhood. She had a tram ride of at least 15 minutes to reach the Club. To see her smiling face in the Club one need never have known that when at home she suffers acutely from the fact that she is unwanted in her son's family, and not allowed to venture forth from her room into the family circle.

Even more striking was the fact that the Club could transform—if only while in its precincts—the outlook of its members towards their material problems, making them seem less acute. This is best illustrated by the case of—

Mr. H—, who was infirm because of gastric and bronchial disease and double hernia. When interviewed in the Club, he declared himself satisfied with life. His cheerfulness and popularity in the Club would have rendered any other conclusion unlikely. When he was subsequently seen in his own house he talked of little else but his difficulty in making ends meet, and the strain imposed upon him by his complaint.

The attitudes expressed by the Club members, like those expressed by people in the other samples, threw many an interesting light on the social problems of ageing as seen by the ageing people themselves. Of particular significance seemed to me their reaction to present employment and retirement policies which are based on chronological age alone. Their attitude can partly be summarized by the vivid statement made by George Lawton* that amongst the peoples of the world the treatment of the aged varies. In some countries the aged are actually killed when they show signs of incompetence; in other parts of the world indifference is shown towards them and their problems, and some peoples provide them with a degree of social care. The attitudes reflected by these types of behaviour towards the aged co-exist in our society. When men and women reach a given age they are executed vocationally and socially, not because they are incompetent, but because it is assumed that senility starts punctually when they reach their 65th birthday. When they are figuratively speaking "dead," society's attitude changes from indifference to solicitude about their welfare.

I will now refer to only one other of the attitudes expressed by the people in the Streatham sample, that towards housing and life with children and relatives, because these social aspects are inseparably linked with social integration. 68 per cent. of the men and 76 per cent. of the women did not wish to live with their children or relatives, and preferred to live either alone or in a Hostel. In the statements of almost all of these people there was an undertone of inadequacy in relation to their children. The old people recognized the importance of being young, and "they seemed to have grown accustomed to contrasting old with 'young' instead of with 'new'." But one could not escape the impression that what the people felt about living with their children was coloured by their Club membership, which had given them a new independence, and changed their views regarding their own isola-

* Lawton, George, "Psychological Guidance for Older Persons." Cowdry, *Problems of Ageing*, 1942.

tion. It is likely that the wish to live in a Hostel, apart from being the result of unsatisfactory housing conditions, was also a reflection of the happy relationships which they experienced in the Club with people of their own age.

The keynote in this sample, as well as in the ones subsequently studied, was the need for personal freedom and independence. Some thought that life in a Hostel might encroach upon this freedom and preferred living by themselves. This was forcibly expressed by—

Mr. E—, aged 69, an ex-prison warden. In Hostels, he said, there is always a certain amount of regimentation. I have been bossing people all my life and would not like to be bossed myself now.

I will now briefly consider the group of elderly studied in Fulham. In many respects the conditions under which they were living closely resembled the pre-hospital existence of the Tooting Bec patients. I asked myself often what it was that made life worth living for these people who lived entirely alone in surroundings which were anything but inspiring. Inspiring, indeed, seems an irrelevant term when one thinks of the hovel in which Mr. M— insisted on staying.

He described his profession as "fiddling"; this means he had a succession of jobs of dubious legality. He looked a perfect tramp without the healthy appearance which often goes with the life of a vagrant. He was dirty and unkempt, and lived in a room which contained nothing but a bedstead covered by filthy rags. I visited him in the winter when his attempts to light a fire had miserably failed. He remained adamant when the Institution was described to him as an ideal alternative. He said: "I want to be free to do as I like. I will not go to the 'House'."

In this case, as in every other one which I visited, the old people were holding on to their freedom as something very precious which compensates for many privations. But in almost all cases I discovered that they had one vital link with the outside world in the form of a much loved child, a relative or a devoted friend. Here again the paramount importance of social integration becomes evident. One case stands out in my mind in which the need for independence is demonstrated by a continuation of the life's work, and which offers a perfect illustration of social integration which transcends the local community and includes a wider social group:

An Irishman, aged 74, a widower living alone in his tailor shop, finds that his business is deteriorating progressively. He applies for the Old Age pension, which he is refused whilst living on these premises. He is advised to go to live in one room, which he flatly declines. Determined to remain a functioning personality in the community he struggles on, obviously unaware that his clothes are neglected and his shoes in shreds. He is much more interested in the welfare of his home country Ireland, and takes an active interest in all its concerns. He has taught himself to compose, and dedicates his songs to Ireland and to a daughter of his who lives abroad.

I found also that in cases in which gross mental deterioration was noticeable, personal contacts were conspicuously lacking. Of all the four groups which I studied, there was least pre-selection in the Fulham sample. Names and

addresses were obtained from sanitary inspectors, house agents, rehousing centres and priests. I also made contact with old men who congregated in the local market and recreation grounds, as it was difficult to find the requisite number of men living alone.

The Mill Hill sample, by comparison, was much more selected, as admission to the Estate was subject to the possession of a minimum income, to certain requirements of health and past connection with the drapery trade. The ratio of women to men on the Estate was two to one, and the majority of the people interviewed there were women. From the point of view of housing conditions, care and nursing in times of sickness, the Mill Hill Estate is nearer to the more ideal background for normal ageing than any of the others which I have discussed. The adjustment, however, which the people on the Estate make to inevitable concomitants of ageing and the happiness they experience under comparatively sheltered conditions is a function of their personality. Quite a number of the people complained that they were being looked down upon by the neighbouring community of Mill Hill because they lived on the Estate; but whenever this statement was made it was found to be related to a lifelong sense of personal inadequacy. There was also evidence of some financial insecurity, but not in the limited meaning of the concept as defined in the Tooting Bec study. Compared to the Mill Hill sample the Tooting Bec patients had led a hand-to-mouth existence, and the old age pension gave them a measure of security. The Mill Hill population, however, had maintained a high standard of living throughout their lives, and very few of them had anticipated life on the Estate, which to most of them represents a charitable institution, despite their own violent efforts to refute this. One lady made it quite clear to me that her only reason for allowing me to interview her was to "disabuse me of the notion that the Estate is a charitable institution."

What was striking in the Mill Hill sample was that their conscious feeling of social integration did not arise out of their propinquity with the other people on the Estate, but through contacts maintained with relatives and friends outside and their activities for the benefit of the larger community.

In summing up I would say that the Tooting Bec sample was too small to justify definite conclusions, particularly as no control group was available. The study did show, however, that in many instances patients might have remained in the ordinary community had social conditions been more favourable. It was encouraging to note that some patients who had broken down socially did improve in Hospital, and became capable of living again in the community. But efforts have to be made to rehabilitate them, socially and emotionally, and the milieu into which they return has to be favourable to their re-integration. Further research needs to be done in this field in order to find out how this rehabilitation can best be achieved.

It further emerged that although infirmities, disease, idleness, under-nourishment and poverty had all contributed to the patients' failure, the lack of social integration was most powerfully averse to mental health. One might say that social integration is the "*leitmotiv*" which significantly recurs in each of the four studies. Although one must recognize that deteriorating mental health made people especially prone to the above privations, and that

the personality of an individual determines the extent to which worthwhile contacts can be maintained, the Club experience showed that personal relationships can be fostered. There are obviously definite limits beyond which Club life cannot succeed in preventive or remedial efforts.

The study showed further that the separation of ages, both physically and emotionally, has gone far, and a closer association of age and youth in larger households might be a move in the right direction. Perhaps this will seem to you as futile as making an attempt to "put the clock back." I can visualize, however, a non-residential advisory centre for the ageing and aged, staffed by doctors, psychologists and social workers, familiar with the problems of this period of life, very much on the lines of a child guidance clinic. One of the functions of the centre could be to interpret the particular needs of the old to the young and vice versa. The success of such centres will be bound up, however, with the wider measures the community takes to cater for the special needs of the elderly, such as provision for adequate housing, care in sickness and infirmity, and facilities for contributing their services to some socially useful end. As long as people live, some kind of accomplishment is open to them, or as Lawton put it: "Our life is not a book, with old age the last chapter; rather a series of books, a sequence of short stories—each with its own adventures, its own consummations."

GENERAL DISCUSSION.

The PRESIDENT (Lt.-Col. A. A. W. Petrie) said that four very interesting papers had been read, though only just at the end was the matter of treatment touched upon, a matter on which some of them would like to hear more. Actually, of course, treatment rested somewhat with the individual concerned. One had heard of notable people who lived hard and died hard too, and who had declared that they would sooner live a brief but full life than the careful life with the prospect of a pleasant and happy old age. A careful and ordered life without stress was obviously one of the ways of living to an extremely old age.

The point that Dr. Richter had made was a very good one indeed, namely, that the physical life was not worth preserving if the mental life was virtually finished. Dr. Lewis had raised a number of questions about which one would have liked to have asked him at the time. It must be fully appreciated that there were a number of factors not quite comparable. What were the criteria for admission? He would have thought that the criteria for admission might vary in different classes of society. Probably the more prosperous sections of the community tended to keep their aged people with them in the home, possibly because they were supporting themselves. That was brought home in the paper which dealt with the social aspects. Generally speaking, the people who got into the poorer type of institution did so for some specific reason, such as faulty habits, or because their failing memory had become dangerous, causing them, for instance, to leave taps on about the house. In a considerable number of cases there were short episodes of confusion, which frequently cleared away, and their dementia was then found to be not of anything like the extent which had been assumed when these patients were admitted. Possibly it was some arterio-sclerotic episode which cleared up, leaving them mildly deteriorated.

The American figures were so much higher than our own that he was led to ask whether there was an equivalent of Tooting Bec in New York or Massachusetts. He had visited these areas, and had not come across such an institution; nevertheless, it might exist. The specialized accommodation in London had been recognized as of great value. Indeed, in the Joint Memorandum some specialized place for old people had been recommended. Mental statistics generally, not only those relating to Tooting Bec, were rather modified by the fact that there

were a very large number of people in public assistance institutions in London—the only area with which he was really familiar—for whom there was no room in special institutions. The London County Council, before the war, was intending to establish another institution because of the demand for this class of accommodation, a demand exceeding the supply. In London observation wards one was asked not to recommend to Tooting Bec because it was so full that they could not be taken in within less than six weeks or so. Thus a considerable surplus of people suitable for that hospital were retained in the wards of public assistance institutions. This to some extent invalidated the statistics, and if these factors were taken into account they would probably bring the London statistics much more into co-ordination with the American figures.

With regard to the social aspects, the various ways in which old people deteriorated had been brought out in the paper. To judge age from the appearance of the person was often quite misleading. He recalled a laundryman who had given his age as 57, but stated when he departed that he was really 85; he was a wonderfully preserved old gentleman, and had been able to get away with such an obvious inexactitude. The Darby and Joan Clubs and the "Granfer" Clubs had been very successful; there was one of these in Sutton. The old people were made to feel that they were not a burden to others, but could move at their own pace. Whether these clubs were residential or not, they did help to solve some of these social problems.

He did not know whether there was any relation between the irritability so common in arterio-sclerotic dementia and the irritability found in the domineering people referred to in the paper by Miss Goldschmidt. An open question was as to the age at which senescence could be said to begin. Degeneration in the eyes, beginning with Descemet's membrane, started in the early twenties, yet people in the early twenties—except for some outstanding examples shown in the war—were not yet necessarily at the highest point for running the world.

Prof. D. K. HENDERSON said that all the papers had points of great distinction about them which had been well worth emphasizing at a meeting such as that. He did not want to go through them *seriatim*. Dr. Aubrey Lewis had given a very interesting historical summary, and had produced figures which he thought amply showed the very great social significance of this problem of the aged. All of them associated with mental hospital work were feeling this burden, not only from the medical but from the nursing point of view, very seriously. In the limited field of some work carried out at Edinburgh in 1944 a review of many senile patients had been made, and bore out very strikingly what Dr. Lewis had said, that the admission-rate had increased within the last ten-year period. It had, in fact, practically doubled itself so far as the aged members of the population were concerned. That fact alone, taken in conjunction with the ageing of the population generally, constituted a very important social problem which should be investigated a little more fully.

Taking the groups, he had always been very much interested in the Alzheimer-Pick group of cases. That group, in his experience of the last few years, had increased tremendously in the mental hospital population. He had no explanation to offer for it, but in consultation work to-day as well as in mental hospital work he noted a very large rise in this so-called presenile or, as it was generically named, Alzheimer-Pick group of disturbances. Whether this was a toxic condition or due to some other cause was very difficult to understand, but he thought it was a matter for very much more intensive investigation by mental hospital workers than had been given to it in the past.

The other point in which he was interested—and which he was sorry had not been mentioned—was in connection with the hereditary aspects. This was a very striking factor. They saw family group after family group who, for one reason or another, irrespective of occupation or anything else, seemed to show striking early degenerative changes, about which a great deal more should be known. While these investigations were proceeding at Tooting Bec, with a population which was so accessible, it might be well to make some studies of the hereditary constitution of the people who were tending to come into these institutions. For all he knew, such studies might be in progress, but he just wanted to emphasize the need for them.

Dr. F. A. PICKWORTH congratulated Dr. Richter on the careful work he had done, and said how easily these results were to be correlated with the changes of

the blood vessels, on the scheme he had put forward at the last meeting. Vitamin C was now known to be concerned with the cement substance of the capillaries which concerned their permeability.

Dr. D. R. McCALMAN asked whether any recognition had been given to the fact that out-patient departments up and down the country, and especially in America, must be beginning to play a part in this question of senility; though he was not quite sure whether these out-patient departments tended to encourage admissions, or had the effect of enabling these people by social and psychiatric care to remain longer in the community than would otherwise be possible. He did not know whether Dr. Lewis could comment on the probable influence of these clinics now and in the future.

Dr. LEWIS replied that no doubt these out-patient activities had an increasingly important effect. In some cases perhaps the patients tended to gravitate to unsuitable places. On the other hand, he did not think it could be doubted that out-patient activities, particularly if they were specially organized, would have the effect of delaying onset of conditions which called for admission. In answer to the President's question, in New York they had no "Tooting Bec," and he did not think they had in Massachusetts. The Commissioners in New York had expressed the strongest wish that something of the kind might be provided, though the need there was not as great as here because in New York State there was an admirable system of family care. But even if they had a Tooting Bec in New York State, it would not bring the figures of hospital admissions to the same proportions as their own. If all the admissions to Tooting Bec were added to the total admissions, it would only bring the mental hospital population up to 91 per 100,000.

Dr. GORDON MASEFIELD said that in New York and Massachusetts all elderly cases were admitted without legal formality, whether or not they came under the type of certification that was necessary in this country, and which still carried with it a certain stigma. If they could be admitted without the legal formality he could understand the increasing number. He very much liked the phrase "moderate senility," which was an admirable one. He desired to ask with regard to Tooting Bec why arteriosclerosis was eliminated, and how, if it was eliminated, cerebral arteriosclerosis was dealt with.

Dr. RICHTER replied that arteriosclerosis was not eliminated; it was one of the factors which could not be eliminated.

The PRESIDENT, in reply to a question, said that his impression was that most of the people at Tooting Bec were admitted under Sect. 25 of the Mental Treatment Act. The general idea with regard to Tooting Bec was, as far as possible, not to use the Lunacy Act.

Dr. LEWIS said that under a special instrument they were allowed to admit under Sect. 25—also under Sect. 24, but the bulk of the admissions were under Sect. 25.

Dr. E. C. DAX asked whether certification was a deterrent to treatment in senility as in psychoses generally. Out of 400 cases over the age of 65 admitted between 1939 and 1945, one-sixth died within a month of admission, one-quarter within three months, one-third within six months, and one-half within a year. Of this number 60 per cent. were certified, as against 30 per cent., taking the figure for all admissions. With regard to administration of the seniles, one pictured a large senile observation ward attached to mental hospitals, where cases could be sorted out before being placed in homes to which they could go more naturally.

Dr. ARTHUR POOL viewed with some concern the recommendation of the Joint Committee of the B.M.A. and the R.M.P.A. that these senile cases should be segregated. He realized that there might be something to be said in its favour, but he would like to learn from some medical officer of Tooting Bec what it was like to be a medical officer in an institution which dealt solely with senile cases. His impression was that it was not very attractive. After all, they had to consider the medical personnel as well as the patients. He personally felt there was a great deal to be said for having a representation in their hospitals of all sections of the community rather than the segregation of an aged community.

Dr. W. J. T. KIMBER said that he hoped they would not lose sight of the fact that there were many sections of the general public who were considering the welfare of these old folk. There were many old folk's committees up and down the country with very definite views regarding the care of old folk—views which would not generally favour the establishment of a large special institution such as the Bec.

but rather the prevention of these people from going into an institution at all. He wished to emphasize the point that they should concentrate on the care of those people who were showing any symptoms of breakdown. Psychiatric social workers were probably doing valuable work, not only in looking after the old people when discharged, but in seeking at the out-patient clinics, possibly in conjunction with the Welfare Committees, to prevent the admission of these old people. He thought they should be committed far more to the avoidance of further institutionalism. It might be very satisfactory to committees to have plenty of bricks and mortar and to administer their institutions, which they did very satisfactorily, and say, "Yes, this is a magnificent show. Look at the people who want to come into it." Of course the people would rather go to Tooting Bec than be certified, but much more would they appreciate it if they could be dealt with without being institutionalized at all. He begged those present to give attention to the preventive aspect of the problem.

Dr. IVISON RUSSELL remarked that it seemed unlikely that they would be able to prevent themselves from growing old, and he thought the question they really ought to ask, when considering the most suitable way of treating old people, was as to what sort of institution they themselves would want to go into. His own choice would be for a small place, not a large one. From what he had heard that day the only thing he could see very much in favour of a large institution was that it was administratively convenient, and that it collected together a wealth of clinical material under one roof, which was of great advantage to research workers. Yet the same research could be carried out by hiring a fleet of motor-cars in which research workers went out into the country and saw these people in small houses.

The PRESIDENT said that the institution which the L.C.C. was proposing to put up before the war was to be one of 600 beds.

Dr. M. B. BRODY did not think that Mrs. Eysenck had sufficiently emphasized the fact that in the studies which had been carried out the intelligence had been conceived always in terms of the young person. That explained in a large measure why the old person was showing up so badly. They would have to come to some agreement on what they meant by intelligence before such a test was taken. The mental aptitudes of the young and of the old were very different. The test of intelligence which was designed for young people should not be used for old. Indeed he thought they might very well get away from talking in terms of intelligence and concentrate more on emotional and conative factors. One of the most serious things in senility was what had been called "emotional apathy." The latest work, by the way, showed very little correlation between cerebral change and observed dementia.

The PRESIDENT said that the effect of malnutrition had been stressed by one of the openers. He would have thought this was a factor likely to affect the younger groups rather than the older.

In brief replies,

Dr. RICHTER said that "cerebral arterio-sclerosis" was not a precise term. All manner of vascular changes were included under it.

Mrs. EYSENCK said with regard to intelligence tests for young adults and old, in the present state of knowledge they could only take such intelligence tests as were available, without differentiation on the ground of age. "Otherwise where were they?"

Miss GOLDSCHMIDT said that some cases of the confusional type cleared up symptomatically fairly soon after admission to an institution, so that their stay there became no longer necessary. These people could lead more useful and less restricted lives in a smaller institution.

Dr. AUBREY LEWIS said that he was not aware of any valid evidence on the point of malnutrition as affecting the aged. He agreed with what Dr. Kimber had said as to the value of preventive measures—or, rather, not preventive in the absolute sense, but measures which would prolong the process as much as possible. By all means there should be concentration on these.

The Vote of Thanks to the openers, proposed from the Chair, concluded the proceedings for the day.

Part II.—Reviews.

Aids to Psychiatry. By W. S. DAWSON, M.A., M.D., F.R.C.P. Fifth edition. London : Baillière, Tindall & Cox, 1944. Pp. viii + 306. Price 6s.

This excellent little "cram" book, now in its fifth edition, has an assured place in the library of the student psychiatrist. In the preface it is stated that the book has undergone an extensive revision, and that many sections have been rewritten.

In the chapter on treatment there should be a section on the modern physical methods, with some reference to technical details. In this edition there are very brief references to these treatments in chapters on specific psychoses. The result is that a reader is liable to gain the impression that such treatments are specific for certain mental disorders. Space could be found for such a section by compressing or eliminating other matter—for instance, the long paragraph on the use of the now unprocurable sulphonal. On case-taking some will think that the method of examination is too suggestive of faculty psychology, and that the scheme advocated by Henderson and Gillespie has many practical advantages. Reference to psychopathy is to be found under moral defect. The older term has much in its favour; it is almost a definition.

S. M. COLEMAN.

The Shaping of Psychiatry by War. By JOHN RAWLINGS REES, M.D. London : Chapman & Hall, Ltd., 1945. Pp. 158. Price 10s. 6d.

The first section reviews the valuable contribution that psychiatry has made to the efficiency of that magnificent fighting machine, the British Army. It has helped to put the right man in the right place, and to keep the wrong person out of the wrong job. The majority will agree with Brigadier Rees that in the society of to-morrow the frontiers of psychiatry should be extended, and that much that has been learnt under stress of war should be incorporated into civilian practice. The more cautious may think that the author's planning goes too far, for, to understand Brigadier Rees' outlook, it should be realized that "Brave New World" is not a satire, and there is internal evidence to suggest that "Erewhon" also should be taken seriously.

As I read the author's conception of the "way ahead" towards the ideal state, every citizen will ultimately have learnt to be "psychiatric conscious." He will have learnt that only by the grace of God and the aid of the state physicians can he remain stable and be guided into the right vocation. The psychiatrists themselves, with their associated workers, would be in the service of the state as a kind of Ogpu or Gestapo. Examinations and tests would make it certain that each citizen is directed into the occupation for which the psychiatric team think he is fitted. This would be from top to bottom, and we are especially advised that aspiring politicians should have the "once over" by the experts. Even in international affairs it is recommended that the mental specialist should put in his oar. Presumably he would sit behind the chair of state, periodically nudging the minister, just to remind him that the destructive urge or self-aggrandisement are either infantile reactions or evidence of serious psychopathy.

Granting the value of modern tests, etc., it has yet to be proved that they are as all-embracing as the experience of Balzac's great city, wasteful and haphazard as it may be. From the purely individual point of view most would prefer to plunge into that experience with illusions, to sink or swim, even if these are ultimately lost.

Owing to the very small amount of psychosis in the British Army, Brigadier Rees considers that this is a matter of low priority as compared with the neuroses, which are abundant. It is not suggested that this is due to the efficiency of those who confine their activities "within four walls." On the contrary these are constantly exhorted to extend their frontiers. However, within those "four walls" conditions have sadly deteriorated and, if the author's priorities are taken seriously, it may be that in World War III psychosis will be a major problem in the Forces.

There is a proverb—but of course anything so traditional as the proverb is anathema to the "planner"—that a shoe-maker should stick to his last.

S. M. COLEMAN.

Conceptions et Traitement des États Neurasthéniques. By J. TINEL.

Paris: Librairie J. B. Baillière et Fils, 1941. Pp. 64. Price not stated.

Dr. Tinel is of the opinion that there should be a place for neurasthenia as a distinct clinical entity. The descriptive section is clearly set out, the fundamental or primary symptoms, asthenia, depression, hyperemotivity and obsessive rumination, being studied first. The secondary symptoms cover practically the whole field of the psychoneuroses and perhaps beyond. There are chapters on diagnosis and on treatment which call for no special comment.

The section on psychopathology is interesting. The writer, though apparently unaware of the Ross controversy in this country, comes down heavily on the side of his adversaries, and this despite the fact that he himself is a disciple of Déjerine. Clinical experience has forced him to regard neurasthenia as a minor psychosis, only quantitatively different from the melancholic episode. For Tinel neurasthenia is a reaction to an emotional shock or to prolonged emotional strain in a predisposed person. The recovered neurasthenic is now conditioned to react in the same way to minimal emotional experiences. Later these recurrent attacks may take place spontaneously, be more severe and so approximate to melancholia. More speculatively, it is suggested that the acquired characteristic, recurrent neurasthenia, will provide an hereditary predisposition to melancholia in the next generation. It would seem that a large proportion of Tinel's neurasthenics would be described as cases of reactive depression in this country.

S. M. COLEMAN.

Rebel Without a Cause: The Hypno-analysis of a Criminal Psychopath.

By ROBERT M. LINDNER, Ph.D. London: Wm. Heinemann, Ltd., 1945. Pp. xii + 260. Price 21s.

This case-report of a criminal psychopath treated by hypno-analysis will well repay careful study. The bulk of the book is devoted to a verbatim report of the 46 analytical sessions. It is an exceptionally complete record of an analytical procedure, provides an exceptional opportunity of gaining insight into the mind of the psychopath, and should, therefore, be of interest to many besides those engaged in the study of the criminal's mentality. An introductory essay on the whole problem of psychopathy includes a striking picture of the salient features of this clinical entity. Psychopathy is ultimately defined as "a disorder of behaviour which effects the relationship of the individual to the social setting." It would seem that a number of other conditions besides psychopathy come within the purview of this definition, and that the author has been no more successful than others before him in setting the limits of psychopathy.

Turning to the psychopathology, it is concluded that there is a constitutional basis, but that a series of psychic trauma, starting in infancy, are also necessary in order to establish the antisocial pattern of behaviour. The author finds that the psychopath is always fixated at a pregenital level. However, it is

stated that the specific features of psychopathic behaviour derive from a profound hatred of the father, which hatred is later transferred to the state.

Dr. Lindner states that psychopathy is a serious menace to the state, especially at the present time. Further, he suggests that his case "makes a mockery of current penological pretence. It points the finger of ridicule at the sterile corridors of modern prisons, the gleaming shops and factories, the bright young social workers, the custodial hierarchy—in brief, the whole hollow structure of rehabilitation that is based upon expediency, untested hypothesis, unwarranted conclusions from a pseudo-scientific empiricism." Hypno-analysis, we are told, is the answer to this serious problem, for the author has treated six patients with success. Each treatment takes four months approximately, but it is not made clear how many years were taken over these treatments, nor is there any mention of failures or selection of cases. An objection to hypno-analysis, as an alternative to the present penal system, is that rather a large number of trained analysts might be required! S. M. COLEMAN.

L'Alcoolisme Aigu et Chronique. By L. DEROBERT and H. DUCHENE. Paris: Librairie J. B. Baillière et Fils, 1942. Pp. 216.

Dr. Heuyer, in the preface, makes it clear that the cause for the collapse of France in 1940 was an outside agent—alcohol, and, more particularly, the vested interest of 3½ million persons, who gain their living in the wine industry. From 1939 to 1940 Dr. Heuyer and some of his colleagues called the authorities' attention to the fact that an inebriate army was being sent to the front. This warning was unheeded. Following the collapse there were restrictions and tariffs on the sale of alcohol. Now in 1942, again on account of vested interest, these measures were being relaxed. Dr. Heuyer, therefore, invited and encouraged two of his colleagues to marshal the facts.

The book is frank propaganda. A statistical section provides evidence to show the relation of alcoholism to crime, insanity, accidents, etc. A physio-pathological section describes the physical and the mental effects of alcohol on the individual and on his descendants. A third section is concerned with legislation in regard to alcohol in France and other countries. A final section deals with the methods by which the use and abuse of alcohol can be further restricted and subjected to control.

Even the figures given here, and there are many questions to be asked about them, support the view that the abuse of alcohol is less common among the French than in certain other great nations. Wine production is a basic industry in France, and all those who believe in her revival will pin their faith in the resilience of Papa Grandet and his kind rather than in the polemics of Dr. Heuyer and his colleagues. S. M. COLEMAN.

Controlled Projection: A Standard Experimental Procedure. By JOHN C. RAVEN, M.Sc. London: H. K. Lewis, 1944. Pp. 38, fully illustrated. Price 12s. 6d.

In the foreword, Raven writes, "The organization of any idea or system of thought is determined by the person who forms it. . . . To understand the development of mental organization and the determinants of character, we need to know how people organize their ideas of themselves and the world they live in. . . ." He describes an experimental method for tackling this problem. Adult subjects are shown a drawing of a person, of the same age and sex as themselves, "sitting at a table thinking and scribbling on a bit of paper." They are asked to draw whatever they wish and simultaneously to answer questions about the person in the picture—what he might be interested in, what sort of people he likes, what is likeable and dislikeable about him, etc. Children are asked to draw whatever they wish, and simultaneously to fill in deliberately left gaps in a standard story. The drawings and verbatim records

provide material of two kinds suitable for "genetic and comparative studies." A technique for group presentation is also described. Many records are given in full. The problem is real and important, and Raven's method promises to be richly productive. Time will tell if this promise will be fulfilled.

Raven also makes some interesting general observations on the nature of projection, and on the factors which modify the drawings and replies to questions.

The beauty of the reproductions cannot be passed without mention.

M. B. BRODY.

The Nature and Treatment of Mental Disorders. By DOM T. V. MOORE, Ph.D., M.D. London: Heinemann, Medical Books, Ltd., 1943. Pp. 312. Price 21s.

Dom T. V. Moore is professor of psychology and psychiatry in the Catholic University of America.

His book deals with the subject of mental disorders from a psychological and psychopathological point of view. The author gives a very readable account of the various theories of psychopathology, and his work is mostly based on psychoanalytical principles, although he is not afraid to descend to "trivialities which may be, on occasion, suggestive and helpful." Here we have real wisdom in treatment showing itself, and the author's long experience with human beings in distress stands him in good stead. There is a very good but too brief account of the physiology of the emotions, and then the author shows his breadth of mind by a chapter on pharmacological treatment, in which he tries to apply physiological principles to the treatment of mental disorder.

G. W. T. H. FLEMING.

Child Guidance. By W. M. BURBURY, M.A., M.B., E. M. BALINT, B.Sc., and B. J. YAPP, M.A. London: Macmillan & Co., 1945. Pp. 200. Price 7s. 6d.

This small book from the Manchester Child Guidance Clinic is a good example of team-work from a busy clinic. The book is divided into the establishing of the clinic, general causes of maladjustment, methods of examination and treatment.

The subject-matter of the book is dealt with in language that any educated layman can understand, and there is a naïve simplification about what is in many ways a difficult and technical subject.

It would have been very helpful if a further course of reading on the subject of child guidance was indicated for the guidance of the reader.

G. W. T. H. FLEMING.

The Diagnosis of Nervous Diseases. By Sir JAMES PURVES-STEWART. Ninth edition. London: Edward Arnold & Co., 1945. Pp. 880, with 358 illustrations. Price 40s.

The ninth edition of this very well-known and popular text-book is a great contrast to the first edition in 1906. It has more than twice as many pages, with much more text on each page and nearly twice as many illustrations.

A great many of the original illustrations remain, but we think that a more up-to-date illustration of a lumbar puncture might have been given. Present-day technique is most certainly different from that illustrated in Fig. 304.

Those of us who are interested in prefrontal leucotomy, which was, of course, devised by Egas Moniz, will be interested to see his name mentioned in connection with radio-arteriography and to see Figs. 325-330.

The author suffered severely from the exigencies of war—the new references and illustrations that he had planned to include are unfortunately at the bottom of the Atlantic, together with the complete manuscript, so that the

whole book had to be re-written. Having regard to this we would have expected to see Argyll-Robertson spelt without a hyphen!

These are, however, small drawbacks in a book which we have all come to regard with the greatest affection and admiration, and it is a great tribute to British neurology that a new edition should have appeared under the stress of wartime conditions and limitations.

We hope this is *not* the author's swan-song, but that we may see the tenth edition at an early date, produced under normal conditions.

G. W. T. H. FLEMING.

Diseases of the Nervous System. By F. M. R. WALSHE, O.B.E., M.D., D.Sc., F.R.C.P. Fourth edition. Edinburgh: E. & S. Livingstone, Ltd., 1945. Pp. xvi + 360. Price 15s.

The fourth edition of this well-known text-book once again fills us with envy of the author's exceptional ability to paint a vivid picture with the utmost economy. And yet a certain leisurely graciousness of style removes all traces of the "cram-book," and puts this work among the few volumes of instruction that can be read from cover to cover with no flagging of interest. The first 60 pages provide a clear and informative description and explanation of the general principles and practical factors in neurological diagnosis, the next 250 pages describe the more common neurological disorders, and there follow a short chapter on the psychoneuroses and a very useful scheme of examination of the nervous system.

Neurologists have been accused of unduly subordinating treatment to diagnosis, and it is a pleasure to find the therapeutic aspect far from neglected. Both in the general text and in an excellent *ad hoc* chapter advice as to treatment is practical, pertinent, and where necessary detailed, and there is a good sprinkling of useful prescriptions. Welcome emphasis is laid on the necessity of studying the patient's comfort and happiness, as well as the disease process, and of allowing as normal a life as is practical in such chronic affections as disseminated sclerosis, epilepsy, cerebral vascular degeneration, etc. "It may be much more important for a young housewife threatened with disability . . . by such a malady as disseminated sclerosis to use her resources in the obtaining of additional domestic help . . . than to expend them on some form of physiotherapy or expensive medication from which no candid adviser can promise her anything" (p. 314) is characteristic of the author's sage attitude. Nevertheless there is no lack of controversial matter. Dipping into the chapter on epilepsy alone, not everyone will agree that "it is an exaggeration to say that there is a characteristic epileptic temperament which can be identified as such even when no fits are observed" (p. 120); and many harassed physicians would wish that the epileptic fit could always be differentiated from hysterical simulations as easily as the writer suggests (p. 125). A more serious matter for debate is the author's admittedly conservative attitude towards new methods of treatment and diagnosis. Even granting his assertion that "the path of our advance is strewn with their abandoned debris," it is arguable that a douche of cold water from so eminent an authority will do more harm than good, and may well encourage many overworked and, dare we say, lazy-minded physicians to condemn untried new remedies of real value.

The chapter on the psychoneuroses, naturally of special interest to psychiatrists, reflects the difference in symptomatic colouring between the neurotic seen by the neurologist and the psychiatrist. The subject is clearly approached from the angle of neurological practice, and thus we find a section entitled "the 'traumatic' neurosis" occupying six to seven times as much space as that given to obsessional states. As long as the author remains on descriptive ground his pictures of the neurotic are as wholly satisfying as those in the rest of the book. When he enters the speculative field, as in his differen-

tiation of anxiety neurosis from hysteria by terming the former a reaction by over-action and the latter a reaction by under-action (p. 322), he invites criticism. Suffice it to say here that this hypothesis affords a splendid example of that "verbal simplification," in which, the author assures us elsewhere in the book, "nature is not interested." Our heart, however, warms towards him for his welcome and timely advice as to the dangers of "exhaustive and expensive search for hypothetical foci of chronic infection in the subjects of the anxiety neurosis" (p. 325). How often have we found both anxiety and hysterical symptoms fixed in the patient's mind, because some distinguished physician stressed the possibilities of an organic origin. There are, alas, many general physicians and even a few psychiatrists who might well take this warning to heart.

The printing, illustrations and general arrangement of the book are admirable, but it is aggravating to find that a large proportion of the textual references to the figures are incorrect. These errors (which no doubt will be remedied in the next printing) are to some extent offset by the excellent system of cross-references, which saves the reader a host of trouble.

L. C. COOK.

Part III.—Bibliography and Epitome.*

AN attempt is being made to provide as far as possible a complete bibliography compiled from the specialist journals dealing only with Psychiatry and Neurology (which are really inseparable) and their ancillary subjects, psychology, anatomy of the nervous system, criminology, etc.

A number of titles may appear to have a very remote relation to psychiatry, but they are included for the sake of completeness.

If any reader can add the names of journals to the following list, which it is hoped to publish each year in the January number, the addition will be gratefully received and acknowledged.

Those journals which are available in the Library of the Royal Medico-Psychological Association are marked "1," those available in the Library of the Royal Society of Medicine are marked "2," those in the Library of the British Psychological Society are marked "3," and those in the Library of the British Medical Association are marked "4."

The titles of these journals are mostly in the form given by the Board of Editors of Publications of the American Psychological Association, January, 1939. Contributors are requested to use the exact form given below.

PSYCHIATRIC JOURNALS.

- 2 *Abh. Neur. Psychiat.*
- Abh. Psychother.*
- 2 *Acta Española Neur. y Psiquiat.*
- 3, 4 *Acta Psychiat. et Neurol.*
- 3 *Acta Psychol., Hague.*
- Acta Psychol., Keijo.*
- Aliéniste Français.*
- 2 *Allg. Ztschr. f. Psychiat.*
- Altersprobleme.*
- Am. Imago.*
- 2 *Am. J. ment. Def.*
- 2, 3 *Am. J. Orthopsychiat.*
- 1, 2, 3, 4 *Am. J. Psychiat.*
- 2, 3 *Am. J. Psychol.*
- An. Bras. Hig. Ment.*
- An. Istit. Psicol. Univ. B. Aires.*
- An. Psicotec., Rosario.*
- Anal. Inst. Neurol. Montevideo.*
- Analele Psihol. (Rumania).*
- Anales de psicol, Buenos A.*
- 2, 3 *Année Psychol.*
- 2, 3 *Ann. Méd. Psychol.*
- 2 *Ann. Osp. psichiatri., Perugia.*
- Appl. Psychol. Monogr.*
- Arb. Psychiat. Inst., Sendai.*
- Arch. Anthropol. crim.*
- 2 *Arch. Argent. de Neurol.*
- Arch. Argent. Psicol. norm. pat.*
- 2 *Arch. Bras. de Neur. e Psiquiat.*
- Arch. Brasil Hig. Ment.*
- Arch. Chilenos de Crim.*
- Arch. Ital. di Studi Neuropsich.*

* A number of abstracts in this section are reproduced from *Chemical Abstracts* and *Psychological Abstracts*. To the Editors of these two Journals we extend our grateful thanks.

- 1, 2 *Arch. Neurobiol.*
 4 *Arch. Neurol., Paris.*
 2 *Arch. de Neurol. de Bucarest.*
 1 *Arch. de Neurol.*
 2 *Arch. di Antropol. Crim.*
Arch. di Crim. Neuropsiquiat. y Disc. Con., Quito.
 2, 4 *Arch. f. Psychiat.*
 2, 3 *Arch. ges. Psychol.*
Arch. Internat. de Neurol.
Arch. Ital. Psicol.
Arch. Krim. Anthropol.
 1, 2, 3, 4 *Arch. Neurol. Psychiat.*
Arch. Neur. Psychiat., Mex.
 2, 3 *Arch. Psicol. Neurol. Psychiat. e Psicoter.*
 2, 3 *Arch. Psychol. Genève.*
 2, 3 *Arch. Psychol., N.Y.*
Arch. Relig. psychol.
Arch. Speech.
Arq. da Assist. a Psicop. de Pernambuco.
Arq. de Neuro-psiquiat., Brasil.
 3 *Austr. J. Psychol. Phil.*
- Beih. Z. angew. Psychol.*
Beih. Zbl. Psychother.
Bol. Inst. Psiquiat., Rosario.
- 2, 3, 4 *Brain.*
 3 *Brit. J. Educ. Psychol.*
 2, 4 *Brit. J. Inebriety.*
 2, 3, 4 *Brit. J. Med. Psychol.*
 2, 3, 4 *Brit. J. Psychol.*
 2, 3, 4 *Brit. J. Psychol. Monogr. Suppl.*
Bull. Canad. Psychol. Ass.
 2, 4 *Bull. de la Soc. de Psychiat. de Bucarest.*
 2 *Bull. de la Soc. Roumaine Neur. Psychiat. Psychol. Endocrin.*
Bull. du Group. Franç. d'étud. de neuro-psychopath. infant.
 2 *Bull. Los Angeles Neur. Soc.*
 2 *Bull. Menninger Clin.*
Bull. Soc. Psihol. med., Sibiu.
- 4 *Canad. Journ. Occup. Ther.*
 2, 3 *Cath. Univ. of Amer. Studies in Psychol. and Psychiat.*
 2 *Cervello.*
 2, 3, 4 *Character and Per. (now J. Personality).*
 2 *Child Developm.*
 2 *Child Developm. Abstr.*
Child Developm. Monogr.
Child Study.
Chin. J. Psychol.
 3 *Comp. Psychol. Monogr.*
 2 *Confinia Neurol.*
Contr. del Lab. di Psichol.
Contr. psychol. Theor.
Criança Portuguesa.
- 2 *Deutsche Ztschr. f. Nervenh.*
 2 *Dis. Nerv. Syst.*
- 3 *Educ. psychol. Measmt.*
 1, 2, 3, 4 *L'Encéphale.*
 2 *Epilepsia.*
Evolut. Psychiat.

Fiziol. Th. S.S.S.R.

- 2 *Folia Neuropath. Esthon.*
2 *Folia Psychiat. et Neurol. Jap.*
2 *Fortsch. Neur. Psychiat.*

- 3 *Genet. Psychol. Monogr.*
Giorn. di Psich. e di Neuropat.

- 4 *Hum. Factor.*
2, 3, 4 *Hyg. Ment.*

Illinois Psychiat. J.

- 2 *Index Neurol. y Psiquiat., Buenos Aires.*
3 *Indian J. Psychol.*
Indiv. Psychol. Bull.
3 *Industr. Psychol.*
3 *Industr. Psychotech.*
1, 2, 3, 4 *Int. J. Psychoanal.*
2, 3 *Int. Z. Psychoanal. u. Imago.*
Jap. J. appl. Psychol.
Jap. J. Exp. Psychol.
Jap. J. Psychol.
1, 2, 3 *J. Abnorm. Soc. Psychol.*
J. Am. Soc. Psychic. Res.
3 *J. App. Psychol.*
2, 4 *J. Belge Neur. Psychiat.*
2 *J. Comp. Neur.*
1, 2, 3 *J. Comp. Psychol.*
J. Consult. Psychol.
J. Crim. Law and Criminol.
2 *J. Crim. Psychopathol.*
2 *J. de Psychiat. Infant.*
3 *J. Educ. Psychol.*
J. Except. Child.
3, 4 *J. Exp. Psychol.*
2 *J. f. Psychol. u. Neurol.*
3 *J. Gen. Psychol.*
2, 3 *J. Genet. Psychol.*
J. Juvenile Res.
1, 2, 3, 4 *J. Ment. Sci.*
1, 2, 3 *J. Nerv. Ment. Dis.*
1, 2, 3, 4 *J. Neurol. Neurosurg. Psychiat., London.*
J. Neuropath. and Psychiat., Leningrad.
1, 2 *J. Neuropath. Ex. Path.*
2, 4 *J. Neurophysiol.*
J. Neuropsychiat. du Pacifique.
2 *J. Neurosurg.*
3 *J. Parapsychol.*
J. Personal.
J. of Psychic. Res.
J. Psihoteh.
2 *J. Psycho-Asthen.*
2, 3 *J. Psychol.*
J. Psychol., Moscow.
2, 3 *J. Psychol. Neurol., Leipzig.*
2 *J. Psychol. Norm. Path.*
J. Soc. for Psychic. Res.
3 *J. Soc. Psychol.*
J. Speech Dis.

Kriminal.

- 3 *Kwart. Psychol.*

- Mag. psychol. Szle.*
 2 *Ment. Health.*
Ment. Health Obs.
 2, 4 *Ment. Hyg., Lond.*
 2 *Ment. Hyg., N.Y.*
Ment. Hyg. Rev.
Ment. Hyg. Bull., Indiana.
 3 *Mind.*
M Schr. Krim. Biol.
 2 *M Schr. Psychiat. Neurol.*

Ned. Tijdschr. Psychol.
 2 *Neopischiat.*
 2 *Nervenarzt.*
 3 *Neue psychol. Stud.*
Neurbiol., Pernambuco.
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 2 *Neuropath. i. Psikkiat.*
 2 *Note e Riv. di Psichiati.*
Now. Psychjar.
Nuova Riv. di Clin. ed Assist. Psichiati.

Obshch. Klin. Neuropat.
 2, 3 *Occup. Psychol.*
 2 *Occup. Ther. and Rehabil.*
 2 *Onder. Psychiat-Neur. Klin., Utrecht.*
 2 *Osped. Psichiati.*

 3 *Person. J.*
Pisani.
Polsk. Arch. Psychol.
Prace Psychol.
 2 *Proc. Amer. Assoc. Stud. Ment. Def.*
 2 *Proc. A. Res. Nerv. and Ment. Dis.*
 3 *Proc. Soc. Psych. Res. London.*
 3 *Psichotec.*
Psicoanal., Rome.
Psicoter. Cordoba.
Psyche, Cambs., Mass.
Psychiat. Monogr.
 2 *Psychiat. en Neurol. Bl., Utrecht.*
 2 *Psychiat. et Neurol. Jap.*
 2 *Psychiat. Neurol. Wchnschr.*
 2 *Psychiat.*
 1, 2, 4 *Psychiat. Quart.*
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 1, 2, 3 *Psychoanal. Rev.*
 2, 3 *Psychol. Abstr.*
 2, 3 *Psychol. Bull.*
Psychol. Clin.
Psychol. Exch.
 3 *Psychol. Forsch.*
Psychol. Index.
 2 *Psychol. Monogr.*
Psychol. Rec.
 3, 4 *Psychol. Rev.*
 3 *Psychol. Rev. Monogr.*
Psychol. Stud. Univ. Bp.
Psychol. wychow.
 3 *Psychomet.*
Psychometr. Monogr.
 2 *Psychosom. Med.*
 2 *Psychosom. Med. Monogr.*

- Quart. J. Speech.*
 2 *Quart. J. Stud. Alc.*
Quart. Rev. Psychiat. Neur., Washington.

Rass. Neurol. Veget.
Rass. Studi Psichiat.
Rev. Argent. Neurol. Psiquiat.
Rev. de Psicoanal., Argentina.
Rev. di Neur. e Psichiat., S. Paolo.
Rev. di Psiquiat., Chile.
Rev. di Psiquiat. y Crim.
Rev. Espan. de Oto-neuro-oftam. y Neurocir.
 3 *Rev. Franç. Psychoanal.*
Rev. Ibero-Amer. de Anal. Biblio. de Neurol. y Psiquiat.
Rev. Mex. Neurol. Psiquiat.
 1, 2, 4 *Rev. Neurol.*
 2 *Rev. Neurol. de Buenos-Aires.*
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 2 *Rev. Neuro-psiquiatr., Lima.*
 2 *Rev. Oto-Neur.-Oftal. Cir. Neur. Sud-Am.*
Rev. Neuropsiquiatr.
Rev. Psicol. Pädag.
 3 *Rev. Psihol.*
 2 *Rev. Psiquiat. Crim., B. Aires.*
Rev. Psiquiat., Uruguay.
Rev. Psiquiat. y Disc. Con., Chile.
Rev. Sudam. Psicol. Pedag.
Rev. Tchèque de Neurol. et de Psichiat.
Ric. Psych.
 2, 3, 4 *Riv. di Neurol.*
Riv. di Neuro-psiquiat., Peru.
 3 *Riv. di Psichol.*
Riv. Ital. di Endocrin. e Neurochir.
 2 *Riv. Patol. nerv. ment.*
Riv. Psychol. Norm. Pat.
 2, 4 *Riv. Sper. Freniat.*
 1 *Rocz. Psychjat.*
 2 *Rorschach Res. Exch.*

 1 *Schizofrenie.*
 2 *Schweiz. Arch. Neurol. Psichiat.*
Skand. Arch. Psychol.
Sovet. nervropatol., psichiatri, psichoguogua.
Sovet. Psichoneurol.
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 2 *Tr. Am. Neurol. A.*
Tr. Beritov Inst., Tiflis.
Tr. Kostchenko Ment. Hosp., Moscow.
 2 *Trud. fiziol. Lab. Pavlova.*
Trud. tsentral. psikhoneurol. Inst.

Univ. Calif. Publ. Psychol.
Univ. Iowa Stud. Psychol.
Untersuch. Psychol. Phil.

 3 *Z. angew. Psychol.*
Z. Arb. Psychol.
Z. Berufs. des Pflegepers.
Z. Individ. Psychol.

- 2, 4 *Z. ges. Neurol. Psychiat.*
 3 *Z. Pädag. Psychol.*
Z. Parapsychol.
 2 *Z. Psych. Hyg.*
Z. Psychoanalyse, Tokyo.
 3 *Z. psychoanat. pädag.*
 2, 3 *Z. Psychol.*
Z. Psychother. med. Psychol.
Z. Tierspsychol.
 2 *Zbl. Neurochir.*
 1, 2 *Zbl. ges. Neurol. Psychiat.*
Zbl. Psychotherap.

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Prefrontal Lobotomy. The Problem of Schizophrenia.

1. Prefrontal lobotomy is less successful in schizophrenics than in certain types of patients who have preserved better contact with reality. Nevertheless, the operation offers definite hope for those who are still fighting their disease.

2. While many chronic patients cannot be discharged from hospitals, their care is greatly simplified because of their new objective outlook on life and pleasure in living.

3. Prefrontal lobotomy bleaches the affect attached to the ego, and turns the patient's interest away from himself toward the outside world.

4. Prefrontal lobotomy is the procedure of last resort. This does not mean, however, that it should be delayed until emotional deterioration is well advanced.

(Authors' abstr.)

Prefrontal Lobotomy : Fifteen Patients Before and After Operation.

The 15 cases reported range in age from 16 to 62, and presented a wide variety of symptoms, from apparent psychotic deterioration to a chronic but non-psychotic tension state. These patients were all considered to have a hopeless prognosis, and most of them had been in hospital for many years, one continuously for 18 years. All but 4 had received one or more forms of shock treatment.

The first lobotomy operation of the series was performed April 1, 1942, the last on January 28, 1944; hence the report cannot deal with end-results. However, the first patient is gainfully employed for the first time in his life, but has had a convulsive seizure; 5 of the others are with their families, comfortable and socially acceptable, one of them doing regular housework. One patient is attending a special school. The rest are still in hospital, but one of them has freedom of the grounds, not possible before, and makes day-visits away from the hospital. None of the 15, so far, was made worse, and all showed some degree of improvement. Two aged patients, not included in this series, died of post-operative hypostatic pneumonia.

Each patient's history is presented as a graph representing onset of illness, the time of hospital residence, and the patient's status in the categories of mental comfort, social acceptability, and capacity for work, before and after lobotomy.

The technique of the operation, its dangers, and the anatomical considerations involved are briefly discussed.

It is suggested that anxiety may be an important common factor in a wide variety of syndromes, allayed by lobotomy; and that the operation may intervene to modify the physical basis for a pathogenic degree of "cerebrotonia."

In some cases, edema and/or tenderness and blister formation appeared during the month following lobotomy, and is thought to be a trophic disturbance of central origin.

There has also been transient diuresis with low specific gravity, in connection with prolonged or periodic enuresis. (Authors' abstr.)

Spontaneous Convulsions following Convulsive Shock Therapy.

1. Of over 500 patients who received electric convulsive therapy, 2 exhibited spontaneous generalized convulsions 6½ to 8 weeks after termination of treatment. These 2 patients had never had seizures prior to treatment, nor were there any epileptic manifestations in any of the family members.

2. Pre-treatment EEGs are reported for the first time in patients exhibiting spontaneous convulsions subsequent to therapy. In both instances the brain-wave tracings were abnormal prior to shock.

3. It is concluded that spontaneous convulsions following convulsive therapy are prone to occur only in those patients who have latent convulsive tendencies as revealed by the EEG.

4. The suggestion is made that pre-shock EEGs are particularly indicated in patients who give histories of previous convulsions in childhood or later life, or who have family members exhibiting epileptic manifestations. (Authors' abstr.)

The Conditioned Aversion Treatment in Chronic Alcoholism.

Since the introduction of the aversion treatment 15 months ago at this hospital, 15 per cent. of an unselected group of patients have remained abstinent for a period of 5 to 15 months. An abstinence rate of 55 per cent., however, was obtained in a selected group of patients with a commendable sociological background. A period of at least three months' sobriety was obtained in 52 per cent. of all patients treated. The aversion treatment is regarded not as a therapy in itself, but merely as a valuable method to interrupt the alcoholic cycle for a conjectural period of time, which should be utilized for intensive psychotherapy. (Authors' abstr.)

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Clinical and Electroencephalographic Studies of Changes of Cerebral Function Associated with Variations in the Blood Sugar.

1. The reaction of the EEG to hyperventilation is discussed with relation to blood-sugar levels, to age and to diagnosis. A group of psychoneurotics is described showing an unusual lability of the EEG to hyperventilation in the presence of normal blood-sugar values.

2. The relationship between the presence of nervous complaints in the early morning and the development of delta activity on hyperventilation in the fasting state was studied. Delta activity develops more frequently in subjects having such complaints than in subjects without them.

3. Patients developing delta activity on hyperventilation in the fasting state feel, in a larger percentage, better at later hours than patients without delta activity.

4. Two cases of spontaneous hypoglycemia with electro-encephalographic studies are reported. (Authors' abstr.)

Factors Affecting the Electroencephalogram of Patients with Neurosyphilis.

Fifty per cent. of 233 cases of neurosyphilis had abnormal EEGs. The incidence of abnormality in the various clinical types of neurosyphilis was as follows: Meningo-vascular lues 60 per cent., general paresis 55 per cent., optic nerve atrophy 44 per cent., tabes 14 per cent. In a control group the incidence of abnormality was 10 per cent. Tabes, therefore, did not have a significantly greater incidence of abnormal EEGs than controls; on the other hand, the incidence of abnormality in optic atrophy, general paresis and meningo-vascular lues was significantly greater than in control subjects.

Twenty per cent. of the total cases with neurosyphilis had positive histories of seizures as compared to an incidence less than 1 per cent. in the general population. The meningo-vascular type of neurosyphilis had the highest incidence of seizure histories and a large proportion were of the Jacksonian variety. The next highest incidence of seizures occurred in cases of general paresis, and they were mostly of the *grand mal* and "atypical" variety. No cases with a history of seizures occurred in the groups diagnosed tabes dorsalis or optic nerve atrophy.

A very high incidence of abnormal EEGs (90 per cent.) occurred in the cases with a history of seizures. The more abnormal the EEG in any given case of neurosyphilis, the greater the likelihood that the patient had a history of seizures. The paroxysmal type of EEG abnormality was the most specific for the seizure disorders.

In a group of cases of general paresis a number of clinical and laboratory findings were correlated with the incidence of EEG abnormality with the following results: The incidence of EEG abnormality was highest in patients with a history of seizures. The presence of tremors, dysarthria, abnormal reflexes or an "organic" mental picture also raised the incidence of EEG abnormality, but not as high as did the presence of a history of seizures. A slightly positive correlation was obtained

between numbers of white blood cells, amount of total protein, severity of colloidal gold reaction in the cerebro-spinal fluid and incidence of EEG abnormality. No correlation was obtained between EEG abnormality and abnormal pupils, or between EEG abnormality and presence of delusions or hallucinations as a primary part of the mental picture.

A study of all cases in relation to age revealed that the largest number of cases of neurosyphilis were in the 40-50 year age-group. The incidence of epilepsy and of abnormal EEGs was lowest in this age-group. There was a rise in the incidence of fast activity with age and a fall in the incidence of slow activity with age. This trend in cases of neurosyphilis parallels the trend previously observed in control subjects and in neuropsychiatric patients. (Authors' abstr.)

The Electroencephalographic and Clinical Effects of Electrically Induced Convulsions in the Treatment of Mental Disorders.

The relationships between different variables incident to the program of electric shock treatment and electroencephalographic and clinical effects have been qualitatively and quantitatively worked out for 54 patients receiving such treatment for different types of mental disorders.

Different types and degrees of post-shock electroencephalographic changes are noted. In general, the degree of electroencephalographic changes varies as the number of shocks administered and inversely as the interval in days between the last shock and the post-shock EEG. There are, however, definite individual differences in shock threshold and subsidence time in regard to the degree of post-shock electroencephalographic changes, and also individual differences in regard to emphasis on some types of post-shock electroencephalographic changes rather than on others, indicating a differential cortical response to shock.

Fifty per cent. of the cases had normal, and 50 per cent. borderline-abnormal pre-shock EEGs. Some having borderline-abnormal EEGs show a marked degree of post-shock electroencephalographic changes, but the difference between the two groups—the normal and the borderline-abnormal—is not proved significant in this respect. However, those who show some epileptoid features in their pre-shock EEG tend to exhibit rare or occasional larval spike-and-wave pattern following shock more than the normal group. A definite electroencephalographic similarity between the epileptic and shocked brain is noted.

There is some tendency for the psychoneurosis with obsessive-compulsive features and depression to be more in the borderline-abnormal pre-shock EEG group than schizophrenia with depression or psychoneurosis with depression.

Following a simple system of weighting degrees of improvement, lack of improvement and relapse, and calculating the index of efficiency of treatment, and then the percentage of efficiency of treatment as compared with recovery, it is found that the percentage of efficiency of the electric shock treatment for the group as a whole at the time of discharge is 49 per cent., which indicates a definite improvement over the pre-shock status. A control group of 64 patients receiving no electric shock has demonstrated only 30.5 per cent. efficiency of the treatment they received. The difference between the results of these two types of treatment is statistically significant. Seventy-six per cent. of the patients who received electric shock and who could be followed up between four months and one year following discharge have retained or bettered their improvement status. It is believed that psychotherapy played an important role in the maintenance of the improvement, though not predominantly in its initiation. There is a statistical indication that patients having psychoneurosis with obsessive-compulsive and depressive features and the highest pre-shock abnormal and borderline EEGs profit by such treatment more as a group than schizophrenia without depression. There is a suggestion that patients with pre-shock borderline-abnormal EEGs profit more as a group by shock treatment than those with normal EEGs.

No significant relationship has been discovered between the number of shocks administered and the percentage of efficiency of treatment.

The necessity for working out intimate relationships between different variables in electric shock treatment for a larger number of patients is indicated to help in the proper selection of cases for treatment and the prediction of its success. The treatment of data as utilized in this study would greatly facilitate the comparison of results from different clinics. (Authors' abstr.)

Spontaneous and Induced Epileptiform Attacks in Dogs in Relation to Fluid Balance and Kidney Function.

1. The so-called epilepsy which occurs spontaneously in dogs follows a distinct and plainly recognizable pattern. Various predisposing and exciting causes are discussed.

2. The water intoxication discovered by Rowntree is characterized by precisely the same pattern of convulsions. It is readily distinguished from other forms of convulsions, such as occur in rabies, uremia or strychnine poisoning.

3. Dogs with spontaneous "epilepsy" are invariably subject to convulsions with administration of smaller quantities of water than normal dogs. Certain other dogs, which remain free from spontaneous attacks during many months of observation, exhibit a similar subnormal tolerance of water, which may possibly represent a latent or sub-threshold stage of "epilepsy." These animals are free from obvious renal abnormalities, and with water administration they pass large volumes of pale urine, so that the sensitiveness is not due to urinary suppression such as Rowntree produced with pituitary extract.

4. Chronic susceptibility to water intoxication and also to spontaneous epileptiform seizures can apparently be produced by suitable kidney resections together with repeated overdosage with water. It is still not certain whether this result can be obtained in all dogs, or whether some undetectable individual predisposition plays a part. Although water elimination is known to be retarded after sufficient reductions of kidney tissue, the abundant polyuria in water tests seems to rule out this superficial explanation of the convulsions. The occult character of the relation with water balance or tissue hydration seems comparable with that in human epilepsy.

5. The name of epilepsy, applied by veterinarians to the canine disorder, seems justified by a number of features, including the ability to elicit seizures by water administration on the same basis as used by some writers for the diagnosis of latent epilepsy in patients. Attention is called particularly to the neglected opportunities for experimental study of the disease in dogs.

6. The apparent success in producing chronic idiopathic epilepsy for the first time experimentally is sufficiently important to deserve confirmation with a sufficient number of animals to test the influence of individual or accidental factors.

(Author's abstr.)

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Experimental Studies on Headache.

After several hours of migraine headache changes in cranial arteries appeared. A distended temporal artery, for example, seems more prominent. It becomes more easily palpable through the skin, and, instead of being readily collapsible, is rigid and pipelike and is less easily compressed by the palpating finger. The nature of these alterations was studied by experimental induction of analogous changes in cats.

The structure of the arteries of the ears of 6 cats was studied after infusion for two hours of 10 c.c. of mammalian Ringer solution containing 0.5 mgm. of acetylcholine bromide per hundred cubic centimeters. Measurements demonstrated thickening of the arterial walls of the infused ears. Also, a vasoconstrictor agent, ergotamine tartrate, was observed to be less prompt and effective in constricting arteries with thickened walls than arteries with normal walls.

It is suggested that during attacks of migraine headache the cranial arteries involved may undergo similar changes after prolonged vasodilatation. Such changes may explain the rigid, pipelike texture of the arteries, the steady aching pain and

the tenderness of these structures when headache has persisted for many hours. Also, these changes may explain the decreased ability of ergotamine tartrate to reduce promptly the intensity of prolonged headache. (Authors' abstr.)

Cerebral Injury by Blunt Mechanical Trauma.

Rats submitted to repeated blunt impacts on the head, the strength of each of which alone was not sufficient to harm the animal (subconcussive trauma), began to reveal ill-effects after a certain number of blows, as shown by unconsciousness, with or without recovery, at times by other, persisting functional disorders and later even by death. When the repeated subconcussive blows were delivered in a short period—one impact after another, one minute apart—there was a somewhat higher incidence of ill effects than when the trauma was delivered at longer intervals from two to six days apart. No remarkable differences were noticed in the effects when, with a trauma of the same strength, the head in rapidly accelerated motion was made to strike a stationary object, and when a moving object was made to strike the fixed head of the animal. In the great majority of animals there was a certain correspondence between the response to the repeated trauma during life and the amount and extent of cerebral damage. Among the post-mortem changes, hemorrhage or any other type of change detectable on gross inspection was extremely rare. On the contrary, widespread evidence of neuronal injury, affecting in a disseminated fashion both nerve cells and nerve fibers, accompanied with loss of myelin and, in the later stages, with glial proliferation, was a consistent microscopic observation.

A neuronal injury identical in type was found in collateral experiments in animals recovering from a temporary period of unconsciousness following a single blow on the head which had left the skull and brain grossly intact. Microscopic evidence of neuronal damage was noticed in these animals as early as one to two hours after the trauma, and in a few instances the lesions were seen to persist as late as two months after the trauma. These observations suggest that concussion may be due to neuronal injury detectable with the present histologic methods. With the production of concussion by a single blow, no pronounced differences were noted in the effects when the impact was delivered on the stationary head and when it was delivered on the head in rapidly accelerated motion, with a trauma of the same momentum. (Author's abstr.)

Studies of the Sensation of Vibration. III. Evidence for Cortical Areas in Inhibition and Mediation of Tickle.

Two operations were performed on the right cerebral hemisphere of a patient. After the first operation a vibrating pointer placed against various parts of the body elicited an intense perception of tickle. The hyperesthesia showed no topographic localization and was bilateral, although it was more pronounced when the contralateral side of the body was stimulated. After the second operation the response of tickle to a vibrating stimulus disappeared. In normal subjects and in two subjects with lesions of the right frontal lobe a vibrating stimulus applied against the skin seldom produced a sensation of tickle.

These results indicate that in the mediation of tickle two centers are involved. One center is primarily involved in the mediation of tickle, and the other inhibits the tickle center. According to this conception, the inhibitory center was destroyed after the first operation, producing the release phenomenon, and the tickle center was destroyed after the second operation, eliminating the abnormal tickle response. A mechanism similar to the one described here has been found for the motor responses. The inhibitory center for tickle appears to be located in the inferior and posterior portions of the frontal lobe, and the tickle center probably in the inferior part of the parietal lobe. (Authors' abstr.)

Effect of Sodium Amytal and Amphetamine Sulfate on Mental Set in Schizophrenia.

The present experiment was performed in an attempt to quantify the improvement in attention (mental set) observed clinically in schizophrenic patients who have received intravenous injections of sodium amytal. The auditory reaction time was obtained under two types of conditions. In one condition the regular

procedure, the length of the preparatory interval, i.e., the time between a visual warning signal and the auditory reaction stimulus, was constant for all the reactions to that interval. In the second condition, the irregular procedure, the length of the preparatory interval varied haphazardly. Five preparatory intervals were used: 2, 3½, 5, 10 and 20 seconds. Nine schizophrenic patients and 9 normal persons served as subjects. Each subject was tested with and without intravenous administration of 250 mgm. of sodium amytal and 10 mgm. of amphetamine sulfate.

Our results confirm the work of earlier investigations in which no drugs were used. The reaction time of the patient group was significantly longer than that of the control subjects in both procedures. The control group reacted more quickly in the regular procedure than in the irregular procedure for all preparatory intervals. The patient group failed to react more quickly in the regular procedure after the five-second preparatory interval. With medication the normal group continued to react more quickly in the regular procedure than in the irregular procedure for all preparatory intervals. The patient group, with medication, had reaction times which were significantly longer in both procedures than those of the control group. However, in contrast to their behaviour without medication, they now reacted more quickly in the regular procedure than in the irregular procedure for every preparatory interval.

It is concluded from these results, first, that the schizophrenic patients as a group suffer from inability to attain as high a level of mental set as do normal subjects, and that they do not maintain the level of preparation they attain as long as controls. Second, the reaction time technic may be used to measure one aspect of the improvement seen clinically (improvement in attention) in schizophrenic patients when sodium amytal is injected intravenously. Third, the improvement is such as to produce a normal relationship between the reaction times of the regular and those of the irregular procedure. (Authors' abstr.)

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Disturbances in Sleep Mechanism.

In 9 cases pathologic sleep was associated with lesions in the cortex. In none was there invasion of the hypothalamus. In 2 cases compression of the hypothalamus could not be completely ruled out. On microscopic examination, however, there was no evidence of changes in the nerve cells.

Increased intracranial pressure was present in only 4 of the 9 cases. It is reasonable to assume that the role played by increased intracranial tension in dysfunction of sleep is negligible, if not totally insignificant. Ocular and endocrine

disturbances, except for diplopia in one case and endocrine features in another, were absent in this group of cases.

From the study of this series of cortical lesions, we are of the opinion that some fibers for the control of sleep originate in the cerebral cortex, especially the hippocampal, cingular, frontal, premotor and temporal convolutions. These areas are connected with the hypothalamus by means of the corticohypothalamic pathways. Injury to these areas or to their connections with the hypothalamus is occasionally the cause of pathologic sleep. (Authors' abstr.)

Electroencephalographic Findings in Cases of Bromide Intoxication.

A study of the electroencephalograms of patients with bromide intoxication reveals the following characteristics:

The incidence of electroencephalographic abnormality is high during the intoxicated state.

A progressive clearing of the patient's sensorium parallels electroencephalographic changes toward normal.

There exists a definite relationship of the blood bromide level, the electroencephalogram and the clinical picture. At high blood bromide levels (over 200 mgm. per 100 c.c.) the electroencephalogram tends to show diffuse slow activity, and the patient as a rule is confused and dysarthric. Thus far, no diffusely slow activity has been found in the absence of dysarthria. As the bromide level falls, the electroencephalograms of a number of patients show a phase of mixed slow and fast activity, and at low levels of bromide concentration the electroencephalogram shows essentially normal or mildly fast rhythms.

The electroencephalogram shows changes over a remarkable range in both frequency and voltage. High voltage activity as slow as 2 cycles per second is occasionally encountered in some of the confused patients with high blood bromide levels. Activity in the 5 to 8 cycles per second slow range is most frequent, however. On the fast side of the frequency spectrum, the activity is of medium or low voltage and is generally in the range of 12 to 25 cycles per second.

A striking phenomenon is the pronounced individual differences in the electroencephalogram and the clinical picture at the same blood bromide level.

(Authors' abstr.)

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Man's Frontal Lobes: A Critical Review.

A patient with bilateral frontal extirpation was observed to have made a good social and economic adjustment six years after operation.

It is concluded that though this patient may show some defect in planning

for the distant future, the defect is not clearly demonstrated or shown to be due to the cerebral destruction. There is no defect of foresight for the immediate future, as shown by tactless remarks or inappropriate social behavior.

An analysis of methodologic difficulties in getting adequate anatomic, pathologic and normal control data suggests that these problems have not been sufficiently appreciated, and have led to error in the interpretation of symptoms referable to the frontal lobes.

A review of published case-reports of removal of the frontal lobe indicates that no one has as yet shown that defects follow a simple loss of tissue from man's frontal lobes; the loss must, presumably, have some effect, but it is hard to demonstrate, and its nature is not yet clear.

The implications of the evidence for surgical treatment, particularly of traumatic injury, are that social and intellectual defects need not follow an uncomplicated bilateral excision of tissue from the anterior part of the frontal lobes.

(Author's abstr.)

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Progressive Facial Hemiatrophy.

In cases of facial hemiatrophy, the hair of the skull and of the face is affected frequently and at an early stage. This involvement may take the form of a circumscribed alopecia or of blanching of the hair, and may precede other symptoms.

The dermatologic manifestations of hemiatrophy usually start in the paramedian area of the face. This area is a vertical streak of about 1 or 2 finger-breadths running parallel and lateral to the midline.

The existence of a disease called abortive progressive facial hemiatrophy is assumed. Its minimal atrophic changes are located in the paramedian area and become stationary for years.

So-called *sclerodermie en coup de sabre* is apparently nothing but such an abortive progressive facial hemiatrophy.

Not only hemiatrophic and sclerodermatous manifestations, but often congenital malformations of the skin, are located in the paramedian area.

The paramedian area corresponds to the vertical line of the body at which the bilateral trophic influence of the brain centers ceases and the unilateral influence begins.

The brain, especially on the affected side, often shows involvement. Contralateral epilepsy is the most conspicuous symptom of such involvement.

The fundamental manifestation of hemiatrophy is the atrophy of the fat and subcutaneous tissues.

The hemiatrophic changes may extend in various degrees from the area of the face to the homolateral parts of the body.

A patient with hemiatrophy may show, on the homolateral side of the body, abortive or latent symptoms of an atrophic process.

The pathologic process which leads directly to hemiatrophy is regarded as an active one, and is due to a state of irritation in the peripheral trophic sympathetic nervous system.

In the areas of hemiatrophy, phenomena of irritation of the sympathetic, the cranial and the spinal nerves are often found. They may be explained by an irritation transmitted from the sympathetic trophic system to other systems.

Inflammatory processes are often found in the areas of hemiatrophy. They have a predilection for localization in the hemiatrophic area because the sympathetic innervation there is disturbed.

The concomitant involvement of the brain homolaterally which leads to epilepsy may be explained by disturbance of the cervical sympathetic system, which innervates the vessels of the brain. This disturbance creates a locus minoris resistentiae for toxic or infective processes.

Thus, hemiatrophy is not due to a primary inflammatory process in the peripheral sympathetic nervous system. The primary process is elsewhere, but it indirectly weakens the resistance of the affected tissues to toxi-infections.

The irritation in the peripheral sympathetic nervous system that causes hemiatrophy is a release phenomenon. It is due to disturbance of the higher centers, which leads to increased and unregulated activity of the lower centers. This phenomenon is analogous to that seen with lesions of the higher centers of the pyramidal and extrapyramidal motor systems.

The etiologic process in hemiatrophy may be encephalitis. Usually it is a heredodegeneration.

As heredodegeneration, hemiatrophy may be compared to torticollis, narcolepsy, paralysis agitans and similar diseases.

The exogenous factors that have been incriminated as causes of hemiatrophy are inadequate to explain the disease. The course of the disease is one typical of a heredodegeneration. (Author's abstr.) .

Emotions and Adrenergic and Cholinergic Changes in the Blood.

The experiments presented here demonstrate that during some specific emotions the blood contains factors that can produce effects on the isolated duodenum of the rabbit similar to those of epinephrine and acetylcholine. The physical condition of all the persons studied was good. Menstruation did not seem to influence the reactions.

The results of such experiments are frequently difficult to analyze because one may not be dealing with merely the one emotion which dominates the psychologic and psychopathologic picture. Emotions which are not obvious may have to be considered. Anxiety, resentment and anger are accompanied with definite adrenergic factors; tension, and possibly fear, with cholinergic factors. The blood of one patient in a depressed state with no other emotions detectable had an entirely negative effect during one observation. In other studies of depressed states and in all observations on elated states, anxiety, tension or fear was present, with corresponding adrenergic and cholinergic effects. There does not seem to be an essential difference between normal and psychopathologic emotions except in the intensity of the adrenergic and cholinergic response. The intensity of the response depends on the intensity of the emotion, and probably on individual physiologic capacity to respond. (Authors' abstr.)

The Central Nervous System in Uremia: A Clinico-pathologic Study.

1. Uremia, although usually treated by the internist, occasionally results in symptoms that may cover the entire field of neuropsychiatric symptomatology.

2. The most common symptoms referable to the nervous system are convulsions and coma, but in isolated cases unusual syndromes, such as monoplegias, hemiplegias, aphasias and apraxias, or even mental symptoms of almost every type, may be present.

3. The central nervous system in cases of uremia reveals widespread tissue changes involving both the nerve cells and the parenchymal elements. In the acute illness the predominant alteration occurs within the cortical neurons, which reveal an acute change in the nerve cells. In the more chronic illness the most striking changes are parenchymal rather than neuronal, and consist of focal and perivascular areas of demyelination and necrosis. The neurons show both acute and chronic changes in the more chronic illness. (Authors' abstr.)

Electroencephalogram of Dogs with Experimental Space-occupying Intracranial Lesions.

High voltage slow (delta) waves were seen characteristically in the electroencephalogram of dogs with subcortical, space-occupying lesions. Such changes at their height resembled the electroencephalographic alteration seen in some cases of intracerebral, space-occupying lesions in man.

Disappearance of normal rapid activity and flattening of the electroencephalogram were seen with subdural and extradural space-occupying lesions in the dog.

Minor shifts in electrode placement can greatly alter the amount of abnormality seen in the electroencephalogram in cases of focal damage to the brain.

The electrocorticogram is a more sensitive record of abnormal brain potentials than is the electroencephalogram obtained by leading from the skull in dogs.

The electroencephalographic alterations caused by space-occupying lesions are of a reversible nature if the lesion is of fixed dimensions.

The electroencephalogram of the unanesthetized waking dog is in part of cortical origin. Brain potentials seen in sleep and during pentobarbital anesthesia may be controlled by subcortical mechanisms. (Author's abstr.)

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The Functional Structure of the Cortex of the Great Hemispheres.

Data recently obtained in the laboratory again bring up the question of cortical representation of the food center. The present investigation utilizes a sugar

solution which is poured into the mouth of the animal, thus removing the presence of natural conditioned stimuli. At the pouring of the 20-40 per cent. sugar solution, the majority of the animals give a small secretion. The greatest secretion occurs at the first pouring; then it sharply decreases, and towards the end of the experiment can approach zero. When conditioned stimuli are applied, the secretion increases. When it approaches a significant quantity, there appears a conditioned secretion. This increase of secretion on application of the sugar solution is explained by positing a gradually increasing excitability of those nerve elements which respond on the pouring of sugar. The question arises as to whether this occurs in the cortex or the subcortex. On the basis of facts presented in the article, the author states that we have a right to speak of a cortical food center, and that we have material characterizing its activity.

P. WORCHEL (Psychol. Abstr.).

Peculiarities of the Cortical Processes and of Functional Organization of the Great Hemispheres.

The author refers to Pavlov's contention that the adjectives "higher nervous" correspond to the adjective "psychical," and presents experimental data for the discussion of the following question: Speaking of cortical processes, do we mean psychic processes? Dolin secured conditioned convulsions by combining a sound stimulus with the introduction of camphor. Kupalov states that on the basis of his and Bykov's work, the cortex not only plays the role of an impulse initiator, selecting responses, but also takes part in the response. For some time experiments have been proceeding on subjecting the thoracic region of the spinal cord of a frog to radium emanations. In one series of experiments, the nerve supplying one side of the frog from the thoracic region of the spinal cord was cut. The muscles in the intact region, after the above radium emanations were applied, lost their striated appearance and were destroyed. The muscles whose nerve connections were severed were still functional and retained their striated cell structure. After a discussion of the data, the author states that the functional physiological organization of the great hemisphere is both an organization at rest and an organization in activity; in other words, the physiological rest is active. Then conditioned inhibition was formed on the introduction of morphine. Kupalov is convinced that the cortex is able to change its organization and to fixate any new complex, even pathological integration.

P. WORCHEL (Psychol. Abstr.).

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Changes in the Nervous System in Acute Porphyria.

Two cases of acute "idiopathic" porphyria are presented. In the first a brief delirium with tremor was followed by recovery. In the second the more usual abdominal cramps with delirium convulsions and severe motor paralysis occurred in two attacks separated by an interval of two years. The patient died in the second attack, and pathological examination revealed lesions of ischaemic nature in the peripheral nerves and cerebral white matter. The possibility of the presence of some locally acting vaso-constrictor substance is discussed in relation to the

pathogenesis of the visceral disorders of porphyria. The importance of consideration of the condition in states of acute delirium with or without "toxic" motor neuritis is emphasized. (Authors' abstr.)

The EEG in the Prognosis of War Neurosis.

Three hundred soldier patients in a psychoneurotic rehabilitation centre had their EEG records taken. After their return to the Army they were followed up for periods up to 15 months. Nine records were discarded owing to the presence of excessive artefact, and one record with a specific form of abnormality, which proved to belong to a traumatic epileptic. Of the remaining 290 men, 59 were subsequently invalided, 58 when last heard of were on light duty, 173 on full duty. Of the whole group 121 records were normal, 70 were doubtful, 99 showed a non-specific abnormality. There was no association between abnormality of EEG and an unsatisfactory follow-up record. The presence of abnormal fast rhythms was associated with a bad outcome, and more definitely so if these rhythms were found in an EEG record which was classified as non-specifically abnormal. The total number of men who showed this combination was less than 10 per cent. of the whole group. The alpha rhythm rate for the poor and good outcome classes showed no significant difference. In the total number of frequencies observed per man, the bad outcome classes showed a greater variability than the good outcome class. This can be thought of in connection with the greater variability of neurotics as compared with normals in respect of several other physical characteristics. It is concluded that the use of the EEG in screening Army entrants, or soldiers who have suffered a neurotic breakdown, can only be engaged in with the utmost caution. (Authors' abstr.)

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Disability Arising from Closed Head Injury.

1. Out of 430 consecutive admissions to the Boston City Hospital immediately following head injury, a series of 200 cases, selected only by exclusion of age-groups under 15 years and over 55 years, and of vagrants and chronic alcoholic addicts, was followed for intervals of six months or longer. Each patient was examined soon after admission and at regular intervals thereafter by a team consisting of neurologists, psychiatrists, a psychometrist, an electroencephalographer and a social worker.

2. The majority of injuries (53 per cent.) were derived from traffic accidents, and relatively few were of great severity, consisting chiefly of "closed head injury" with varying degrees of scalp injury and loss of consciousness. Twenty-seven patients had post-traumatic amnesia lasting over twelve hours, 22 patients over two days, 8 over seven days. Eighteen patients had clear evidence of fracture of the skull.

3. One hundred and ten patients (55 per cent.) complained of symptoms in convalescence. The symptoms were related to structural physical disorder in 16 patients, to psychiatric symptoms in 70, to headaches in 81, and to dizziness in 68. These symptoms were frequently associated, but each could occur alone. The association of headache, dizziness and psychiatric symptoms ("postconcussion syndrome") occurred in 30 patients.

4. Absence from full occupation occurred in 30 cases by reason of other injuries or unrelated causes. In the remaining 170 patients, 136 returned to full occupation within two months, 16 in the third and fourth months, 4 in the fifth and sixth, 9 between six and nine months, and 5 nine months or more after injury. Such disability has variable relationship to the various post-traumatic symptoms. Psychiatric symptoms had the highest correlation with prolonged disability.

5. Factors of bad prognostic significance in relation to return to occupation within two months of the injury, and within six months of the injury, were analyzed. In each case features indicative of severity of injury (prolonged disorientation, abnormal neurologic signs, blood in the spinal fluid, electroencephalographic abnormality) and those indicative of psychologic stress (initial excitement or apathy, occupational worries, anxiety over compensation) were intermingled.

6. The symptoms associated with prolonged disability, whether the injury had been severe or mild, were predominantly mental symptoms related to anxiety. Even after severe injuries cranial nerve paralysis, dizziness and headache, and personality change accounted for a minor part of disability. Intellectual disorder played no significant part.

7. The environmental factors of the injury were in total effect more important in accounting for disability than were the factors indicative of severity of injury, but neither can be neglected in the assessment of prognosis. The extensive association between head injury and psychiatric factors indicates possibilities for lessening disability by psychiatric treatment. (Author's abstr.)

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The Psychometric Pattern: (1) Anxiety Neurosis.

Twenty-five white males, diagnosed as psychoneurosis (anxiety neurosis) following psychiatric examination, were given the Wechsler-Bellevue Adult Intelligence Scale to afford qualitative and quantitative data regarding their performance on this test. The factors considered in evaluating such performance were (a) the number of patients deviating either positively or negatively on each subtest from their own mean weighted score on all ten tests; and (b) the magnitude of the median deviation on each subtest. The results indicated no statistically significant difference between verbal and performance IQs. When the rank-order performance of the psychoneurotics on the ten subtests was correlated with that found to exist among normal subjects, the coefficient (ρ) was both small and unreliable. The performance of the neurotic patients on each subtest was considered in detail, and compared with the empirical findings of Wechsler. While some discrepancies were evident, no complete reversal of results was found. Considering only significantly deviating scores, as described by Wechsler, no consistent psychometric patterns were discerned. It was suggested that the prescribe magnitude of the deviations held to be significant might be too great to reflect trends that actually exist. A discussion of the quantitative phases of scatter and the value of qualitative observations during test administration was presented. (Author's abstr.)

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Peptic Ulcers in the Insane.

A psychosomatic study showed peptic ulcers in 42 out of 2,000 necropsies on mental patients. More than half of the ulcer patients were emotionally unbalanced before the outbreak of their insanity. There was little or no evidence to show that there was any causal relationship between the personality-type, emotional instability, psychosis and ulcer formation.

S. M. COLEMAN.

Electroencephalogram in Psychoneurotics.

"The electroencephalographic patterns occurring in psychoneurotics were studied with the patients at rest and during hyperventilation. They were compared with the patterns of control subjects. It was demonstrated that patterns with a high amount and good continuity of alpha activity are rarer in psychoneurotics than in the control subjects, and that they are particularly rare in patients with chronic anxiety and difficulties in adjustment. While, as a rule, the amount and continuity of alpha activity increase or remain the same during hyperventilation, a decrease was found in some psychoneurotics."

S. M. COLEMAN.

Psychodynamics of Art Work of Problem Boy.

A detailed study, profusely illustrated, of the art work of a nine-year-old behaviour problem boy. It is shown how the projective technique of "free" art expression can be used to supplement play therapy. S. M. COLEMAN.

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Neuro-Optic Myelitis.

Two cases are reported of patients showing acute degeneration of the spinal cord and optic nerves. It is concluded that the material supports the contention that a definite clinicopathological syndrome of neuro-optic myelitis exists. The possible aetiology of one of the cases is discussed. S. M. COLEMAN.

Electroshock Therapy in the Depressions.

Twelve patients with endogenous depressions had complete remissions following 5 or less convulsions. The remissions were complete, and have lasted from 5 months to 2 years. These cases were relatively free from paranoid, hypochondriacal or neurotic symptomatology. S. M. COLEMAN.

Definition of Psychopathic Personality.

Having surveyed some of the relevant literature, psychopathic personality is defined as "a mental disease which develops before or during puberty, caused by inherited predisposition, or by acquired personality deviation due to psychic or somatic factors or both, which, in turn, cause super-ego deficiency; it is characterized by stereotyped deviations in the moral, social, sexual and emotional components of the personality, without intellectual impairment, psychosis or neurosis, with lack of insight or ability to profit by experience, and is of lifelong duration in almost all cases." S. M. COLEMAN.

Psychosomatic Aspects of Stuttering.

The writer's findings are based on a study of 116 cases investigated at the National Hospital for Speech Disorders in New York. The frequency of families of stutterers is noted, but it is seldom possible to rule out imitation or other non-hereditary factors. Physical examination failed to reveal evidence of constitutional inferiority or organic disease in a significant number of cases.

Psychiatric investigation revealed that the stutterer is often a schizoid individual. Many provided a history of bed-wetting, nail-biting and nightmares indicative of emotional tension. Analysis of the onset of the stutter revealed in nearly 50 per cent. a specific aetiological factor—a fear situation. The subsequent history supports this, viz., close association between emotion and the speech disorder, capacity for stutter-free speech in favourable conditions.

It is concluded that stuttering is the resultant of a conscious will to express oneself and an unconscious inhibition of speech. The latter appears to serve as a defence against anxiety. Therefore the symptomatic "cure" of stuttering is condemned. S. M. COLEMAN.

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Healing Mechanisms in Shock Therapy.

Forty-two neurotic patients were treated with convulsive therapy (the majority receiving unidirectional, electrostimulated convulsive therapy), with a condition of remission resulting in 38 per cent. and improvement in an additional 55 per cent. An investigation of the healing mechanisms disclosed an interplay of physiological, psychobiological and psychological factors. S. M. COLEMAN.

Psychiatry and Propaganda.

The common denominator between psychiatry and propaganda is that both deal with social relationships. A basic error of democracy, which allowed itself to be deprived of a great idealistic weapon, consists in mistaking for propaganda in general the propaganda psychology preferred by the fascists. The crucial problem for democracy and propaganda for democracy consists in selecting that proportion of tangible and abstract contacts which is suitable for the present time. S. M. COLEMAN.

Shock Treatment in Psychopathic Personality.

This report on three cases, two of which showed some improvement following shock therapy, suggests that the outlook for the psychopath need not be quite so gloomy after all. S. M. COLEMAN.

Fatigue in Latent Epilepsy.

A group of cases in which convulsions occur as a result of excessive fatigue is described. These cases have certain definite features in common, and their management is comparatively simple. The term latent epilepsy is applied to them, to indicate this very feature, and also because it connotes a more hopeful prognosis. S. M. COLEMAN.

Problems of Orphanhood.

The basic problem of orphanhood must be understood in terms of loneliness and of problems connected with any exceptional position. Special factors are: In many cases the orphan tries to compensate for the loss of a parent by the formation of a phantasy image in which it takes refuge when it needs sympathy. Feelings of guilt towards the dead parent may be at the root of the neurotic trends. The surviving parent may be made responsible for the death of the other parent, with consequent hostility. Identification with the dead parent may provide the content to hypochondriac and phobic fears. Conflicts between resentment and attachment may interfere in the relation with the parent substitute. Uncertainty about the meaning of death and the dangers of sickness may be the cause of anxiety. The reaction on the feeling of security may develop either towards a clinging behaviour, or in the direction of independence and withdrawal. S. M. COLEMAN.

APRIL.

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Studies of Homosexuals.

Fifty-five homosexuals were studied clinically and electroencephalographically. A high incidence of histories and neurological signs suggestive of cerebral lesions were found as well as neuropathic taint in the family histories. Pathological or borderline variant EEGs were present in 75 per cent. It is concluded that an inherited or early acquired abnormality of the C.N.S. plays a contributory role in the development of homosexuality. S. M. COLEMAN.

The Psychoneurotic Ex-Soldier.

A follow-up on 142 ex-soldiers 5 months after discharge showed that improvement, when present, was attributed by the men themselves to: independence, quiet, being home, job and country life. Reasons for persistence of symptoms included lack of freedom, unsuitable employment and feelings of guilt. S. M. COLEMAN.

Psychiatric Factors Influencing Learning.

The psychiatric factors influencing learning in the child include "nervousness" or nervous tension, emotional disturbances and neurotic traits, and organic brain lesions. S. M. COLEMAN.

MAY.

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War Psychiatry and Its Influence.

Among the subjects discussed in this address are: The intimate relationship that exists between military neuropsychiatric disabilities and morale; the clinical manifestations, underlying conflict, prognosis and treatment in military neuropsychiatry; and finally, the effect that war psychiatric experience is likely to have on civilian psychiatry and civilization in general. S. M. COLEMAN.

Present and Future Effects of War Neuroses.

The view is held that the war has released potential instabilities through the breaking up of patterns. Admitting that these mass instabilities are very serious, it is thought that much more could be done if the whole psychiatric machinery was clear in its purpose and was organized towards a single aim—the economic one. The objective of the psychiatrist is to get the neurotic into a job. Successful here, he will be best fitted to make an adjustment to social and domestic life. S. M. COLEMAN.

War Neuroses or Battle Fatigue.

Some hold that war neurosis or "operational fatigue" is entirely dependent on recent experiences and conflicts, and that the term "psychoneurosis" differentially denotes the presence of symptoms which are dependent on conflicts which arose early in childhood. While agreeing that this is a useful working concept in the combat zone, it is submitted that more thorough investigation always shows that such battle reaction individuals never start with a psychologically clean slate. More particularly in the fatigue reaction type a certain degree of ego immaturity is to be found.

S. M. COLEMAN.

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Mechanisms in Experimental Epilepsy.

Experimental epilepsy was induced in the dog by electrical stimulation of the brain or by the injection of convulsant drugs, and the blood plasma from the superior longitudinal thoracic vein was analysed for potassium content before and after the seizure. It was found that convulsions modify the permeability of nerve cells, with a consequent loss of intracellular potassium. This is associated with an increase in frequency and intensity of brain waves. On the other hand, natural and artificial sleep are accompanied by a decrease in the potassium content of the brain and in the frequency of its waves.

S. M. COLEMAN.

Treatment of Epileptic Patients.

The above hydantoin derivative, hydantal, in combination with phenobarbital, is considered to be less toxic than epanutin, and also to be superior in the control of epilepsy. This is a preliminary report, and the number of cases (17) is admittedly small.

S. M. COLEMAN.

Nightmares of Suffocation.

The writer's theories conform with those of Otto Rank. Analysis reveals that nightmares of suffocation are to be traced back to the trauma of birth, more especially the subsequent phase of partial asphyxia. Claustrophobia—fear of being in an enclosed place, coffin, etc.—has a prenatal origin. It represents the anxiety of the foetus as to its ability to escape from the womb.

S. M. COLEMAN.

First Evidence of Pancreatic Disease.

Three cases of pancreatic disease are reported, with depression and anxiety as the presenting symptoms. It is advised that the clinician should be always alert for a pancreatic disease, particularly in a negative history, when the subjective complaints include deep-seated pain in the epigastrium and mental disturbances.

S. M. COLEMAN.

Tubercle Bacilli in Dementia Praecox.

Tubercle bacilli are to be found in the C.S.F. in 40 per cent. by culture in cases of schizophrenia.

S. M. COLEMAN.

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Intracranial Pressure and Headaches.

Headaches persisting for several months after a head injury cannot be directly related to the pathology of the brain injury, as indicated by examination of the cerebrospinal fluid. S. M. COLEMAN.

Acute Spinal Epidural Abscess.

A case is presented in which an acute spinal epidural abscess occurred as a complication of a routine diagnostic lumbar puncture. The patient was operated upon and recovered with residual weakness. The importance of early recognition and prompt surgical intervention is stressed. S. M. COLEMAN.

The Liver in Extrapyramidal Disease.

The findings of mild and unspecified structural liver changes in three cases of postencephalitic parkinsonism, one case of Parkinson's disease and one case of Huntington's chorea sustain the prevailing histological reports. With the employment of delicate liver function tests positive readings were obtained in 85 per cent. out of 54 cases with extrapyramidal disease. The highest percentage of positive readings (93 per cent.) was found in 15 cases of Huntington's chorea. No summary issue is taken with the problem of primary, secondary or correlated involvement of the liver in extra-pyramidal disease. S. M. COLEMAN.

Integration in Psychoanalysis.

According to the writer the principle of integration is implicit throughout the theory of psychoanalysis. Examples here studied are the synthesis of id, ego and super-ego within the total personality and the evolution of cultural thought. S. M. COLEMAN.

AUGUST.

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Devic's Disease.

Devic's disease, or neuromyelitis optica, is characterized by a morbid process that involves both the spinal cord and the optic pathway. This disease, with multiple sclerosis, diffuse sclerosis and the encephalomyelitides, are viewed as

basically identical processes, the difference being the location, intensity and other individual variabilities. A fairly typical case is reported which is complicated by the presence of an adhesive diffuse arachnoiditis, causing a complete spinal block.
S. M. COLEMAN.

Character and the Traumatic Syndrome.

It is concluded that to refer to a mental reaction following a trauma as a neurosis, implying a disease entity, is incorrect because the etiology is not specific or clear. Also the adjective "traumatic" is not valid because the same picture may occur where there has been no obvious trauma, and a number of symptom pictures may follow the same trauma. Finally, the term syndrome seems superfluous because it is purely descriptive and not explanatory.

In the writer's opinion these patients should be treated by Karin Horney's technique of character analysis. It is explained that "character analysis as a method of thinking, feeling and acting in theory and practice is a dynamic method of describing a dynamic process; in other words, it is a dialectic method. It frees us of the static descriptive type of thinking implied in the nosology of disease entities." There follows a section on the pretraumatic personality, including case histories. It is found that the traumatic syndrome is preconditioned by the feeling of failure to live up to an idealized image of the self.
S. M. COLEMAN.

Speech Disorders in World War II.

Two hundred and seventeen cases of speech disorder were observed, 18 per cent. of which followed wounds or exposure to modern warfare. These were classified in the following manner: Dysarthria (73), dysphemia (49), dysphasia (48), dysphonia (28), dyslalia (19). Speech therapy was found of value in many patients.
S. M. COLEMAN.

Electroencephalographic Findings.

The cerebral electro-activity of four children during the acute stage of encephalitis and meningo-encephalitis is described. It is grossly disturbed; the abnormalities are generalized, and consist of slow, bilateral synchronous waves of enlarged amplitude.
S. M. COLEMAN.

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Neurosis and Sexuality.

The clinical records of 1,233 neurotic soldiers were classified by the degree of sexual activity they had shown, and the frequencies of various psychiatric findings were analysed in the two groups of the sexually inadequate and the sexually average. Sexual inadequacy was found to have significant associations with neurosis in childhood, unsatisfactoriness of home life, school record, occupation, rank in Army, past head injury, degree of military stress undergone, bodily habitus, intelligence, various personality traits, amnesic symptoms, outcome of illness. In nearly every case sexual inadequacy was found to be positively associated with a higher frequency of the abnormal finding. Where a graded characteristic is in question, such as in intelligence and bodily habitus, sexual inadequacy was more frequent at the extremes of the distribution. The findings are closely paralleled by a similar analysis of the same clinical material by degree of military stress undergone. It is concluded that the factors which tend to bring about neurotic breakdown and those

which predispose to sexual inadequacy are related. Various hypothetical bases for this observation are discussed. One which appears to be particularly favourable for further investigation suggests that the common factors are to be sought in an imbalance of the endocrine system. (Author's abstr.)

An Exploratory Study of Mental Organization in Senility.

Twenty psychological tests were given individually to 84 senile dementia patients and repeated after four months, total testing time per patient being approximately three and a half hours. The average age of the patients was 73.4 ± 6.5 years. Test-retest reliabilities were established for the tests used, and intercorrelations run between the tests. A factorial analysis was carried out on these inter-correlations, in an attempt to throw some light on the type of mental organization to be found in senility. Comparisons were made between the scores of the patients on various tests and the scores of normal adults and children on these tests. A comparison was also made between the scores on the tests of a "superior" and an "inferior" group of seniles, as determined by the level of the skill required in the work they had been doing in the course of their lives.

With few exceptions the reliabilities found for the tests were remarkably high, thus demonstrating that it is quite feasible to apply psychological tests of the type used even to senile dementia patients. A slight improvement was found for most of the tests from first to second testing, which was probably due to practice effects and "test sophistication."

The factor analysis resulted in a factor-pattern which accounted for 43 per cent. of the variance, a general factor contributing 20 per cent. to the variance, and three group-factors, identified as being concerned mainly with speed, memory, and physical strength, contributing 10, 7 and 6 per cent. respectively.

The general factor presented a picture of the mental organization of the patients which differed greatly from that found in normal adults. An attempt was made to account for this difference in terms of the theory of "fluid" and "crystallized" ability.

The level of the senile patients on the progressive matrices test of abstract non-verbal ability approximated that of 8-year-old children; similarly, their performance on the digits repetition test was similar to that of 8-year-old children. On the vocabulary test, however, the seniles scored well above the 14-year-old level. The correlation between matrix and vocabulary for the senile patients was shown to be very significantly lower than the same correlation for normal adults. These facts were also brought into relation with the theory of "fluid" and "crystallized" ability.

The comparison of the superior and the inferior senile patients showed the superior group consistently scoring at a higher level than the inferior group, even on tests of physical strength. The degree of superiority, however, varied within wide limits.

The results allow the following conclusions:

- (a) Mental ability in the seniles tested has considerably deteriorated.
- (b) This deterioration affects most strongly tests involving abstract reasoning ability ("fluid" ability).
- (c) This deterioration affects least tests involving a mere reactivation of past experiences and knowledge ("crystallized" ability).
- (d) Due to the differential deterioration in the abilities of senile patients, the organization of these abilities, as compared with normal adults, becomes profoundly altered. (Author's abstr.)

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*Focal Autonomic Representation in the Cortex and its Relation to Sham Rage. <i>Kennard, M. A.</i>	295

Cerebral Changes in the Course of Pernicious Anemia and their Relationship to Psychic Symptoms.

The brains of five cases of pernicious anemia in which the manifestations of this disease appear to have developed in the course of a psychosis were studied, with one case of pernicious anemia without neuro-psychiatric complications and one of psychosis following pernicious anemia.

The alterations were qualitatively the same in all cases, only the intensity of the process showing some variations. The nerve cells presented acute, severe, chronic, ischemic, edematous and fatty changes in varying degree.

The small blood vessels appeared to be increased in number, and presented a mild endarteritis in all cases.

The distribution of the glia of the white matter was markedly irregular. Often the glia nuclei gathered around the blood vessels, so that the course of the latter was well outlined, even when the vascular walls were at a different level, and could not be seen. Frequently between the conglomeration of the glia nuclei and the blood vessels a small area of white matter, which frequently underwent a process of demyelination, was interposed. These areas of demyelination at times had the tendency to coalesce.

Inasmuch as in at least two cases the vascular changes were found with especial intensity in the regions involved in Wernicke's encephalopathy, it is permissible to consider the described findings as abortive forms of that condition. Some facts gathered from the literature justify a conclusion that more or less pronounced forms of Wernicke's encephalopathy may be found in all conditions in which Castle's formula is altered.

The cases here reported seem to confirm the idea expressed by other authors that there is a certain relation between pernicious anemia and paranoid reactions (may be a common constitutional factor).

Since no mental symptoms were observed in one of our cases which showed the same neuropathologic alterations, the hypothesis is advanced that the organic changes merely precipitate or sensitize one toward a psychosis, the type of which is predetermined by psychological or constitutional mechanisms.

(Authors' abstr.)

Physicochemical Effects of Electrically Induced Convulsions.

(1) Following the convulsions, the electrolyte content of the cerebrospinal fluid as indicated by its conductivity, the total interferometric values (IV) and the ratio of the interferometric value of non-electrolytes (INE) to that of the electrolytes (IE) were increased. Particularly the increase of the IV value and of the $\frac{INE}{IE}$ ratio after the convulsions were statistically significant.

(2) Regarding the electrolyte content of the cerebrospinal fluid, a distinct increase in the potassium and phosphate content was found.

(3) Consideration of the time factor seems of importance. The average increase of the phosphates was 18.5 per cent., that of the K 21.5 per cent., if the puncture was performed within one hour after the last convulsion (group 1), while 1-3 days after the last convulsion (group 2), the increase of phosphates was 1.3 per cent., that of K 11.2 per cent. The difference in the electrolyte content shortly after the last convulsion and 1-3 days later is also reflected in the conductivity measurements that show an increase of 2.3 per cent. in group 1 and of 0.5 per cent. in group 2.

(4) Experiments on isolated surviving frog's brains showed a definite increase in the conductivity and thus in the ion concentration of the bathing fluid during and one minute after stimulation. This increase of leakage from the brain on

stimulation is at least partly due to diffusion of K as shown by determinations of K in the bathing fluid. Thus stimulation of the brain is followed by a brief release of ions from cells of the central nervous system. The amounts diffusing into the subarachnoid space are too small to produce a perceptible change of the blood : cerebrospinal fluid ratio.

(5) Regarding the non-electrolytes, in increase of the ratio $\frac{NE}{E}$ by 4.1 per cent. was found in the dogs that were punctured within the first hour following the convulsions (group 1); it may be inferred that following the convulsions, there is an increase not only of electrolytes, but also of non-electrolytes in the spinal fluid, and that the increase of the non-electrolytes is even larger than that of the electrolytes. In the following days the ratio $\frac{NE}{E}$ further increases (6.8 per cent. in group 2).

(6) Analyzing these changes, the permeability of the blood-liquor barrier was studied by the uranine test. As far as this test permits conclusions, it seems that an increased permeability of the blood-liquor barrier is not responsible for the increase of non-electrolytes. An abnormal content in glucose and proteins also could be excluded as the cause of this increase of non-electrolytes.

(7) Using Hauptmann's saponin hemolysis test as an indicator of lipides in the cerebrospinal fluid, a slight increase of the inhibitory effect upon saponine hemolysis as compared with normal spinal fluids was found following convulsions only occasionally.

(8) In spectrophotometric studies, the cerebrospinal fluids of dogs subjected to convulsions showed band absorption between wave-length 2,550 and 2,850 Å. Since an abnormal protein content could be excluded, and barbiturates had not been administered to the dogs, the absorption band probably is due to abnormal amounts of nucleic acids or their constituents, belonging to the pyrimidine-purine group. Microchemically traces of thymonucleic acid were detected in the spinal fluid following the convulsions. These findings suggest a breakdown of nuclear substances under the influence of the convulsions. (Authors' abstr.)

Focal Autonomic Representation in the Cortex and Its Relation to Sham Rage.

(1) In the cat, cortico-autonomic representation lies entirely or chiefly in the frontal lobes. Bilateral removal of this area is followed by all the symptoms of sham rage which appear in preparations which are totally decorticate.

(2) The orbital surface of the frontal pole has been previously shown to be related to vagal function. Removal of this region bilaterally causes panting, increase in heart rate and increased production of adrenalin, as shown by denervated iris and nictitating membrane. Such animals may die within the first hours following operation as a result of respiratory and cardiac disturbances.

(3) Removal of the lateral and mesial portions of the frontal lobes bilaterally causes protrusion of the claws, piloerection, increased irritability and some increased production of adrenalin as shown by the sympathectomized iris and nictitating membrane. None of the other manifestations of sham rage appears in such animals.

(4) In the cat, removal of the cortical representation of the autonomic system results in signs of excessive function of the autonomic system, which are chiefly sympathetic. In the monkey there are similar signs of release of autonomic function following the same procedure, but no sham rage results.

(5) The diminution of sham-rage phenomena which occurs in chronic decorticate and frontal lobectomized preparations is a manifestation of homeostasis, which is probably brought about by adjustment of the entire remaining autonomic system. (Author's abstr.)

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The Effect of Anticonvulsant Drugs on Recovery of Function Following Cerebral Cortical Lesions.

Following previous observations that cortical stimulants increased both rate and amount of recovery of motor activity of *Macaca mulatta* deprived of areas 4 and 6 of one hemisphere, the effects of sedatives were tried under the same experimental conditions.

(1) Phenobarbital, in doses which had no observable sedative effect on cage performance, produced marked slowing in rate of recovery and eventual retardation in motor performance.

(2) Dilantin alone did not seem to cause such retardation, but, administered together with doryl, it inhibited or prevented the enhanced recovery rate which is caused by doryl alone.

(3) Electroencephalograms taken pre-medication and before and after operation were not affected in any way by either dilantin or doryl and atropine in the doses given.

(4) The electroencephalogram was altered after several days by phenobarbital in doses of approximately 40 mgm. per kgm. This dose was not, however, enough to cause any clinical change in the performance of the monkeys.

(Authors' abstr.)

Chemical Changes in the Cerebral Cortex Associated with Convulsive Activity.

Cerebral lactic acid increases during the convulsive electrical discharge produced by metrazol in an animal immobilized with dihydro-beta-erythroidine and maintained by artificial respiration. A decrease in cerebral phosphocreatine usually occurs, with a corresponding increase in inorganic phosphate. Adenosine triphosphate is unchanged.

The findings are similar in the epileptiform seizures occasionally seen in animals given morphine with local infiltration of procaine.

The observed chemical changes occur in the absence of any decrease in the cerebral oxygen supply, but are interpreted as indicating that the oxidative processes lag behind an increased energy expenditure during convulsive activity.

(Authors' abstr.)

The Functional Significance of the Rostral Cingular Cortex as Revealed by its Responses to Electrical Excitation.

Excitation of the rostral part of the cingular gyrus in the monkey (*Macaca mulatta*) produces a complex response characterized by opening of the eyes, dilatation of the pupils, changes in facial expression, alterations in the respiratory movements, changes in the cardiovascular apparatus, vocalization, piloerection, and cessation of muscular movements with relaxation of muscular tension.

Cytoarchitectural study reveals that the responsive cortex is situated in the region designated by Brodmann, from his study of *Cercopithecus*, as area 24. In the macaque this cortical region does not possess cytoarchitectural uniformity.

The complex response bears the connotation of emotional expression, thus

definitely implicating the cingular region in the emotive process, and demonstrating the potentiality of the cerebral cortex to produce emotional expression.
(Author's abstr.)

Efferent Fibers of the Parietal Lobe of the Cat (Felis domesticus).

In six adult cats the cytoarchitecture and efferent pathways of the parietal lobe have been investigated.

The cortex pattern was found to be of six layers, and these were found to be similar throughout the parietal lobe. Some increase was noted in the depth of the molecular layer more posteriorly in the parietal lobe. No Betz cells characteristic of motor cortex were seen.

The parietal cortex was found to send association fibers to the adjacent cerebral lobes.

The parietal cortex was found to send commissural fibers by way of the corpus callosum to the opposite parietal lobe.

Parieto-thalamic fibers terminated in the thalamic nuclei ventralis posterolateralis, ventralis posteromedialis, posterior and pulvinar.

Parieto-tectal fibers ended in the superior colliculus.

The parietal cortex sent fibers through the pyramids to the spinal cord, in which they accompanied the lateral cortico-spinal tract of the opposite side.

The functional significance of this parietal projection system has been reviewed, and from this investigation it is felt that the interpretation of its function as a mechanism of sensitization of sensory neurons is the more plausible one.

(Authors' abstr.)

Effects of Lowering the Blood pH on Excitability of the Nervous System.

Changes in excitability of various parts of the nervous system which occur with reductions in the pH of the blood in the intact animal were studied.

The greatest reductions in excitability occurred in reflex arcs. The changes in excitability of supranuclear centers were of much smaller magnitude. Nevertheless, the reductions in excitability were considerable. Motor nuclei and peripheral motor nerves underwent the least reduction in excitability in extreme acidosis.
(Authors' abstr.)

Generalized Atonia and Profound Dysreflexia following Transection of the Brain-stem through the Cephalic Pons.

Dogs after brain-stem transections through varying levels of the midbrain and pons have been maintained and studied by gross clinical inspection for several weeks subsequent to the operation.

The transections were made by *blunt traction*, so that the brain structures cephalad to the transection remained undisturbed in the cranium. During the operative procedure, *the blood supply to the brain was not molested by ligation of the carotid, nor by temporary occlusion of the vertebrals.*

A generalized and enduring muscular atonia invariably followed a transection placed appropriately at an upper pons level.

A profound dysreflexia followed a transection of the brain-stem at any level of the midbrain and pons. It was selective to the extent that some reflexes were affected to a greater degree than others, and the extent that the reflexes were affected varied with the level of the transection. This dysreflexia was more inclusive and more profound following a transection through the upper pons.

An obvious spontaneous extensor rigidity did not routinely follow midbrain transections. These preparations did not exhibit undue resistance to passive manipulation of the limbs or trunk musculature, and the reflex standing stance was not exaggerated. Low midbrain preparations did invariably exhibit a profound and permanently enduring impairment of the righting reflexes.
(Author's abstr.)

Facilitation of Flexion Reflex in Relation to Pain after Nerve Injuries (Causalgia).

Reflex contractions of the tibialis anticus muscle in the spinal cat are used as indicators of changes in conductivity within the spinal cord.

When the reflex response of the muscle is near threshold, it is found that contractions can be greatly increased if there be cutaneous or other stimulation of the foot or lower leg while rhythmic faradic stimulation of the cut sensory nerve is taking place.

This increase in conduction is brought about by facilitation, since the non-electrical stimuli are ineffective if the electrical stimuli to the nerve be discontinued.

Stimuli which cause such facilitation when applied simultaneously with the faradic shocks are hot (55°) or cold (ice) water, spreading the toes, twisting a claw, rubbing the fur with an applicator, or blowing strongly on the fur of the foot.

It is suggested that such facilitation may have a relation to the production of paroxysmal pain from slight cutaneous stimuli in patients who are suffering the pain following nerve injury (causalgia). (Authors' abstr.)

Electrical Activity of Denervated Mammalian Skeletal Muscle as Influenced by d-Tubocurarine.

1. The effects produced by the intra-arterial injection of acetylcholine upon denervated muscle may be duplicated by d-tubocurarine.

2. The intra-arterial injection of this alkaloid provokes both electrical activity and contraction of denervated mammalian muscles.

3. Following the injection of d-tubocurarine the muscle becomes less responsive, or completely unresponsive, to previously effective concentrations of acetylcholine.

4. In larger concentrations the injection of d-tubocurarine is capable of causing prolonged muscle-contractures.

5. During these contractures the electrical fibrillation of denervation is markedly diminished and is sometimes completely suppressed.

6. These experimental findings are discussed. (Authors' abstr.)

Electrical Activity of the Thalamus and Basal Ganglia in Decorticate Cats.

1. Typical bursts of 8-12 per second spikes were recorded for as long as three days from the thalamus of cats which had undergone either homolateral or bilateral removal of the neocortex, and, in one instance, bilateral decortication plus section of both optic nerves and transection of the midbrain.

2. Normal bursts were absent in preparations studied from 21 days to one year after decortication, although two of these animals yielded atypical low voltage bursts from restricted areas.

3. The activity of other subcortical areas was briefly noted, and found to be in general agreement with the results of others. (Authors' abstr.)

Nerve Regeneration in Cats on Vitamin B₁ Deficient Diets.

1. The behaviour of cats on a raw carp diet showed rapid development of anorexia, ataxia, vestibular disturbances and convulsions.

2. With a better controlled thiamine deficient diet which was tube-fed, ataxia and vestibular disturbances were mild even in cats which survived 116 days.

3. The peripheral nerves (tibial, peroneal and saphenous), which were excised immediately after death from thiamine deficiency, were able to conduct impulses as shown in action potential records. Also, microscopic examination showed no peripheral nerve damage.

4. The tibial, peroneal and saphenous nerves regenerated "normally" in the presence of severe thiamine deficiency. The longitudinal and diameter growths of the fibers and action potentials were used to measure the regeneration. (Authors' abstr.)

Lumbar Sympathetic Dermatomes in Man Determined by the Electrical Skin Resistance Method.

1. By means of the electrical skin resistance method areas of skin denervated by lumbar and sacral sympathectomies (at intended levels from L₁ to S₁ inclusive) were outlined in 75 patients with a total of 103 operations.

2. At each level the operations gave characteristic patterns of high electrical skin resistance.

3. The outlines of these patterns were continuous and divided each leg into regular segments.

4. It was shown that the outline of the pattern for operations at any one level represented the lower boundary of the next higher dermatome. Thus, in this study the lower boundaries of T₁₁ to L₄ sympathetic dermatomes, inclusive, were determined.

5. The outlines of these sympathetic dermatomes agreed closely with those of the sensory and vasomotor dermatomes determined by Foerster.

6. It is now known that the entire surface of the human body, like that of the salamander, is divided into regular segments from one end of the longitudinal axis to the other. (Authors' abstr.)

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Cerebral Concussion.

Concussion is a fundamental mode of reaction of nervous tissue. Clinically it is a transitory and reversible state following head injury of sufficient velocity, brevity, and energy, and it is characterized by instantaneous onset, followed by widespread paralytic symptoms and later non-recoverable amnesia, without evidence of structural cerebral injury. The physiological mechanism appears to be an excitation of every neuronal mechanism, followed by a refractory interval varying from neurone to neurone, shortest in the respiratory centre, longest in some parts of the cortical apparatus. The EEG gives evidence that the cortex is primarily affected. The supranuclear mechanisms are also very susceptible. In man, the peculiar amnesia is its chief external sign, accompanied by loss of reactivity, which is its most prominent feature in animals (stunning). The only comparable reaction in man is that produced by electroshock therapy. There is no clear evidence of its identity with blast shock. Many features of concussion are still unexplored.

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The Psychometric Pattern. II. Migraine.

Twenty-five white males, ranging in age from 17 to 33 years, with an average chronological age of 19.6 years, were tested by the complete Wechsler-Bellevue Adult Intelligence Scale in conjunction with neuropsychiatric examination. Each was examined by at least two psychiatrists, and the resulting diagnosis of migraine headache met with general agreement. Data obtained from the test results were analyzed with a view toward determining specific abilities or disabilities on the various subtests and discovering consistencies of function. This was accomplished by considering: (1) The number of patients deviating either positively or negatively on each subtest from their mean weighted scores on all subtests, and (2) the magnitude of the median of these deviations. The mean I.Q. obtained on the full scale was 96.24, $\sigma = 13.80$. The difference between the mean verbal and performance I.Qs. was 2.92 in favor of the performance scale; however, this difference was not statistically significant. When the rank order performance of the migrainous patients on the various subtests was correlated with that of normal subjects, the coefficient was found to be $\rho = +.536$, P.E. = .16. This is larger than that found to exist between neurotics and normals, but smaller than that obtained when the performances of neurotics and migrainous patients are correlated.

The best performance of the migrainous patients was evidenced on tests involving visual motor co-ordination, perceptual discrimination, synthetic and analytical ability, and ability to differentiate essential from non-essential details. Their relatively good performance on the Object Assembly test and relatively poor performance on the Picture Arrangement test were found to be of interest from a clinical standpoint when compared with the observations of other investigators. A discussion of the relationship between the migraine syndrome and the psychoneuroses was presented. (Author's abstr.)

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The Use of the Wechsler-Bellevue Scales with Normal and Abnormal Persons.

The Wechsler-Bellevue Scales have stimulated considerable psychometric research and have supplanted some time-honored diagnostic tools. The reliability and validity of Wechsler's scales, as a whole and in part, have been proved in several studies. The consensus of opinion is that the test correlates highly with some of the best measures of intellect, and that it tends to differentiate better than other measures between the dull and feebleminded. The literature produces a dissenting opinion which is undocumented and statistically unproved. It also tends to narrow the I.Q. range as compared with other tests. There is considerable evidence that the Verbal Scale correlates more highly than the Full Scale or Performance Scale with most intelligence tests. The Verbal Scale compares well with other tests in predicting academic success at the college level; the Performance Scale is practically useless in this respect.

Because of its particular structure as a point scale, the Wechsler-Bellevue is easily adaptable to research in the field of mental deficit in special clinical groups in particular, and to research involving the differentiation of various groups in general. Several approaches, from a statistical and technical view-point, in the analysis of test findings, have been made available. The differentiation of groups by means of their attained mean scores on the various subtests is the most obvious method. This, however, does not take the absolute total score magnitudes into consideration. Ranking the means of subtest scores for groups is a method which circumvents this difficulty. The differences between Verbal and Performance I.Qs. have also been used widely. A difference in favor of the Verbal Scale, following Babcock's rationale concerning the preservation of verbal capacities and the reduction in new learning in deterioration, is probably indicative of some pathological conditions (usually schizophrenia), while a difference in the opposite direction tends to be indicative of psychopathic personality. A verbal dominance

akin to that found in psychopathological conditions may also be found in Southern negro criminals. A more sophisticated method developed deals with intra- instead of interpersonal variations. The deviation of each subtest from the mean of all subtests in the same individual has been used as a yardstick. This method tends to produce some results which are at variance with those obtained with the simpler methods. Special *Indexes* based on ratios between the sums of the scores of some subtests (for schizophrenia and psychopathic personality) and on differences between such combinations (cerebral damage) have also been devised. Several other methods of intra-individual variation have been suggested, but not investigated. It seems to some clinicians that the use of this method in the description and diagnosis of individual cases is possible despite the absence of sufficient statistical support. Such procedure would, to a large extent, be intuitional, and dependent on the degree of clinical insight and experience of the examiner. Variability, according to most investigators, is characteristic of pathological conditions. The data tends to show that the patient's emotional condition and attitude are largely responsible for this variability. A study in which the patients were selected on the basis of their good attitude in the testing situation failed to attain more variability than in normalcy.

The fact remains that the various measures of scatter and variability, the different patterns, have succeeded in differentiating *groups* but not *individuals*. The patterns are characteristic enough of certain groups, but mask the peculiarities of some individuals within those groups. Hence, thus far, on the basis of the Wechsler-Bellevue patterns we have group, but not individual, diagnosis. There is insufficient agreement even in those group differentiations. The studies failed to control all of the most important factors; they controlled some. Hence, variation in findings. Age, race, schooling, intellectual level, cultural background and degree of co-operativeness are major factors which have not been equally controlled in the several studies. For this reason, the results are not comparable. In case of psychopathological material, the diagnostic criteria, which may differ from one institution to another, must also be reckoned with if exact and comparable data is to be produced. Patterns obtained, after the above-mentioned factors are taken into consideration, may achieve a status of a differential diagnostic tool in *individual cases*. In order to achieve this degree of accuracy, the co-operative effort of several institutions may be required. In the meantime, the individual variability analysis and descriptions and the utilization of the broad hints from the group studies have their place in clinical practice. In this connection more qualitative studies of Wechsler-Bellevue responses and more detailed analysis of their content are wanting. Also, the investigation of several factors (based on factor analysis) in different clinical groups and at different age levels, rather than considering the subtests as *functional unities*, is an untapped source of important data.

The psychometric literature, especially dealing with psychopathological material, is lacking in retest data. Long range retest studies are rare. Only a few small attempts in which the Wechsler-Bellevue is employed have been made. Such studies do not only throw some light on the problem of reliability, but also offer more insight into the problem of *patterns*. Quantitative measures of attitude, or behavior schedules administered to patients examined and re-examined, will shed further needed light on concomitant intellectual conditions and psychometric correlates of various behavior and personality disorders. (Author's abstr.)

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The Neuropsychiatric Aspects of Porphyria.

A review of the case-histories outlined above reveals that, in addition to the features of the syndrome of acute porphyria which are already well known, there are others which require emphasis.

The disease occurs with special frequency, if not exclusively, amongst people with severe, neurotic personality disorders. The patients usually appear to be hysterical, except in those instances where organic brain disease clouds the underlying features of the personality. It is probable that the psychoneurosis plays an important part in the pathogenesis of the disease, and in determining the time of onset of the acute attack. Thus, Eldahl has reported a case of acute porphyria in which a psychic insult was thought to have been the releasing factor.

In seven of the ten cases reported here there was a history of major psychosis or serious personality deviation in one or more members of the last three generations of the family. In two of the remaining three cases there was no opportunity to enquire into the family history, so that the incidence of mental disease amongst the relatives of these patients may have been even higher. It is obvious that porphyria occurs in families in which psychiatric disorders run rife.

The peculiarities of the deep tendon reflexes constitute a striking feature of the symptomatology of the acute attack. Other authors have reported cases in which the ankle-jerks were present, while the knee-jerks were absent, but the frequent occurrence of this sign has not been sufficiently stressed. The fact

that the absent reflexes may frequently be elicited if the tendon is repeatedly tapped should be borne in mind, while the phenomenon of summation, in which the reflexes become progressively more active as the tendons are struck, is a distinguishing feature of this disorder. Another peculiarity of the reflexes is their great variability, the degree of their activity varying much from time to time.

Once the porphyriopathic polyneuropathy and degenerative changes in the anterior horn cells have set in, the small muscles of the hands appear to be affected early and with great frequency.

The diagnosis of porphyria without porphyrinuria should be kept in mind in those cases in which the clinical signs and symptoms of the syndrome are not accompanied by the presence of porphyrins in the urine. (Author's abstr.)

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A Case of Stable Modification of the Character of Conditioned Reflex Activity in dogs.

During previous experiments, difficulties were encountered in obtaining complete reversal of a differential stimulus into a positive stimulus. The physiological mechanism of this phenomenon was explained in terms of the inactivity of the initial inhibitory phase of the stimulation process as a result of reversal. The present investigation has been planned to establish the relation of the above-mentioned phenomenon to the stability of the inhibitory connection formed by the stimulus being reversed, or, in other words, to the number of combinations with the inhibitory stimulus effected previous to the reversal. The conclusions are: (1) The relation looked for exists. (2) However, a preliminary intensive training of the inhibitory process by some other form of experiment contributes to the formation of stable inhibitory connections, even if the number of applications of the inhibitory stimulus was not large. (3) After a long training of the inhibitory process, a two-times repeated reversal of a pair of antithetic conditioned stimuli can lead to inertness, though the remaining stimuli of the system applied, which has not been reversed, may continue in action. (4) During this period no attempt to form a delayed conditioned reflex as an experimental means for determining the mobility of nervous processes is successful.

P. WORCHEL (Psychol. Abstr.).

Magnitude of the Conditioned Response as Affected by Extension of the Conditioned Stimulus Over the Period of Action of the Unconditioned Stimulus.

The present investigation extends the work of F. P. Mairov, who demonstrated that a weak stimulus protracted into the period of eating acquires a greater efficiency in evoking the conditioned response. Four dogs were involved in the experiment. Each was made to develop two pairs of food-conditioned responses

to strong and weak stimuli. In one case the strong and the weak stimuli were allowed to continue 5 seconds after food was presented; and in the other, the weak and strong stimuli were extended for 30 seconds, that is, all the time the dog was eating. In two dogs of the strong type, the conditioned stimulus became more efficient by not discontinuing it until eating was over. In dogs of the weak type this rule was overshadowed by the lower limit of working capacity of their cortical cells; and with them the inverse relation was observed in some cases, the conditioned stimulus decreasing in strength when prolonged throughout the eating period.

P. WORCHEL (Psychol. Abstr.).

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Nervous System Dysfunction in Adaptation to High Altitude and as Post-flight Reactions.

Severe nervous dysfunction without circulatory collapse occurred in 0.28 per cent. of a group exposed to a simulated altitude of 38,000 ft. with a constant oxygen supply, either during flight or several hours after reaching ground level. The reactions fall into the following categories: Disturbances of equilibrium and co-ordination, of subcortical mechanisms, or of the large sensory and motor tracts; migraine and symptoms suggesting meningeal irritation and increased intracranial pressure; and disturbances of cortical function in the nature of amnesia, confusion, disorientation, and aphasia. Their causation is obscure. Signs of lesions in the large tracts suggest a vascular origin rather than aero-embolism. The disturbances are not relieved by further administration of oxygen, but they disappear fairly promptly without residuals. No one portion of the nervous system is more vulnerable than another.

M. E. MORSE (Psychol. Abstr.).

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1. Psychiatry and Neurology.

Experimental Alcoholism and Alcoholic Neuritis. Lecoq, Raoul. [Compt. rend. soc. biol., 136, 659-60 (1942).]

Daily treatment of pigeons with alcohol for long periods sometimes produced acidosis and neurotic symptoms and sometimes not, depending on the kind of stock diet used.

L. E. GILSON (Chem. Abstr.).

Recent Researches on Poliomyelitis. Finlayson, M. H. [*Clin. Proc. (S. Africa)*, **3**, 481-5 (1944).]

A brief review.

H. L. WILLIAMS (Chem. Abstr.).

Electroencephalography in the Study of Chronic Behavior Problems. Will, O. A., jun. [*Nav. med. Bull., Wash.*, **44**, 341-52 (1945).]

A survey is made of electroencephalographic findings both of behavior problem individuals and of various types of mental abnormalities. A high percentage of abnormal brain waves is noted both for the mentally ill and for the disciplinary cases, indicating a disturbance of brain physiology. It is suggested that many of the disciplinary cases are mentally ill, and that an electroencephalographic study would be an advisable routine for the more severe disciplinary cases.

G. W. KNOX (Psychol. Abstr.).

Mechanism of Experimental Epilepsy. Parrot, Jean Louis, and Lefebvre, Jacques. [*Compt. rend. soc. biol.*, **137**, 662-4 (1943).]

Dogs lightly anesthetized with chloralose were given an intravenous injection of 1.25 mgm./kgm. of eserine, then the brain was stimulated sufficiently with 110 v.a.c. to produce general epileptiform convulsions. Blood samples taken from the longitudinal sinus of the brain during or shortly after the convulsions contained something that acted like acetylcholine on leech muscle.

L. E. GILSON (Chem. Abstr.).

Nervous and Mental Manifestations Observed in Spontaneous Hypoglycemia. Lieberman, Alan A. [*Elgin Papers*, **5**, 43-51 (1944).]

A patient with spontaneous hyperinsulinism due to pancreatic adenoma, and chronic mental symptoms, responded to surgery of the pancreas with full recovery. Two patients with functional hypoglycemia recovered on a high-protein, low-carbohydrate, moderate-fat diet. Conclusions: Hypoglycemic states may simulate any variety of nervous and mental disorders. Glucose-tolerance studies must be made in cases showing fluctuations in the level of conscious awareness.

T. LAANES (Chem. Abstr.).

2. Anatomy, Physiology, Biochemistry and Pathology.

Influence of Morphine on the Temperature of Cerebral Cortex. Voronin, N. M. [*Farmakol. i Toksikol.*, **7**, No. 4, 3-4 (1944).]

By use of Voronin's technique for introducing a thermocouple into canine cerebral cortex without trauma, the temperature effects of subcutaneous morphine-HCl solution were observed. The dose was 0.01 (unit not stated) per kgm. body weight. In the first 2 minutes after injection the cerebral cortex temperature rises 0.1 or 0.2° but soon begins to drop. Vomiting and unease retard the temperature drop, but after 20-30 minutes the dogs become quiet. The temperature drop continues, more slowly, for 3-5 hours. The observed temperature changes in three dogs were: 38.8 to 36.9° (rectal 38.3 to 37.7°); 39.3 to 36.4 (vaginal 40.3 to 6.9°); 38.7 to 35.2° (vaginal 39.1 to 36.8°). The temperature effect should be duly considered in prescribing morphine.

JULIAN F. SMITH (Chem. Abstr.).

Phlorizin Glucosuria. McKee, F. W., and Hawkins, W. B. [*Physiol. Rev.*, **25**, 255-80 (1945).]

None of the theories to account for the action of phlorizin is satisfactory. The only thing fairly certain is the localization of its action on the epithelial lining of the proximal convoluted tubules, the glucosuria apparently being due to interference with the sugar reabsorption. The effect of phlorizin on various organs (kidney, liver, pancreas, and endocrines) is discussed. Other questions considered include the influence of phlorizin on the total metabolism, as well as the intermediary protein and fat metabolism and mineral metabolism.

S. M. (Chem. Abstr.).

Influence of Hypocapnic Anoxemia on the Effects of Excitation of the Splanchnic Nerve. Grandpierre, R., and Franck, C. [*Compt. rend. soc. biol.*, **137**, 743-4 (1943).]

In dogs under chloralose anesthesia electric excitation of the splanchnic nerve produced a much greater rise in blood pressure when they were breathing air containing only 3-7 per cent. of O₂ than when breathing normal air. The effect is partly nervous, since it occurs in less-marked degree in adrenalectomized dogs, and is partly due to adrenaline discharge. Injected adrenaline produces less effect during hypocapnic anoxemia than normally.

L. E. GILSON (Chem. Abstr.).

Antagonistic Effects of Histamine and a Synthetic Antihistamine, RP 2339. Chauchard, B., and Chauchard, P. [*Compt. rend. soc. biol.*, **137**, 708-9 (1943).]

In a guinea-pig or rat 0.25 mgm. of histamine injected intraperitoneally increases peripheral sensory and motor-nerve chronaxia and cortical chronaxia (depression of central nervous system); 12.5 mgm. of RP 2339 (N-dimethylamino-ethyl-N-benzylaniline) produces exactly the opposite effects. In rabbits, local application of a 1 : 2,000 solution of histamine to the cervical sympathetic system causes a large increase in chronaxia, or even blocks conduction by the preganglionic fibers (sparteine type of action), while a 2.5 per cent. solution of RP 2339 decreases chronaxia and may cause conduction block of the strychnine type. The two drugs together completely neutralize each other. On the postganglionic fibers of the superior cervical ganglion the effects of the individual drugs are the reverse of the effects on the preganglionic fibers, but together they still neutralize each others' effects.

L. E. GILSON (Chem. Abstr.).

Changes of Amino N in the Blood of Mental Patients. Horwitt, M. K. [*Elgin Papers*, **5**, 177-8 (1944).]

Preliminary report. The average basal blood amino N level of 8 young schizophrenic patients was raised from 3.14 to 4.47 after 6 weeks of bi-weekly insulin shock treatments, and it remained at 4.31 (average) 2 weeks after treatment.

T. LAANES (Chem. Abstr.).

Subcortical Epilepsy from Electric Shock. Gley, P., Lapipe, M., Rondepierre, J., Horande, M. H., and Touchard, T. [*Compt. rend. soc. biol.*, **137**, 737-8 (1943); cf. *C.A.*, **36**, 3265¹.]

In dogs 30-60 mgm./kgm. of diphenylhydantoin suppresses the epileptic symptoms ordinarily produced by bipolar electric shock excitation of the sigmoid gyrus of the cerebral cortex. It does not suppress the epileptic tonoclonic convulsions produced by shock from placing one electrode on each temporal region in dog or man.

L. E. GILSON (Chem. Abstr.).

Composition of Bones of Paralytics. Bartolomucci, Ermelindo. [*Folia med. (Naples)*, **27**, 623-32 (1941).]

In order to test the veracity of statements in the literature that nervous disorders cause changes in the skeleton, a study of the bones of paralytics was undertaken and the following conclusions were formulated. The water content varies within normal limits. The Ca and P contents are somewhat less constant than in normal tissue, but the ratio is maintained. The phosphatase action is like that in normal cases. No connection between paralysis and skeletal changes was found. Four cases of poliomyelitis were included.

WILLIAM F. BRUCE (Chem. Abstr.).

Further Investigations on the Recovery of Inhibited Conditioned Reactions. Gellhorn, Ernst. [*Proc. Soc. Exptl. Biol. Med.*, **59**, 155-61 (1945); cf. *C.A.* **37**, 4803¹.]

Further experiments on rats showed that several conditioned reactions which had been established and inhibited in a definite temporal sequence may recover simultaneously under the influence of hypoglycemic coma or convulsions or as the result of electrically induced convulsions. The restitution of inhibited conditioned

reactions is not accompanied by a change in the response of positively established conditioned reactions. Thus insulin coma and electric shock can act specifically on inhibited conditioned reactions without causing dedifferentiation.

L. E. GILSON (Chem. Abstr.).

Influence of Depressants of the Ganglionic Cells of the Autonomic Nervous System on Anaphylactic Shock in Rabbits. Valley-Radot, Pasteur, Mauric, G., and Holtzer, Mme. A. [*Compt. rend. soc. biol.*, **138**, 336-7 (1944).]

The preliminary intravenous injection of nicotine tartrate or sparteine sulfate had no inhibiting influence on the production of anaphylactic serum shock.

L. E. GILSON (Chem. Abstr.).

Action of Anti-epileptics on Convulsions Produced by Electric Stimulation of the Spinal Cord. Gley, P., Lapipe, M., Rondepierre, J., Horande, M. H., and Touchard, T. [*Compt. rend. soc. biol.*, **138**, 231-2 (1944).]

One electrode was placed on the back of the neck of a rat or guinea-pig and one on the base of the tail. The application of 110 v. (a.c.) for $\frac{1}{4}$ second produced tonic followed by clonic convulsions. Phenobarbital, 0.2 gm./kgm., and diphenylhydantoin, 0.4 gm./kgm., both suppressed these convulsions, although it is known that these two drugs do not act alike on various other nervous reactions.

L. E. GILSON (Chem. Abstr.).

Effect of Histamine and a Synthetic Antihistamine (RP 2339) on Visceral Excitability. Chauchard, B., and Chauchard, P. [*Compt. rend. soc. biol.*, **138**, 219-20 (1944); cf. *C.A.*, **39**, 3587*.]

When injected intravenously in dogs or intraperitoneally in rats and guinea pigs, histamine decreases the chronaxie and summation time of the intestine and uterus while N-dimethylaminoethyl-N-benzylaniline (RP 2339) produces the opposite effects. On the heart the actions of the two compounds are reversed. In each of these three cases the two compounds antagonize each other. But both compounds decrease the summation time of the splanchnic vasoconstrictor nerves and increase the summation time of the splanchnic vasodilators, and both have a constrictor action on the muscles of blood vessels, both excite the adrenal medulla, and both decrease the chronaxie of striated muscles.

L. E. GILSON (Chem. Abstr.).

Chronaximetric Study of Electric Shock. Chauchard, B., and Chauchard, P. [*Compt. rend. soc. biol.*, **138**, 158-9 (1944).]

Convulsions were produced in rabbits by application of 90-100 v. (a.c.) to the head. The central nervous system showed a very large increase in chronaxie and the peripheral nerves showed a slight decrease. These effects are like those observed in convulsions produced by insulin or metrazole.

L. E. GILSON (Chem. Abstr.).

Electrophysiology and Pharmacodynamics of Experimental Epileptic Convulsions. [*Ibid.*, 318-19.]

The effects of electric shock, metrazole, diphenylhydantoin, phenobarbital, and chloralose on the chronaxie of the central nervous system are discussed.

L. E. GILSON (Chem. Abstr.).

The Pathological Affinities of Beri-beri and Poliomyelitis. McCormick, W. J. [*Med. Record*, **157**, 414-19 (1944).]

A marked resemblance in the epidemiology, symptomatology and pathology of beri-beri and poliomyelitis is cited in support of the author's hypothesis of vitamin B deficiency as the basic etiological factor in poliomyelitis.

RUTH BERGGREN (Chem. Abstr.).

Antidiuretic Material in the Supraoptic Nucleus. Melville, Eleanor V., and Hare, Kendrick. [*Endocrinology*, **36**, 332-9 (1945).]

As judged by application of the method described in the preceding abstract, the supraoptic region of the hypothalamus of a 6.6-kgm. dog contains water-

soluble antidiuretic substances equivalent to 1.5-5 units of pituitrin. Degeneration of the supraoptic nuclei resulting from hypophysectomy or surgical transection of the pituitary stalk is attended by a severe loss of this material.

KATHRYN KNOWLTON (Chem. Abstr.).

The Effect of Electrical Stimulation of the Vagosympathetic on the Frog Lung. Brecht, K., and Fraessle, K. [*Arch. ges. Physiol. (Pflüger's)*, **247**, 649-59 (1944).]

Electrical stimulation of the vagosympathetic caused contraction or tension of the smooth musculature of the lung. Since the lung is more sensitive to acetylcholine than the heart it responded to a weaker stimulus. The contraction resulted from stimulation of vagus fibers with release of acetylcholine. The tension resulted from stimulation of sympathetic fibers with an adrenaline effect.

H. L. MASON (Chem. Abstr.).

The Influence of Carbon Dioxide Tension on the Bio-electric Phenomena of the Cerebral Cortex. Kornmüller, A. E., and Noell, W. [*Arch. ges. Physiol. (Pflüger's)*, **247**, 660-85 (1944); cf. *C.A.*, **38**, 2112'.]

The effect of hypocapnia on the action current, the spontaneous potential variations, and the convulsion current indicated an increased excitability of the cerebral cortex. Increased CO₂ tension stimulated certain rhythmic processes but decreased nerve sensitivity.

H. L. MASON (Chem. Abstr.).

The Effect of Oxygen Deficiency on the Cerebral Cortex: A Bio-electric Study. Noell, W., and Kornmüller, A. E. [*Ibid.*, 685-712.]

A general hypoxemia or local KCN poisoning caused increased excitability of the cerebral cortex. This effect was not due to lowered metabolism, since local cooling had none of the effects of hypoxemia.

H. L. MASON (Chem. Abstr.).

The Influence of Carbon Dioxide on the Effect of Oxygen Deficiency. Kornmüller, A. E., and Noell, W. [*Ibid.*, 713-22.]

The effects of hypoxemia were specific, and were not due even in part to the accompanying hypocapnia. Increased CO₂ tension did not modify the effects of severe hypoxemia, but when the hypoxemia was moderate, a high CO₂ tension reversed the effect of hypoxemia and had the effect on the cerebral cortex of CO₂ alone. No evidence was found for a central sensitization by CO₂ in the presence of O deficiency.

H. L. MASON (Chem. Abstr.).

The Blood Flow and Oxygen Supply of the Brain. IV. The Role of Carbon Dioxide. Noell, W., and Schneider, M. [*Arch. ges. Physiol. (Pflüger's)*, **247**, 514-27 (1944); cf. *ibid.*, **246**, 181 (1942).]

A quantitative description of the effect of CO₂ on the blood flow of the brain of dogs was obtained from determinations of the arteriovenous O difference and arterial and venous CO₂ and O tensions. In the physiological range a small change (e.g., 2 mm.) in alveolar CO₂ tension caused a relatively large (8-10 per cent.) change in blood flow. As the CO₂ tension was decreased the blood flow decreased, but not below a rate which was necessary to maintain the venous O tension at 19 mm.

H. L. MASON (Chem. Abstr.).

V. The Effect of Lowered Blood Pressure. Noell, W. [*Ibid.*, 528-52.]

With an initially good blood flow through the brain the blood flow varies linearly with the blood pressure while the vessels remain passive. When the pressure falls to about 90 mm., however, vasodilation occurs. In the presence of a greatly decreased blood flow as the result of hypocapnia, a very small fall in blood pressure results in vasodilation. The vasodilation is not related to the CO₂ tension of the tissues, but more probably to the O demand of the tissues.

H. L. MASON (Chem. Abstr.).

VI. Influence of Hypoxemia and Anemia. [*Ibid.*, 553-75.]

The vascular constriction which results from hypocapnia is reversed sufficiently by reduction of arterial O tension so that the venous O tension does not fall too

low. With good blood flow and high alveolar CO_2 , vascular reaction to lowered arterial O tension first becomes evident when the venous O tension falls to 20–30 mm. When venous O tension falls below 20 mm. blood flow increases rapidly, and at 10–12 mm. is three times normal. Decreased O capacity due to removal of erythrocytes increases blood flow. With a normal arterial O tension a small lowering of the venous O tension, which is evidence of an O deficit in the tissues, causes the same vasodilation as a large fall in arterial O tension. The hypoxemia resulting from ascent to 7,500–8,000 m. causes the same marked vascular reaction as reduction of the blood pressure to 60–70 mm., or reduction of hemoglobin to 10–12 per cent. by loss of erythrocytes, or, if the viscosity is maintained without loss of erythrocytes, by reduction of hemoglobin to 36 per cent.

H. L. MASON (Chem. Abstr.).

Heat Regulation After Section of the Cervical Spinal Cord. Issekutz, B., Jr. [*Arch. ges. Physiol. (Pflüger's)*, **247**, 204–21 (1943).]

During 2–3 days after section of the 7th cervical segment the O consumption by the hind legs of dogs decreased when the nose and neck were cooled. Later, the O consumption increased in response to the stimulus. Cooling one hind leg of a normal, lightly narcotized dog increased O utilization of both legs; warming decreased it. This reaction was abolished temporarily by section of the cord. It returned in 3–5 days, but the increase of O consumption of the one leg due to cooling of the other occurred only when the rectal temperature fell 0.5–1.0°.

H. L. MASON (Chem. Abstr.).

Relative Effects of Androgen upon the Mating Behavior of Male Rats Subjected to Forebrain Injury or Castration. Beach, F. A. [*J. exp. Zool.*, **97**, 249–95 (1944).]

The mating responses of 24 male rats with demonstrated preoperative sexual vigor were tested after castration, unilateral hemidecortication, unilateral hemidecortication plus castration, and bilateral decortication with and without castration. If copulation with a receptive female was absent after operation, an average of .5 mgm. of testosterone propionate per day was injected until copulation returned or until 20–25 mgm. had been administered. Small amounts of the hormone revived the incomplete mating responses, which survived 90 days after castration, so that the copulatory reaction returned; ejaculation returned after the administration of larger doses. In some cases androgen, in amounts greater than was required for castrates, was required to restore the mating responses in hemidecorticates. Hemidecorticated castrates showed even less postoperative sexual responsiveness and required still greater amounts of androgen. Complete bilateral decortication with or without castration permanently eliminated copulatory behavior; although the hormone administration led to increased responsiveness, copulation did not occur even after 20 mgm. It is suggested that a "central excitatory mechanism" indicates a "copulatory threshold" which is raised or lowered by the presence of absence testicular hormone.

L. C. MEAD (Psychol. Abstr.).

Deficient Efferent Innervation of the Extremities Following Removal of Neural Crest in Amblystoma. Yntema, C. L. [*J. exp. Zool.*, **94**, 319–46 (1943).]

Embryos of *Amblystoma punctatum* were subjected to bilateral removal of the crest of the neural folds in stages 15 or 16. The effects of this operation were determined by histological examination following a classification of the extent of limb movements. It is concluded: "(1) Extensive removal of the neural crest frequently results in fore and hind limbs with deficient motor innervation. These limbs are not functional. In complete absence of nerves, the muscles of the limb are atrophic. (2) Limbs with an adequate motor supply, but no sensory supply, are functional. (3) In non-functional limbs, the posture may be determined by muscles which are innervated and normal. (4) The motor fibers appear to depend on presence of early sheath cells to reach and penetrate the extremities, and establish a complete distribution. (5) The number of primary motor fibers is not appreciably reduced in absence of neural crest. The variations in the size of the motor roots in the experimental animals are dependent upon the number of secondary fibers present."

L. C. MEAD (Psychol. Abstr.).

Further Experimental Evidence Against "Neurotropism" in Nerve Regeneration. Weiss, P., and Taylor, A. C. [*J. exp. Zool.*, **95**, 233-57 (1944).]

The theory of neurotropism (regenerating nerve fibers are attracted by degenerating nerve) is contradicted by these experiments. Nerves in the rat were allowed to regenerate in forked arteries, the branches of which confronted the outgrowing fibers with alternative routes. These led either into blind channels or channels containing degenerated nerve, tendon, or fat tissue. It was found that the regenerating nerve fibers "(1) grew into blind channels with the same density and orientation as into channels containing degenerated nerve; (2) were never deflected from their course toward channels containing supposedly 'neurotropic' agents; (3) approaching the entrance of a degenerated nerve have shown no tendency to converge upon it." The results also suggested that fibers connected with a functional periphery may grow to a larger diameter than fibers not so connected.

L. C. MEAD (Psychol. Abstr.).

Resorptive Action of Mustard Gas on the Central Nervous System. (1) *Dynamics of Chronaxia in Cerebral Cortex After Applying Mustard Gas to the Skin.* Levitina, G. A., and Palatnik, S. A. [*Farmakol. i Toksikol.*, **7**, No. 3, 60-3 (1944).]

Chronaxia (1) of the cerebral motor area in rabbits was determined before and after application of a lethal dose (LD) of mustard gas (100-115 mgm./kgm.) to a shaved patch (8 x 8 cm.) of dorsal skin, or 4 x 4 cm. for $\frac{1}{2}$ and 3 x 3 cm. for $\frac{1}{4}$ the LD. The poison increases (1), i.e., it decreases the functional lability of cerebral cortex cells. Thus, of 9 rabbits given the LD the increase of (1) in 6 rabbits after a latent period of 13-48 minutes was 10-60 per cent.; in the other 3 (latent period 10-30 minutes) an initial small decrease in (1) was followed by an increase. Of 5 rabbits given $\frac{1}{4}$ the LD the increase in (1) (latent period 12-38 minutes) was 10-40 per cent. in 3; in the other 2 a small initial decrease was followed by an increase.

JULIAN F. SMITH (Chem. Abstr.).

Influence of Aniline on Permeability of the Hemato-encephalic Barrier. Shakhnovskaya, S. B. [*Farmakol. i Toksikol.*, **7**, No. 3, 59-60 (1944).]

In tests with white mice both acute and chronic PhNH₂ poisoning often raised the permeability of the hemato-encephalic barrier to intravenously injected 1 per cent. trypan blue solution (10 c.c./kgm.). Topographic distribution of the dye in the brain differed; acute poisoning gave preferential staining of the cortex, whereas in chronic poisoning the dye went mainly to the periventricular and nerve-stem areas. Restoration of the hemato-encephalic barrier was faster after acute than after chronic poisoning. Test mice were poisoned by inhalation of PhNH₂ vapor.

JULIAN F. SMITH (Chem. Abstr.).

Vagotonin and Central and Peripheral Nervous Excitability Chauchard, B., and Chauchard, P. [*Compt. rend. soc. biol.*, **137**, 631-2 (1943).]

The intra-peritoneal injection of 1 mgm. of vagotonin in guinea pigs produces first a decrease in central and peripheral nerve chronaxia, indicating excitation, then, 20-30 minutes after the injection, a decrease in chronaxia throughout, indicating depression. Between these stages there is a period during which cortical chronaxia is still decreased while peripheral chronaxia is increased. The same effects are produced in lightly anesthetized guinea-pigs. These effects are different from the effects of insulin on chronaxia.

L. E. GILSON (Chem. Abstr.).

Pigmentary Changes in the Nervous System. Formation of Pigments (Autogenous Pigments). Casal, P. [*Compt. rend. soc. biol.*, **138**, 95-6 (1944).]

The melanin, lipofuscins and Spatz pigment of nerve tissue are discussed.

L. E. GILSON (Chem. Abstr.).

Pigmentary Changes in the Nervous System. Pigment Deposits (Exogenous Pigments). Elimination and Disintegration. [*Ibid.*, 116-17.]

Discussion. Pigments formed by decomposition of blood hemoglobin are often deposited in nerve tissue, but they do not remain there indefinitely.

L. E. GILSON (Chem. Abstr.).

The Central Nervous Regulation of the Protein Metabolism. Schrade, W., and Roester, L. [*Klin. Wochschr.*, **22**, 390-1 (1943); *Chem. Zentr.*, **2**, 735 (1943); cf. *C.A.*, **38**, 2379⁹.]

Insufflation of air into the brain ventricle of rabbits after occipital puncture resulted in a primary considerable lowering of the rest N within a minimum 2-3 hours after the onset (in one case a reduction from 41 to 13 mgm. per cent.). This was followed by an increase to an average of 32 per cent. above normal. The entire reaction disappeared after 12-24 hours. Schrade and Roester discuss the extent to which the shock occasionally observed after the central stimulation by air, or the action on the heat center (made evident by a primary temperature fall and occasionally a secondary temperature rise), are involved in the development of the reaction. A nearly 50 per cent. decrease in the urinary N excretion occurred through the central stimulation. Especially the 2nd phase of the reaction, the rest-N increase, is assumed to be independent of the heat center.

RUTH BERGGREN (Chem. Abstr.).

Cytochrome Oxidase in Normal and Regenerating Neurons. Howe, Howard A., and Mellors, Robert C. [*J. Exptl. Med.*, **81**, 489-500 (1945).]

Manometric determinations of cytochrome oxidase (I) activity were carried out on gray matter from the thalamus (II) and anterior horn (III) of cats and monkeys under various experimental conditions. The (II) of the cat was studied following the degeneration of virtually all the thalamic neurons secondary to decortication. In comparing the deneuronated (II) with the normal (II), it was found that approximately 34 per cent. of the (I) activity was contributed by the neurons and the balance by neuroglia and mesodermal tissues, which on the operated side remained comparable to that of the normal side. Total activity of the normal (II) averaged 5.52 units per mgm. of dry weight where 1 unit is defined as the amount of (I) required to produce a net O consumption of 10 c.c./hr. under the specified conditions of the experiment. The gray matter of the (III) of the spinal cord was isolated by a special technique, and its (I) activity was compared with (III) in which motoneurons had been stimulated to regenerative activity by section of peripheral nerves. Average normal levels of 2.23 units were found for cat (III) and 0.69 unit for monkey. Reductions of (I) activity in the range of 22-23 per cent. were observed for both cat and monkey following nerve section. The maximum reduction of (I) activity coincided with maximum refractoriness of the cells to poliomyelitis virus (30 to 70 days following nerve section). Neither of these states could be correlated in time with maximum chromatolysis (10 to 15 days).

C. J. WEST (Chem. Abstr.).

Regenerative Cycle of Motoneurons with Special Reference to Phosphatase Activity. Bodian, David, and Mellors, Robert C. [*J. Exptl. Med.*, **81**, 469-88 (1945).]

Experiments are reported on the determination of the possible changes in, and localization of, acid phosphatase activity in motor nerve cell undergoing axon regeneration.

C. J. WEST (Chem. Abstr.).

Action of Quinine-HCl on Subordination and Chemically Stimulated Reflexes. Lapique, Marcelle. [*Compt. rend. soc. biol.*, **137**, 343-4 (1943); cf. *C.A.*, **18**, 2204.].

The influence of quinine-HCl on nerve reactions in frogs and toads was studied. The effects were slight and irregular.

L. E. GILSON (Chem. Abstr.).

Changes of Noble-metal Electrode e.m.f. of Cerebral Cortex. McCulloch, W. S., Klein, J. R., and Goodwin, C. [*Proc. Soc. Exptl. Biol. Med.*, **58**, 292-3 (1945).]

One noble-metal, one glass, and two Ag-AgCl saline-wick electrodes were placed close together on the cerebral cortex of a cat. The e.m.f. between each pair of electrodes was measured and in some experiments recorded continuously. The electric hook-up is shown. When the effect of ether used for operation had passed off in cats curarized with dihydro- β -erythroidine-HCl by continuous infusion, and under constant artificial respiration, the e.m.f. of glass and noble-metal remained practically constant. The d.c. voltages between wick electrodes were

less than 1 mv. The e.m.fs. of noble-metal electrodes (Pt, Au, Ta) and C were not significantly different, and were most frequently between 0.14 and 0.15 v. positive to the theoretical H electrode referred to which the Ag-AgCl wick electrode is 0.27 v. positive. Alteration of composition of respired gas from 100 per cent. O₂ to 4 per cent. of O₂ in N₂, although it altered the O₂ tension of the cortex by a factor of 4, did not affect the e.m.f. of either glass or noble-metal electrodes. Intravenous injection of glucose was similarly without effect. Injection of adrenaline decreased the e.m.f. of glass and noble-metal electrode; breathing 5 per cent. CO₂ in O₂ increased both. Cessation of artificial respiration produced an increase in the e.m.f. of the glass electrode and a decrease in that of the noble metal. When air was readministered at the end of 3 minutes both electrodes overshot their original e.m.f. and returned slowly. The equivalence of noble-metal electrodes and that they are noble suggest that *in vivo* as well as *in vitro* the observed e.m.f. measures an oxidation-reduction potential. Its value is in the range of the hemochromogens. Since in computing oxidation-reduction potentials the log of the ratio of oxidant to reductant and the log of the concentration of H⁺ enter with the same sign, changes of both noble-metal and glass-electrode potential in the same direction may only indicate that the system communicating with noble-metal electrodes includes H⁺, and one cannot conclude that the change involves any other significant alteration in the oxidant-reductant ratio. But the large changes seen upon cessation of respiration are opposite in sign, implying a great change in this ratio. For this reason, alterations of e.m.f. of noble-metal electrodes may indicate chemical alterations which have escaped other methods of synchronous detection.

L. E. GILSON (Chem. Abstr.).

Peripheral Mechanism of Pain. Mediation of Histamine in Sensations of Burning and Itching. Parrot, Jean L. [Compt. rend. soc. biol., 137, 620-1 (1943).]

In human subjects, previous ingestion of 0.2 gm. of N-dimethylaminoethyl-N-benzylaniline (RP 2339) decreased the sensitivity of the skin to the sensation of burning when the finger was plunged into hot water, and also decreased the itching sensation produced by intradermal microinjection of histamine, and by other methods of skin irritation. This indicates that histamine is a mediator in these pain sensations.

L. E. GILSON (Chem. Abstr.).

Sensitivity of Nerve Tissue Cultivated in vitro to 2, 4-Dinitrophenol. Verne, Jean. [Compt. rend. soc. biol., 136, 635-6 (1942); cf. C.A., 38, 4628⁷.]

Although fibroblasts grow normally in the presence of dinitrophenol, 1 : 90,000, nerve fibers and neuroblasts undergo degeneration in presence of concentrations higher than 1 : 160,000. By repeated subculturing in media containing increasing concentrations of dinitrophenol neuroblasts are enabled to tolerate a 1 : 120,000 concentration.

L. E. GILSON (Chem. Abstr.).

Excitability Changes at the Neuromuscular Junction During Tetany. Kuffler, Stephen W. [J. Physiol., 103, 403-11 (1945); cf. C.I., 38, 2752⁷.]

Experimental tetany was produced in cats by thyroparathyroidectomy and in frogs by parathyroidectomy, and by reduction of ionized Ca in the blood stream. The effect of tetany on the neuromuscular system was studied, and it is suggested that the symptoms of tetany are a result of lowering of the threshold at synapses and end plates. The severity of symptoms was not directly related to the degree of blood-Ca reduction.

H. L. WILLIAMS (Chem. Abstr.).

Some Rarer Forms of Mental Deficiency. (1) *Phenyl-pyruvic Oligophrenia.* Medlicott, R. W. [New Zealand Med. J., 43, 191-4 (1944).]

A review including the biochemical aspects of this disease and a report of two cases.

RUTH BERGGREN (Chem. Abstr.).

The Elimination of Phenylpyruvic Acid by Mentally Deficient Individuals. Brugger, C. [Schweiz. med. Wochschr., 73, 967-9 (1943); Chem. Zentr., 1, 1104 (1944).]

The close relatives of a 16-year-old imbecile did not eliminate phenylpyruvic acid in the urine, in some cases even after feeding *l*-phenylalanine.

W. H. FISHMAN (Chem. Abstr.).

The Cerebrospinal Syndrome in Brucellosis. Videla, Carlos Alberto, and Giudice, Carlos R. [*Rev. asoc. bioquim. argentina*, **12**, 15-28 (1945).]

The cerebrospinal fluids of 10 light cases of brucellosis have shown hypertension, a slight increase in glucose, and an indication of meningitis in the colloidal benzoin reaction. Chloride and albumin contents and the Lange reaction were normal.

F. FROMM (Chem. Abstr.).

The Occurrence of Lactoflavin, Nicotinamide, and p-aminobenzoic Acid in Cerebrospinal Fluid. Abderhalden, Rudolf, and Elsaesser, Karl H. [*Arch. ges. Physiol. (Pflüger's)*, **247**, 325-35 (1943).]

Lactoflavin (I) could not be detected in free or combined form in human spinal fluid. The blood-spinal fluid barrier appeared to be impermeable to (I) but, injected cisternally, (I) disappeared rapidly from the spinal fluid. (I) added to spinal fluid *in vitro* was destroyed much more rapidly by ultraviolet light than (I) in aqueous solution. Spinal fluid contained 0-120, average 69 γ per cent., of nicotinamide (II). Nicotinic acid and codehydrase were not detected. Parenteral administration of (II) increased the concentration in the spinal fluid. Cisternally injected (II) disappeared within 12 hours. *p*-Aminobenzoic acid could not be detected in the spinal fluid in normal persons or after intravenous injection.

H. L. MASON (Chem. Abstr.).

Determination of Protein in Cerebrospinal Fluid. Nagel, W. [*Schweiz. med. Wochschr.*, **73**, 1299-1300 (1943).]

The advantages of Kafka's method (*cf. C.A.*, **27**, 744-5), using the centrifuge, include simplicity and the small quantity of fluid necessary for testing.

MAURICE M. RATH (Chem. Abstr.).

Ca Content of Human Serum and Cerebrospinal Fluid. Neto, Bento Magalhães. [*Anais soc. biol. Pernambuco*, **5**, 3-6 (1944).]

The average minimum and maximum Ca contents of 15 human serums and cerebrospinal fluids were: 9.37 (5.86-11.83) and 5.06 (3.73-6.00) mgm./100 c.c., respectively.

BRUNO VASSEL (Chem. Abstr.).

The Effect of Breathing Pure O on the N Dissolved in the Cerebrospinal Fluid. McArdle, B. [*J. Physiol.*, **103**, 35-6P (1945).]

The rate of disappearance of the N was such as to suggest its complete disappearance in about 6 hours. Approximately half of the N was removed in 40 minutes.

H. L. WILLIAMS (Chem. Abstr.).

Comparison of the Effects of Pyridoxine and Pantothenic Acid Deficiencies on the Nervous Tissues of Swine. Follis, Richard H., Jr., and Wintrobe, Maxwell M. [*J. Exptl. Med.*, **81**, 539-52 (1945).]

When pigs were fed diets deficient in pyridoxine or pantothenic acid, ataxia developed and lesions were found in the sensory neurons. The morphological pattern of the lesions differed in the early stages of the two deficient states. Degeneration of the peripheral process of the sensory neurons was the initial and most prominent feature in pyridoxine deficiency. Chromatolysis was the first evidence of damage to the afferent neurons in pantothenic acid-deficient animals.

C. J. WEST (Chem. Abstr.).

Changes in the Hypophysis During Avitaminosis. Giroud, C. A., and Desclaux, P. [*Compt. rend. soc. biol.*, **138**, 315-16 (1944).]

Histological, on guinea-pig hypophysis.

L. E. GILSON (Chem. Abstr.).

Antipolyneuritic Value of Different Breads According to the Degree of Extraction of the Wheat in Flour Making. Mouriquand, G., Coisnard, J., and Edel, Mme. V. [*Compt. rend. soc. biol.*, **137**, 565-6 (1943).]

Pigeons fed exclusively on bread made from fine white flour representing a 70 per cent. extraction of the grain developed polyneuritic symptoms on the 35th day. Those fed bread made from flour of 85 per cent. or higher extraction appeared quite healthy on the 370th day (termination of experiment).

L. E. GILSON (Chem. Abstr.).

Protective Power of Different Breads in a Diet Otherwise Completely Deficient in Vitamin B Complex. [*Ibid.*, 566.]

Pigeons were fed a mixture of heated polished rice 2 parts and bread 3 parts. With bread from flour of only 70 per cent. extraction they showed the first symptoms, a decrease in vestibular chronaxia, after 25-27 days. On a straight rice diet this occurs after 17-25 days. With bread from flour of 85 per cent. extraction the pigeons showed a decrease in vestibular chronaxia on the 41st day but no polyneuritis on the 140th day (end of experiment). With bread from flour of 98 per cent. extraction they showed possible slight symptoms on the 62nd day.

L. E. GILSON (Chem. Abstr.).

Studies on the Metabolism of Nicotinic Acid in the Horse. Pearson, P. W., and Luecke, R. W. [*Arch. Biochem.*, 6, 63-8 (1945); cf. *C.A.*, 38, 4013³.]

Weanling Shetland ponies were observed to make normal growth on a diet containing 0.1 mgm. nicotinic acid (I) per kgm. body weight. More (I) was excreted in the urine and in the feces than was ingested when the ponies were fed a diet containing 0.01 mgm. (I) per kgm. body weight. Neither trigonelline nor N-methyl-nicotinamide was found in the urine.

VERNON L. FRAMPTON (Chem. Abstr.).

Action of Thiamine on Nerve Centers and the Oculopalpebral Reflex. Meidinger, F. [*Compt. rend. soc. biol.*, 137, 600-1 (1943).]

In rabbits the intravenous injection of 0.04 gm./kgm. of thiamine produces a suppression of the oculopalpebral reflex almost as prolonged as that produced by an equal weight of morphine-HCl.

L. E. GILSON (Chem. Abstr.).

Infiltrative Lesions of the Brain During Experimental Avitaminoses A and B₁ in the Rat. Bertrand, Ivan, Chauchard, Paul, and Mazoué, Henriette. [*Compt. rend. soc. biol.*, 136, 716-17 (1942).]

The lesions described appeared 50-90 days after rats were deprived of either vitamin A or thiamine.

L. E. GILSON (Chem. Abstr.).

Disturbances of Neuromuscular Excitability During Dietary Imbalance and Avitaminoses. II. Role of Acidosis and Variations in Blood Sugar in the Changes in Chronaxia Observed During Total B-complex Avitaminosis in Pigeons and Thiamine Deficiency in Rats. Lecoq, Raoul, Chauchard, Paul, and Mazoué, Henriette. [*Bull. soc. chim. biol.*, 26, 79-93 (1944); cf. *C.A.*, 38, 2364⁴.]

The progressive change in chronaxia in rats deprived of thiamine differs from that in pigeons deprived of thiamine by a preliminary increase in nerve chronaxia without change in muscle chronaxia. Muscle chronaxia increases later. The same order of changes occurs in pigeons deprived of the entire vitamin B complex. After several days the chronaxia of both muscles and nerves decreases in all cases. The avitaminotic animals develop acidosis and hypoglycemia, which later changes to hyperglycemia. Effects of administration of NaHCO₃, glucose, and insulin at different stages of avitaminosis are discussed.

L. E. GILSON (Chem. Abstr.).

Chronaxial Signs of Hypervitaminoses. Chauchard, Paul. [*Compt. rend. soc. biol.*, 137, 429-30 (1943).]

Rats were given subcutaneous injections of the vitamins. Repeated large doses of vitamin A produced decreases in nerve and muscle chronaxia and excitation of the central nervous system. 2 mgm. of thiamine or 50 mgm. of nicotinamide caused increases in all chronaxias and nervous depression of central origin. 50 mgm. of ascorbic acid decreased muscle chronaxia, increased nerve chronaxia, and depressed the central nervous system. These effects are like those of alkalosis. Vitamin D, 800 I.U., increased nerve and muscle chronaxia and produced symptoms of hypercalcemia. In most cases a second injection of vitamin D caused a transient return to normal chronaxia followed by an increase as before.

L. E. GILSON (Chem. Abstr.).

What is the Antineuritic Vitamin? Wintrobe, Maxwell M., Miller, Mitchell H., Follis, Richard H., Jr., and Stein, Harold J. [*Trans. Assoc. Am. Physicians*, **57**, 55-9 (1942); *cf. C.A.*, **36**, 7081^a.]

Sensory neuron degeneration developed in young pigs only when they were deprived of pyridoxine or pantothenic acid. Induced thiamine deficiency resulted in vomiting, anorexia, impaired growth, and elevated blood pyruvic acid, but failed to produce nerve degeneration.
H. L. MASON (Chem. Abstr.).

Studies on Choline Deficiency in Dogs. McKibbin, J. M., Ferry, R. M., Jr., Thayer, S., Patterson, E. G., and Stare, F. J. [*J. Lab. Clin. Med.*, **30**, 422-8 (1945); *cf. C.A.*, **39**, 731^a.]

The feeding of choline to choline-deficient dogs rapidly produces an increase in food consumption and weight, withdrawal of lipide from the liver, and improvement in liver function as shown by bromosulfalein elimination, plasma cholesterol, and prothrombin time tests. Determinations of creatine or creatinine excretion or of the excretion of methylated nicotinic acid derivatives are of doubtful value in testing the Me reserves of dogs, since excretion of these compounds does not appear to be influenced by choline deficiency.
A. E. TEBBI (Chem. Abstr.).

The Microbiological Determination of Choline. Siegel, Louis. [*Science*, **101**, 674-5 (1945).]

The method of Horowitz and Beadle (*C.A.*, **38**, 391^a) based on the growth response of a *choliness* mutant of *Neurospora crassa* gave erroneous results. By using fritted glass filters (30 ml.) of medium porosity, quantitative removal and washing of the mold growth are easily effected. The relation between the dry weight of the mold and choline concentration is then consistently linear. The dry weight of mold for a given choline concentration is reproducible within ± 2 per cent. Tests on biological materials gave good agreement with different assay levels.
E. D. WALTER (Chem. Abstr.).

Acetylcholine Transmission at Nerve Endings. Singh, Inderjit, and Sehra, K. B. [*Current Sci.*, **14**, 72-3 (1945).]

The stomachs of certain frogs were found to be insensitive to otherwise effective concentrations of acetylcholine (I) even after treatment with eserine. The same was also found true of their hearts, but the rectus abdominis was sensitive; potency of solutions was proved by this as well as by tests on dog stomach and rabbit intestine. Refractory hearts were inhibited on stimulation of the vagus nerve, and refractory stomachs responded to direct electric stimulation. In some cases (I) produced temporary inhibition of the heart, followed by augmentation, then a return to normal in the presence of (I); refractoriness was retained on perfusion with strong fresh (I), but was lost when (I) was alternated with Ringer. Vagus stimulation was still effective in presence of acquired refractoriness to (I). Strong solutions (1 in 10⁵) of (I) might produce augmentation of contractions, hyperirritability, even contracture of the frog heart. Inhibitory effect of (I) on heart was augmented by increase in initial length of the fibers (increased perfusion pressure). Small concentrations of (I) enhanced response of frog stomach to electric stimulation (*cf. Singh, C.A.*, **34**, 173^a).

E. D. WALTER (Chem. Abstr.).

Effect of Amino Acids on Acetylcholine Synthesis. Torda, Clara, and Wolff, Harold G. [*Proc. Soc. Exptl. Biol. Med.*, **59**, 181-3 (1945); *cf. C.A.*, **39**, 1918^a, 1927^a.]

Low concentrations of most of the amino acids and of carnosine, glutathione and creatine increased the synthesis of acetylcholine by minced frog brain; glycine, leucine and creatinine had no influence, and NH₃ had a retarding action.

L. E. GILSON (Chem. Abstr.).

Effect of some Isocyclic, Aromatic and Heterocyclic Compounds on Acetylcholine Synthesis. [*Ibid.*, 183-4.]

The synthesis of acetylcholine by frog brain was not significantly affected by low concentrations of cyclohexane, inositol, C₆H₆, toluene, C₁₀H₈, and BzOH.

Hydroquinone, PhOH, *p*-aminophenol, salicylic acid, α - and β -naphthol, BzH, camphor, and penicillin decreased the synthesis in concentrations of 10^{-5} M or higher. Conjugated products (K phenolsulfonate, phenacetin, diphenylamine, benzidine, acetylsalicylic acid, and the sulfonamides) either did not modify the synthesis or decreased it slightly. Indole, skatole, quinoline, and carbazole decreased synthesis more or less, 3-indoleacetic acid was nearly inactive, *dl*-tryptophan was inactive, and natural tryptophan increased the synthesis. Penicillin decreased the synthesis because being an unsaturated ketone it can react with the SH group, an active group of the enzyme involved in the synthesis of acetylcholine.

L. E. GILSON (Chem. Abstr.).

Effect of Fatty Acids on Acetylcholine Synthesis. [*Ibid.*, 246-8.]

The synthesis was not modified by presence of glycerol, AcOH, Me₂CO, and palmitic, stearic, and acetoacetic acids. It was increased by butyric, propionic, valeric, and caproic acids, and decreased by formic, caprylic, capric, lauric, oleic, and linoleic acids and by AcH, glyceraldehyde, and β -hydroxybutyric acid.

L. E. GILSON (Chem. Abstr.).

Curare Superimposed on the Vascular Effects of Acetylcholine and Adrenaline. de Moraes, J. Lacaz. [*Anais faculdade med. univ. S. Paulo*, 20, 191-200 (1944).]

In the isolated rabbit ear perfused with Ringer-Locke solution curare (2 c.c. of 1 per cent. solution) abolished the effects of adrenaline (1 : 1,000) and of acetylcholine (1 : 10,000).

B. V. (Chem. Abstr.).

Interference of the Local Dilating Effect of Acetylcholine with Central Nervous Vasoconstriction in the Peripheral Vascular System. Mercher, H. [*Arch. ges. Physiol. (Pflüger's)*, 247, 336-41 (1943); cf. *C.A.*, 37, 4800^a.]

Increased CO₂ tension causes, by stimulation of the central nervous system, a vasoconstriction which counteracts the vasodilating effect of acetylcholine.

H. L. MASON (Chem. Abstr.).

Influence of Akuammine on the Cardiovascular Action of Acetylcholine. Raymond-Hamel. [*Compt. rend. soc. biol.*, 138, 199-201 (1944); cf. *C.A.*, 39, 2569^a.]

Akuammine-HCl was prepared from extract of the seeds of *Picralima nitida*, Stapf. In chloralosed bivagotomized dogs the hypotensive action of acetylcholine was only slightly augmented, but greatly prolonged by previous injection of 7 mgm./kgm. of akuammine-HCl.

L. E. GILSON (Chem. Abstr.).

Depression of Acetylcholine Synthesis by Serum from Working Muscle. Healthy Subjects and Myasthenia Gravis Patients. Torda, Clara, and Wolff, Harold G. [*Proc. Soc. Exptl. Biol. Med.*, 59, 13-16 (1945); cf. *C.A.*, 39, 1918^a.]

Further experiments on the synthesis of acetylcholine by frog brain in the presence of serum are reported. Synthesis was much greater in presence of serum from a healthy subject than with serum from a myasthenia gravis patient, and in either case synthesis was greater with serum from a rested arm than from an arm fatigued by repeatedly clenching the fist (circulation occluded with a sphygmomanometer cuff while samples were taken, in all cases).

L. E. GILSON (Chem. Abstr.).

The Formation of Acetylcholine, the Freeing of Aneurine, and the Metabolism of Peripheral Nerves in vitro. Sanz, Manuel C. [*Arch. ges. Physiol. (Pflüger's)*, 247, 317-24 (1943).]

In a suspension of finely ground nerve in Locke solution containing glucose at 37° there was no change in the total acetylcholine (I) content but a large increase in bound (I). Without glucose, free and bound (I) decrease at first, then increase again. O consumption in the presence of glucose was 15 c.c./gm./hr.; without glucose O utilization was large in the first hour, but in 4 hours the total utilization was less than with glucose. Aneurine was set free from cocarboxylase with and without glucose. The respiratory quotient with glucose was 0.92-0.96; without glucose 0.82-0.87. Glycolytic formation of acid was greatly increased by addition of glucose.

H. C. MASON (Chem. Abstr.).

Role of Acetylcholine and Vitamin B₁ in Nervous Excitation. Murali, A. v. [*Nature, Lond.*, **154**, 767-8 (1944).]

Stimulation of the vagal supply to the frog's heart was found to liberate, in addition to acetylcholine, a second substance regarded as a special form of aneurin or aneurin compound (evidence from chemical assay, polarographic analysis, comparison with the properties of vitamin B₁) probably concerned with the recovery processes of nerve (evidence from photomicrographs, Wallerian degeneration, etc.).
A. C. HOFFMAN (Psychol. Abstr.).

Spontaneous Cessation of the Inhibiting Effect of Acetylcholine on the Isolated Frog Heart. Cause of the Phenomenon. Tiffeneau, Robert, and Beauvallet, Marcelle. [*Compt. rend. soc. biol.*, **136**, 745-6 (1942).]

It is suggested that acetylcholine is fixed by certain receptors in the cells; it is then hydrolyzed to choline, which continues to occupy the receptors, and while exerting no important pharmacodynamic action itself, prevents access of new molecules of acetylcholine.
L. E. GILSON (Chem. Abstr.).

Inhibition of Acetylcholine Apnea in Dogs by Procaine and by Atropine. Hazard, René, Corteggiani, Elisabeth, and Cheymol, J. [*Compt. rend. soc. biol.*, **138**, 78-9 (1944).]

In dogs acetylcholine, 5 mgm./kgm. injected intravenously, produces a transient drop in arterial pressure accompanied by apnea, then a short period of polypnea and a second and longer period of apnea. Procaine, like atropine, paralyzes the vagus nerves and also acts directly on the bronchial musculature, inhibiting the apnea.
L. E. GILSON (Chem. Abstr.).

Procaine-HCl and Acetylcholine. Hazard, René, and Cheymol, Jean. [*Compt. rend. soc. biol.*, **137**, 280-1 (1943); cf. *C.A.*, **38**, 5592^a.]

In dogs anesthetized with chloralose, large doses of procaine-HCl (25-50 mgm./kgm. given intravenously) partially inhibited the muscarinic (cardioinhibitor) action of acetylcholine (1-2 mgm./kgm.), and diminished, suppressed, or reversed the nicotinic (hypertensive) action of acetylcholine.
L. E. GILSON (Chem. Abstr.).

The Influence of Acetylcholine on the Distribution of K in Muscle Tissue. Kometiani, P. A., Dolidze, Sh. V., and Klein, E. E. [*Biohimiya*, **9**, 218-28 (1944).]

The action of acetylcholine, eserine, caffeine, nicotine, and veratrine was studied on frog preparations by perfusion through Ringer solution. Acetylcholine does not act in the same manner as the other substances causing muscle contraction. Caffeine, like acetylcholine, transforms part of the K into a form possessing the property of diffusion. This caffeine contraction, however, is similar to that caused by indirect tetanic stimulation. No matter how prolonged the action of acetylcholine, no phosphagen is decomposed although K is liberated in the process.
H. PRIESTLEY (Chem. Abstr.).

Synthesis of Acetylcholine by Tissue of the Central Nervous System. Feldberg, W. [*J. Physiol.*, **103**, 367-402 (1945); cf. *C.A.*, **38**, 1778^a.]

Some acetylcholine (I) is released and replaced by synthesis in fresh brain tissue during grinding. These processes continue in a suspension of the brain material in eserine-saline at 36°, so that (I) increases in the system while the quantity in the tissue particles remains practically constant. Dried and powdered brain substance, suspended in saline, is still capable of synthesis of (I). If eserine is present, (I) accumulates in this system. Ether reduces the (I) content of suspensions of brain tissue, but accelerates (I) synthesis when eserine is added. In a system composed of dried brain, saline, eserine, and ether, synthesis of (I) at room temperature is greater than under any other conditions so far observed. Within the temperature range 3-37° increase of temperature has a two-fold effect; the initial rate of (I) formation is increased, but during incubation the synthesizing power of the brain material declines at a rate which also increases with temperature. Synthesis of (I) occurs under anaerobic conditions, but not to the same extent as

under aerobic conditions. The addition of glucose increases the synthesis of (I) by fresh brain suspension, but is without effect when powdered brain is used. NaCN has no effect in concentrations usually used to inhibit tissue respiration, but has a slight inhibitory effect in higher concentrations. Iodo-acetate and Ca^{++} decreases the synthesis of (I), while K^+ increases the synthesis. These data are discussed. The inhibitory effect of glucose at its normal blood concentration is discussed in relation to the effects of hypoglycemia.

H. L. WILLIAMS (Chem. Abstr.).

Effect of Cobra (Naja naja) Venom and its Constituents on the Synthesis of Acetylcholine by the Brain Cells of the Rats and Pigeons. Ghosh, B. N., De, S. S., and Sarkar, N. K. [J. Ind. Chem. Soc., 21, 93-6 (1944).]

Minced brain was allowed to respire in oxygenated Locke-phosphate solution containing 1 : 7,000 eserine sulfate at a temperature of 37°. After shaking for 2-3 hours the pH was brought from pH 7.4 to 3.0. At the end of 30 minutes the contents of the flask were neutralized, and the acetylcholine (I) was determined by measuring the contraction of the dorsal muscle of the leech in oxygenated Locke-bicarbonate-glucose solution. Cobra venom did not interfere with the action of leech muscle. Glucose strongly favored synthesis of (I) by rat and pigeon brain. Dried cobra venom in doses of 2-4 times minimum lethal dose (m.l.d.) (0.1 mgm. for pigeon) markedly inhibited the formation of (I). Neurotoxin (R) isolated from cobra venom by Ghosh and De (C.A., 36, 2288⁷), and which was shown to inhibit respiratory movement, had no effect on synthesis of (I) in doses of 2-3 times m.l.d., which was 0.0065 mgm. for pigeons. A fraction of venom containing a principle that inhibited respiration and the formation of lactic acid from glucose by brain was isolated. This fraction was much more active than cobra venom in suppressing the synthesis of (I) by brain. The authors suggest that this principle in the venom is responsible for the synthesis of (I).

J. D. TAYLOR (Chem. Abstr.).

The Stimulating Action of Acetylcholine on the Heart. McDowall, R. J. S. [J. Physiol., 103, 33 (1945).]

If acetylcholine concentration in Ringer solution reaching the perfused cat, frog, rabbit, or rat heart exceeds 1×10^{-4} , the typical slowing is seen, but this is followed by a marked increase in the force of the beat which may or may not be associated with an increased rate. The stimulative stage is associated with increased sensitivity to adrenaline, a reduced response to acetylcholine and a tending to extrasystoles. Both the stimulation and depression are abolished by atropine. The stimulation is abolished by ergotoxine. Very minute doses of acetylcholine show stimulation only, associated with increased coronary flow.

H. L. WILLIAMS (Chem. Abstr.).

A Comparative Study of the Cholinesterase Activity of the Vertebrate Nervous System, with Especial Reference to its Relationship to Motor Ability. Lindeman, Verlus F. [Am. J. Physiol., 143, 687-91 (1945).]

A quantitative study of the cholinesterase activity of the central nervous system was made on 8 different animals representing 3 classes of vertebrates. The enzymic activity was determined by means of a microchemical method which involved the titration of the acid equivalent (ml. 0.01 N HCl) formed by the hydrolysis of acetylcholine. When the cholinesterase activity was computed per cell, for a unit of the nuclear surface and for a unit of the whole mass, a consistent correlation existed between the activity of the enzyme and the general motor ability of the animal within each of the classes.

E. D. WALTER (Chem. Abstr.).

Cholinesterase. 1. The Specificity of the Enzyme in Nerve Tissue. Nachmansohn, David, and Rothenberg, Mortimer A. [J. Biol. Chem., 158, 653-66 (1945); cf. C.A., 39, 716⁸.]

Several esterases, including cholinesterase, were tested on a number of substrates and the resulting patterns used to distinguish the specific cholinesterase from other esterases. Specific esterases, including cholinesterase, have the characteristic

that no substrate is split at a higher rate than is the substrate which is specific for the enzyme involved. The esterase in all nerve tissue (mammalian brains of various species, abdominal chain of lobster, squid ganglion and axon, and fish electrical tissue) is exclusively or predominantly cholinesterase. No difference is found between the properties of the esterase of freshly homogenized tissue and that after high purification. This observation supports the concept that the parallelism between voltage and enzyme activity in electrical fish indicates a parallelism between voltage and acetylcholine metabolism. The esterase of human serum is nonspecific, whereas that of red blood cells is cholinesterase. The esterases of nerve ending-free striated and heart muscles show a cholinesterase pattern. Curves are shown of hydrolysis rate as a function of substrate concentration.

WM. M. GOVIER (Chem. Abstr.).

Cholinesterase. Chowdhury, D. K. [Ann. Biochem. Exptl. Med., 4, 77-86 (1944); cf. C.A., 37, 1458^b.]

Cholinesterase from the venom of two varieties of *Naja tripudians* was purified by fractional precipitations with $(\text{NH}_4)_2\text{SO}_4$. Activity was increased twentyfold, and the product was twenty-two times more active than that prepared by Stedman and Stedman (C.A., 30, 3002^a). Cataphoretic and adsorption procedures failed to produce further increase in activity. Cholinesterase from the venom of *Bungarus fasciatus* was purified elevenfold by the same process.

HOWARD S. MASON (Chem. Abstr.).

Activity of Cholinesterase in Intact Mammalian Heart Muscle and Influence of Various Drugs, Especially Narcotics, on Its Activity. Genuit, H., and Labenz, K. [Arch. exptl. Path. Pharmacol., 198, 369-89 (1941); Chem. Zentr., 1, 1019 (1944).]

Isolated rabbit hearts were perfused in closed circuit with Ringer-Locke solution by Langendorff's method. No cholinesterase passed into the perfusion liquid. The hydrolysis of added acetylcholine by the heart muscle varied with the temperature and with the coronary minute volume. The time course of the reaction is exponential. Prostigmine and physostigmine in very high dilutions completely inhibited the cholinesterase activity; prostigmine was 10 times as active as physostigmine. Cholinesterase activity was also inhibited, but to a relatively small extent, by barbital Na, evipan-Na, chloral hydrate, urethan, EtOH, iso-AmOH, and urea in physiologically active concentrations. It was completely inhibited by tetanus toxin in 1 : 100,000-1 : 300,000 dilution.

L. E. GILSON (Chem. Abstr.).

The Use of Cholinesterase in Shock. Schachter, R. J. [Am. J. Physiol., 143, 552-7 (1945).]

Dogs in hemorrhagic shock responded well to beef plasma administered in appropriate volumes by recovering from shock. Dogs in traumatic shock were benefited by plasma only temporarily. When dogs in traumatic shock were given intravenous injections of cholinesterase, the blood pressure usually returned to normal and remained there for the duration of the experiment.

E. D. WALTER (Chem. Abstr.).

Mechanism of Enzyme-inhibitor-substrate Reactions. Cholinesterase-esterine-acetylcholine System. Goldstein, Avram. [J. Gen. Physiol., 27, 529-80 (1944).]

The mechanism of enzyme-inhibitor-substrate reactions is analyzed from the theoretical viewpoint and illustrated by data from the cholinesterase-esterine-acetylcholine system. Competitive enzyme-inhibitor-substrate systems show the same characteristic "zones of behavior" as non-competitive systems. The three zones determine the mathematical function relating activity of an enzyme to concentration of added substrate or inhibitor, or both. The effects of suboptimum substrate concentration in these systems are discussed. The zone-behavior phenomenon is useful in determination of the number of molecules of substrate or inhibitor combining reversibly with a single enzyme center. Kinetics of competitive inhibition, dilution effect, combination of inhibitor or substrate with enzyme, and destruction of inhibitor or substrate by enzyme are analyzed and verified, and absolute velocity coefficients are determined. Inhibition of cholinesterase by

eserine is competitive, and one molecule of eserine or acetylcholine combines with one center of cholinesterase. No definite value can be assigned to the molar concentration of enzyme centers, but in 4.54 per cent. serum (dog) it is less than 1.8×10^{-8} . Competitive displacement of inhibitor by substrate and *vice versa* introduce considerable error in the normal 20-minute determination of activity of an inhibited enzyme unless a correction is applied. Dissociation of enzyme-inhibitor complex proceeds moderately slowly on dilution, so that full corrections for dilution cannot be applied unless time has been allowed for complete dissociation. Combination of eserine with cholinesterase is slow at all but high concentrations of inhibitor. Destruction of eserine or acetylcholine by cholinesterase follows the predicted curve; kD for destruction of eserine is greater than 0.00182, while for destruction of acetylcholine it is greater than 3,500. There is no evidence of inhibition of destruction by excess of substrate or inhibitor. The assumption that enzymic activity follows or nearly follows a unimolecular course is true only under certain definite limited conditions; it is generally invalid for enzymic destruction of an inhibitor.

B. C. P. A. (Chem. Abstr.).

Cholinesterase of Human Blood. Rumma, K., and Sibul, I. [*Z. ges. exper. Med.*, **112**, 686-701 (1943).]

Serum-cholinesterase activity varies widely in different diseases. It varies inversely with the K/Ca ratio of the serum. High cholinesterase activity usually accompanies a high lymphocyte count. No relation was found between cholinesterase activity and the total cholesterol content of the serum.

L. E. GILSON (Chem. Abstr.).

Effects of Inorganic Ions on Activity of Serum Cholinesterase. I. In Horse Serum in vitro. Frommel, Ed., Herschberg, A. D., and Piquet, J. [*Helv. Physiol. Pharmacol. Acta*, **2**, 169-91 (1944) (in French).]

The cholinesterase of horse serum is activated by Ca, Na, and Mg hyposulphites and by Ca, Mg, and NH_4 chlorides. Its activity is inhibited by ionic Pb, Hg, Ag, Au, Li, Fe, Ba, Cu, K, Zn, and Al, and by bromides, iodides, borates, hypophosphites, and As and Sb compounds. The Na, Ni, manganous, NO_2 , and PO_4 ions have no effect on activity.

L. E. GILSON (Chem. Abstr.).

II. In the Guinea-Pig in vivo. [*Ibid.*, 193-201.]

The effects were practically the same as *in vitro* for those ions which could be studied in live guinea-pigs.

L. E. GILSON (Chem. Abstr.).

Occurrence of Different Types of Cholinesterase in Human Organs. Langemann, H., [*Helv. Physiol. Pharmacol. Acta*, **2**, C17-18 (1944) (in German).]

There are two types of cholinesterase, the s-type or pseudocholinesterase, and the e-type or true cholinesterase. The s-type has no substrate optimum concentration, and is strongly inhibited by 0.001 M percaïne but only slightly inhibited by 0.001 M caffeine or papaverine. The e-type has a very definite substrate optimum concentration and is strongly inhibited by caffeine. The cholinesterase of human skeletal muscle is pure e-type, that of brain and hypophysis probably all e-type, that of heart probably a mixture of both types, and that of ovary pure s-type. In the thymus of very young infants only e-type is present, but both types are present in thymus of children 2-10 years old.

L. E. GILSON (Chem. Abstr.).

Differentiation of Types of Cholinesterase. Zeller, E. A. [*Helv. Physiol. Pharmacol. Acta*, **2**, C23-4 (1944) (in German); cf. *C.A.*, **37**, 1135^b.]

Differences between true cholinesterase (e-type) and pseudocholinesterase (s-type) are discussed. The cholinesterases of guinea-pig, horse, and human serums are all of the s-type.

L. E. GILSON (Chem. Abstr.).

Serum Choline Esterase in Barbiturate Addiction and Epilepsy. Schutz, F. [*Quart. J. Exper. Physiol.*, **33**, 35-52 (1944).]

During the period of withdrawal of the slow-acting barbiturates after prolonged administration, a predominantly cholinergic status apparently exists because of a relative lack of choline esterase.

RACHEL BROWN (Chem. Abstr.).

Studies on Choline Acetylase. (1) *Effect of Amino Acids on the Dialyzed Enzyme. Inhibition by α -keto Acids.* Nachmansohn, David, and John, Hedda M. [*J. Biol. Chem.*, **158**, 157-71 (1945); cf. *C.A.*, **39**, 1179*.]

Choline acetylase in extracts of rat or guinea-pig brain is able to catalyze the formation of 100 to 150 γ of acetylcholine per gm. per hour under anaerobic conditions. This is coincidental with the rapid splitting of adenosine triphosphate even in the presence of fluoride. The enzyme requires K ions, the optimal concentration of which is 0.08 M. Choline acetylase is inactivated by dialysis (80 to 85 per cent. in 2 hours) and is reactivated partly by K⁺ and further by l(+)-glutamic acid, but not by d(-)-glutamic acid. The enzyme is also activated by cysteine, glutamic acid plus CN⁻, and l(+)-alanine, in the order named. Dicarboxylic acids have no effect, but citric acid reactivates almost as well as does glutamic acid. The enzyme is inhibited by α -keto acids in 10⁻³ to 10⁻⁴ M concentrations. Choline acetylase can be separated from cholinesterase by treatment with acetone, which destroys the latter enzyme.

WILLIAM M. GOVIER (Chem. Abstr.).

3. Pharmacology and Treatment.

Convulsive Factor in Commercial Penicillin. Walker, A. Earl, and Johnson, Herbert C. [*Arch. Surg.*, **50**, 69-73 (1945).]

The application of commercial penicillin to the cerebral cortex of cats, dogs, monkeys, and human beings gives rise to convulsive manifestations. The antibiotic and convulsive factors seem closely related, since they are about equally affected by ageing, boiling, and acidifying the penicillin solution, and by dissolving penicillin in alcohol. In the human subject, application of 10,000-20,000 Oxford units of penicillin to the cerebral cortex may produce convulsive manifestations.

JOHN T. MYERS (Chem. Abstr.).

The Effect of Intracranial Penicillin on Brain Involvement in Experimental Relapsing Fever. Schuhardt, V. T., and O'Bryan, Billie E. [*J. Bact.*, **49**, 312-13 (1945).]

Penicillin injected intracranially is capable of curing the brain involvement in experimental relapsing fever of the white rat.

JOHN T. MYERS (Chem. Abstr.).

Effect of Amphetamine (Benzedrine) Sulfate on Higher Nervous Activity. Alpern, E. B., Finkelstein, N., and Gantl, W. H. [*Johns Hopk. Hosp. Bull.*, **73**, 287-99 (1943).]

Amphetamine sulfate administered orally to dogs caused a moderate loss of differentiation in conditioned reflexes (secretory, motor, and autonomic). It increased the conditioned secretion relative to the unconditioned secretion to food, and thus was an excitatory stimulant of the supra-segmental nervous system. The latent period of conditioned secretory responses was shortened, while that of conditioned motor defense reflexes was unaltered or lengthened. The unconditioned secretion to food and the unconditioned sexual reflexes were decreased. The effects on the nervous system began in about $\frac{1}{4}$ hour, reached a maximum in 1-2 hours, and could be detected up to 6 hours after administration of the drug. There are thus 3 effects: loss of differentiation, excitation of the supra-segmental system, and the possible inhibition of at least part of the segmental or peripheral nervous systems (secretory). Since theoretically each effect may be dominant under various conditions, this is a possible explanation for the variable action of the drug.

M. E. MORSE (Psychol. Abstr.).

Influence of Analeptics on Respiration in KCN Poisoning. Shvartsalon, N. S. [*Farmakol. i Toksikol.*, **7**, No. 3, 29-39 (1944).]

After intravenous injections of KCN in dogs the use of stimulants for the central nervous system during cessation of respiration is contra-indicated. In the period of deep, infrequent respiration lobeline and cytitone stimulate respiration, but since they are cardiac depressants their doses must be small. Cytitone (dose

0.1 ml./kgm. equivalent to 0.015 mgm. cytisine per kgm.) is preferable because of lower cardiac activity. Large intravenous doses of adrenaline are beneficial to test animals in KCN poisoning; ephedrine is less effective. Sympatol sometimes stimulates respiration. Like adrenalone, its effect is variable and adrenaline is preferable. Cordiamine and spiramine are ineffective unless the test animal is already in a coma. In the stage of rapid, shallow breathing respiratory stimulants are superfluous. Respiration charts are shown, and some tests with metrazole are reported.

JULIAN F. SMITH (Chem. Abstr.).

Anticonvulsant Effects of Steroids. Wycis, H. T., and Spiegel, E. A. [*Am. J. Med. Sci.*, **209**, 548-9 (1945); cf. Spiegel, *Federation Proc.*, **2**, No. 1, 47 (1943).]

Androstenedione (I), dehydroandrosterone (II), desoxycorticosterone acetate (III), acetylpregnenolone (IV), progesterone (V), and testosterone (VI) produced anticonvulsant effects in female white rats. The anticonvulsant dose lies close to, or is identical with, the hypnotic dose for (III), (V), and (VI). A definite margin between these doses exists for (I), (II), and (IV). The following steroids had no or only questionable anticonvulsant action: cholesterol, allocholesterol, cholesteryl bromide, epicholestanol, stigmasterol, stigmasteryl acetate, α -spinasteryl acetate, ergosterol, ergosteryl acetate, α -ergostenyl acetate, dehydrocholic acid, desoxycholic acid, Δ^4 -3-acetoxycholic acid, sarsasapogenin acetate, pseudosarsasapogenin acetate, diosgenin acetate, pseudodiosgenin acetate, α -estradiol benzoate (progynon B), theelin in oil, 6- α -acetylpregesterone, etiocholan-3(β)-ol-17-one acetate, 5-pregnen-3(β)-ol-20-one acetate, 5, 16-pregnadien-3(β)-ol-20-one acetate, and stilbestrol.

RACHEL BROWN (Chem. Abstr.).

KCNS in the Treatment of Alcoholism. Carratala, Rogelio. [*Rev. asoc. med. argentina*, **59**, 34-6 (1945).]

Injections of 5 per cent. KCNS (0.05 gm. per kgm.) were given to dogs habituated to alcohol and 0.2 to 0.4 gm. per day was given to human beings by gastric tube. The alcoholic habit was not altered by the drug.

E. S. G. BARRON (Chem. Abstr.).

Influence of Lactoflavin and the Antipellagra Factor on Glutathionemia. Murano, Giulio. [*Pediatrics (Riv.)*, **49**, 469-501 (1941).]

From a study of 16 children, aged 5 to 30 months, injection of 0.5 mgm. of lactoflavin intramuscularly for 10 days gave a distinct decrease in the amount of reduced glutathione after 5 days. The significance of these observations is discussed.

WILLIAM F. BRUCE (Chem. Abstr.).

Does the Iodomethylation of Quinoline Modify its Action on the Sympathetic Nervous System? Raymond-Hamet. [*Compt. rend. soc. biol.*, **138**, 88-90 (1944).]

In dogs, quinoline iodomethylate is sympathicolytic in large doses (77 mgm./kgm.) and sympathicosthenic in small doses (7 mgm./kgm.).

L. E. GILSON (Chem. Abstr.).

Method for Studying the Central Action of Analeptics in Raising Blood Pressure. Hahn, Fritz. [*Arch. exptl. Path. Pharmacol.*, **198**, 472-90 (1941); *Chem. Zentr.*, **1**, 1019-20 (1944); cf. *C.A.*, **38**, 2109^b, 2731^a.]

Method and preliminary report on the action of metrazole in cats.

L. E. GILSON (Chem. Abstr.).

The Response of the Central Nervous System of the Rat to Methylcholanthrene. I. The Induction of Tumors Derived from Nervous Tissue. Russell, Wm. O. [*Cancer Research*, **5**, 140-51 (1945).]

Intracranial tumors were produced in 21 of 42 rats after implantation of pellets containing 30 per cent. methylcholanthrene (I) in cholesterol in the right cerebral hemispheres. In 14 of the 21 rats the growths were derived from nervous tissue, in 10 the growths were fibrosarcomas, and in 3 both types were present.

E. R. MAIN (Chem. Abstr.).

II. *The Effect of a Diet Deficient in Thiamine and Riboflavin on the Induction of Tumors Derived from Nervous Tissue.* [*Ibid.*, 152-6.]

The periodic removal of thiamine and riboflavin from the diets of rats with intracranially implanted pellets of (I) shortened the period of induction of tumors derived from nervous tissue to 230 days from 370 days for rats on control diets. The tumor incidence was not affected. The dietary deficiencies affected neither the incidence nor the induction time of tumors derived from connective tissue.

E. R. MAIN (Chem. Abstr.).

Production of a New Type of Poison for the Sympathetic Nervous System by Iodomethylation of a Sympathicolytic Agent. Raymond-Hamet. [*Compt. rend.*, 218, 425-7 (1944).]

Upon iodomethylation, hydroxycinchonidine in large doses maintains its sympathicolytic activity, while in small doses it has a sympathicosthenic action.

RACHEL BROWN (Chem. Abstr.).

Influence of Excitants of Parasympathetic Nerve Endings on Anaphylactic Shock in Rabbits. Vallery-Radot, Pasteur, Mauric, G., and Holtzer, Mme. A. [*Compt. soc. biol.*, 138, 123-4 (1944).]

Pilocarpine neither increased nor decreased the severity of serum shock, eserine sulfate had no protective action, and the influence, if any, of acetylcholine was slight and uncertain.

L. E. GILSON (Chem. Abstr.).

Effects of Morphine, Pentobarbital, Ether, and Eserine on Two-neuron and Multi-neuron Reflexes in the Cat. Wikler, Abraham. [*Proc. Soc. Exptl. Biol. Med.*, 58, 193-6 (1945); cf. *C.A.*, 38, 2115⁹.]

In the spinal cat, small doses of morphine (5 mgm./kgm.) enhanced two-neuron arc reflex discharges and depressed those traversing multineuron arcs. After doses of 15 mgm./kgm. depression of multineuron arc discharges was followed by enhancement of these discharges. Na pentobarbital depressed all discharges, and these effects were unaltered by previous injection of eserine or morphine plus eserine. Ether depressed all discharges. Eserine enhanced two-neuron arc discharges, but had little effect on multineuron arc discharges. Eserine after morphine enhanced both types of discharges.

L. E. GILSON (Chem. Abstr.).

Action on the Nervous System of Venom of the Scorpion Tityus serrulatus. Sampayo, R. R. L., and Odóriz, J. B. [*Rev. soc. argentina biol.*, 20, 569-80 (1944).]

Experiments made on rabbits anesthetized with nembutal showed that the venom is a neurotoxin which acts on the central nervous system, as demonstrated by the simultaneous recording of the electrical activity of cerebral cortex and striated muscle.

L. E. GILSON (Chem. Abstr.).

Action of Scorpion Venom on the Vasomotor System. Del Pozo, E. C., Anguiano, G. L., and González, J. [*Q. Rev. inst. salubridad enfermedad. trop. (Mex.)*, 5, 227-40 (1944).]

Intravenous injection of scorpion venom elevates the blood pressure in normal, decerebrate, acute spinal, and adrenalectomized cats. The effect is not observed if the spinal cord is destroyed. Curare does not abolish the effect. Vasoconstriction is caused in the sympathectomized pinnae of cats and rabbits, but not after adrenalectomy. There is also bradycardia which is not observed after section of the vagi. Vascular reflexes in response to central stimulations of the sciatic and vagus are not affected by the venom. Conclusion: The action is largely stimulation of the pre-ganglionic neurons of the sympathetic which control vasoconstriction and adrenal secretion.

H. L. WILLIAMS (Chem. Abstr.).

Comparative Actions of Barbiturates, Hydantoins and Bromides on Epileptic Convulsions from Electric Shock in Rats. Delay, Jean, and Soullairac, A. [*Compt. rend. soc. biol.*, 138, 60-1 (1944).]

Tonic convulsions lasting 5-10 seconds followed by clonic convulsions lasting 20-30 seconds were provoked by 170 v., 0.1-0.5 microampoules from electrodes

applied to the head. Hyperglucemia was produced. Previous subcutaneous injection of 0.3 gm./kgm. of phenobarbital prevented the convulsions and the rise in blood sugar. After injection of 0.3 gm./kgm. of 5, 5-diphenylhydantoin it was necessary to increase the power to 230 v., 0.6-1.2 microampoules to obtain convulsions. The tonic phase was very short and the clonic phase prolonged. Hyperglucemia was marked. After injection of 3.0 gm./kgm. of NaBr the tonic phase of convulsion was prolonged to 30-40 seconds, with marked hyperglucemia.

L. E. GILSON (Chem. Abstr.).

Action of Certain Anticonvulsants on Smooth Muscle. Gayet-Hallion, Th. [*Compt. rend. soc. biol.*, **138**, 332-4 (1944).]

In 1 : 70,000 or higher concentrations, Na diphenyl-hydantoin antagonized the action of minimal effective concentrations of histamine, acetylcholine, pilocarpine, and BaCl₂ on isolated guinea-pig intestine and uterus. Of other hydantoin (not named) tried some were effective in higher concentrations and some were without action. Benzophenone was more active than diphenylhydantoin, acetophenone was much less active, and phenobarbital had a very low activity.

L. E. GILSON (Chem. Abstr.).

Action of Hypnotics on Thalamic Centers. III. Effects of Sodium Barbitol on Hunger Contractions and the Hypermotility of the Stomach After Insulin. La Barre, J., and Vesselovsky, O. [*Arch. intern. pharmacodynamie*, **66**, 414-20 (1941).]

Na barbitol (100-150 mgm./kgm.) causes immediate cessation of hunger contractions in dogs, but has no effect on the post-insulin contractions. The latter are affected only by doses of 250 mgm./kgm. (Cf. C.A., **38**, 4029⁷.)

M. L. C. BERNHEIM (Chem. Abstr.).

Influence of Various Salts on Metrazole Reactions. Wasil, H. [*Arch. intern. pharmacodynamie*, **66**, 397-408 (1941).]

Ca salts (150 mgm./kgm.) injected intraperitoneally into guinea-pigs, either before or with 75 mgm./kgm. metrazole, decrease the incidence of convulsions and the mortality rate. Ca gluconate and lactate are most effective in reducing the mortality rate, and Ca benzoate and salicylate in reducing the incidence of convulsions.

M. L. C. BERNHEIM (Chem. Abstr.).

Experiments in the Group of Sympathomimetics. V. Relation Between Chemical Constitution and Pressor Activity of Possible Sympathomimetics Derived from the Benzene, Naphthalene, Phenanthrene, and Isoquinoline Rings. Rajagopalan, S., and Venkatchalam, K. [*Proc. Indian Acad. Sci.*, **20A**, 175-86 (1944); cf. C.A., **39**, 2742⁸.]

In experiments on pressor effect in the spinal cat, with tyramine as a control, the α -naphthylmethylamines and benzylamine showed little activity. Fair activity was shown by the ω -aminoacetanaphthones, β -naphthylethylamines, and the β -naphthylethylamines. Rules governing structure and pressor activity relationships apply to members of the naphthalene series only to a limited extent. Naphthalene derivatives usually, but not always, are more active than are benzene derivatives. The naphthalene and acenaphthene nuclei are about 7 times as effective as the benzene ring, but the phenanthrene ring is only twice as effective. The naphthalene ring series may be a promising source of new potent pressors.

LEONARD WALKER (Chem. Abstr.).

Effects of Prolonged Action of Aniline in Small Doses on the Permeability Coefficient of the Hemato-encephalic Barrier. Shakhmousskaya, S. B. [*Farmakol. i Toksikol.*, **7**, No. 4, 51-3 (1944).]

Prolonged exposure of dogs to the approximate concentration of PhNH₂ vapor occurring industrially caused a break in the permeability coefficient of electrolytes (K⁺, Ca⁺⁺, and Cl⁺) and wide fluctuations of the ratio K : Ca in spinal fluid and in blood serum. The amount and direction of the shift in the coefficient for K,

Ca and Cl, together with the stimulant effect observed in some dogs, indicate that chronic PhNH₂ poisoning acts on the vegetative nervous system.

JULIAN F. SMITH (Chem. Abstr.).

Relations Between Chemical Constitution and Pharmacological Effects of Barbituric Acid Derivatives. Zakrivdoroga, S. P. [Farmakol. i Toksikol., 7, No. 4, 7-11 (1944).]

Amination of 5-alkylbarbituric acids does not yield soporifics; neither does conversion of thiobarbituric acid to sulfide type derivatives. In speed and intensity of soporific effect, and also in toxicity, 5-propyl-5-furfuryl-barbituric acid ranks higher than barbital; the corresponding thio compound is soporific but highly toxic. Propylcyclohexylbarbituric acid has first a stimulating and then a slight, transient, soporific effect on white mice. The activity of N-methylbarbital is fully equal to that of barbital.

JULIAN F. SMITH (Chem. Abstr.).

OBITUARY.

Sir HUBERT BOND, K.B.E., C.B.E., D.Sc., M.D.Edin., LL.B., F.R.C.P.

SIR HUBERT died in April, 1945, at the age of 74. Only some of his achievements can be given here. He was a distinguished student, then a Gaskell gold medallist, and while still quite young he held two successive posts as first Medical Superintendent of two newly-opened mental hospitals. His next appointment, in 1912, was as one of H.M. Commissioners in Lunacy, and in 1930, by this time having received a knighthood, the K.B.E., he became a Senior Commissioner of the Board of Control, a post from which he had retired, full of plans for the future, a few days before his death.

He always cared for the hospitals with which he had been associated: Powick Asylum (as it was), where his father was chaplain; Morningside, Wakefield, Banstead and Bexley, where he worked; Ewell and Long Grove, where he was Superintendent. Every detail of a hospital was of interest to him, from the planning and lay-out of the whole, and the flowers and trees in the grounds, to the preservation of the historic records of the past. Admission units were his special care, and the provision of clinical rooms where doctors could have what he used to call "heart-to-heart talks" with their patients.

Such a phrase had a real meaning where he was concerned; he gave much thought and time to individual patients. There are those all over the country to this day who say, "Dr. Bond understood me." It was ironical that he, of all men, should have been involved in litigation about detention; no one who knew him could doubt that his leading thought was always for the welfare of the patient concerned.

Professionally he was very eminent. As a specialist he had a forward vision that was most inspiring. He was the moving force in many of the advances of the Mental Treatment Act of 1930, and always believed in boldness of handling and increased freedom in care and treatment. The Maudsley Lecture in London and the Withering Lecture in Birmingham were given by him in 1931; he was at one time or another lecturer for the Middlesex Hospital and the Maudsley Hospital, and examiner for the Conjoint Board of England and Wales and for the Universities of London and Leeds.

He took a large part in the work of the Royal Medico-Psychological Association, of which he was first Hon. Gen. Secretary (for six years), then President, and later Honorary Member. He was member, and in turn President, of the Psychiatric Section of the Royal Society of Medicine.

He disliked the term "psychiatrist," and held strong views on the unity of medicine and on the close relation between physical and mental disorder. Sepsis as a cause of mental disturbance was often in his mind, and he believed that great advances would be seen in this field.

Thoroughness was characteristic of him. At official visits he was never content to accept facts as they stood; he would go off full of energy, with springy step, although burdened with books, files and papers, to investigate all the material he could lay hands on, to compare and analyse his facts and set them in a true perspective. In the hospitals it was pleasant to see him, full of years and honours, turning courteously to the youngest medical officer as the most recent comer from the teaching schools, to discuss the cause of some muscular atrophy or unusual hallucination, or whatever it might be that he had observed in a patient during his visit.

To young and old he brought inspiration and encouragement in medicine. No one man could keep fully abreast of the complex developments of clinical and laboratory work, but whatever was presented to him he touched with an experienced hand, and with the most kindly interest in the worker and in the use that might be made of the work.

Nursing, as to its practice and its conditions of work, had much of his attention. He was Chairman of a Departmental Committee on Nursing in 1922-4. As

President of the Association of Occupation Therapists he watched and stimulated in its growth yet another branch of treatment.

Abroad, as at home, he was loved for his geniality and humour, and respected for his knowledge. For many years he was an Associate Member of the Société Médico-psychologique de Paris.

In every way he gave of his best to his country. In the last war and in this he was closely concerned with the arrangements which released beds from hospitals and institutions in his own service, for the treatment of the Forces or civilians. He was in the recent war a member of the Central Medical War Committee. One of his most cherished appointments was that of Consultant in Neurology and Mental Diseases to the Royal Navy, which he held for 20 years.

A deeply religious man, a fine physician, a lover of the countryside and of old records and old churches, a genial host and a good companion on social occasions, a kind friend in trouble, happy in his work and profoundly attached to his own family from its earliest appearance in some ancient parish register to its latest representative in his little grandson, Hubert—such he was. Sympathy goes out to Lady Bond and to his daughter in their loss. It has been truly said that we are the poorer for his passing. Yet the cause which he served and the many who knew him are the richer for his cheerful and courageous life.

C. F. P.

ROBERT DICK GILLESPIE, M.D., F.R.C.P., D.P.M.

A FEW weeks ago, and within a few hours of receiving the sad and tragic news of the death of my friend and colleague, Robert Dick Gillespie, I was privileged to write for the *British Medical Journal* an appreciation of his life and work. This additional tribute may reduplicate to a certain extent what I have written already, but I felt that I must accede to the Editor's request, and place on record in this old-established *Journal of Mental Science* my estimate of my friend's work and worth. It is not easy to do, but it is a pleasure to try and recapture, even for a short time, the spirit which imbued him in his endeavour to help those who came to him for counsel and treatment.

As Physician for Psychological Medicine, Guy's Hospital, and Lecturer in Psychological Medicine, Guy's Hospital Medical School, he had attained a position of great distinction, and had come to wield an important influence both in undergraduate and post-graduate teaching. To have attained such a responsible post only nine years after graduating from Glasgow University is perhaps the best indication of the confidence he inspired in all those who had the pleasure of having him as pupil and colleague. He had never had the advantage which material things and social position carry in their train, but by sheer ability, intellectual gifts of the highest quality, and the capacity to adapt himself harmoniously to those with whom he worked, he carved out for himself a career and a successful life which anyone might envy. Naturally he took pride in the establishment of the York Clinic, Guy's Hospital, the first psychiatric clinic in this country as part and parcel of a general hospital organization. He may rest assured that his name will forever be closely identified with it, and those who have the honour and fortune to succeed him will remember with gratitude his pioneer spirit, and his vision in relation to preventive psychiatry.

From the time I first became associated with him, and appointed him to the post of Assistant Physician at the Glasgow Royal Mental Hospital, Gartnavel, I was impressed by his clarity of thought, the felicity with which he could talk and write, and the easy manner in which he could form contact with his patients. He had a persuasive understanding which enabled him to unfold intricate histories dealing with emotional conflicts without unduly disturbing the course of the illness, and, although more especially interested in the subjective, yet he always paid proper attention to the objective, and never allowed theoretical considerations or hypotheses to run away with his judgment. It was this ability to balance the one with the other, to study the patient as a whole personality, which eventually led to his success as doctor and teacher. His psychological insight and enthusiasm was always controlled by his physiological training. Those two interests, as applied to his clinical work, were greatly developed by his experience at the Phipps Psychiatric Clinic, Johns Hopkins Hospital, Baltimore, then under the distinguished

leadership of Professor Adolf Meyer, and by his association there with his colleague, Dr. C. P. Richter, to whom he frequently expressed much gratitude. It was on Gillespie's return from the United States in 1926 that I asked him to collaborate with me in writing a *Textbook of Psychiatry*, which was first published in 1927. We dedicated that book to Professor Adolf Meyer because we felt that we owed him a great debt of gratitude, and because we believed that Meyer's formulation of nervous and mental illness in terms of psycho-biological reaction types provided a new approach to prevention and treatment. We never deviated from that point of view. Our collaboration and association was a most happy one. As the years passed it became closer, and I shall ever remember with gratitude the help he gave me. The appropriate word, the turn of a phrase, an apt quotation, were ever at his command. His presentation of a topic held one's attention, because he had always something constructive or provocative to suggest, his voice was pleasant to listen to, and his argument was always very convincing. I never heard him give evidence in the law-courts, but his friends have told me that he was an excellent witness, and never failed to impress the Court by his obvious sincerity and knowledge. He worked hard all his days. He was not content with the merely routine, but constantly explored new pathways, interesting himself especially along social and preventive lines. It was this aspect which led him to take such an interest in the nervous disorders of childhood, as a result of which he gathered around him a group of enthusiastic social workers and students. It was the same outlook which dominated his thought in his formulation of the Salmon lectures dealing with the Psychological Effects of War. He hated war and all the ruthlessness and senseless destruction which it implied; his gentle nature rebelled against it, and yet he had a high sense of patriotism, and had the distinction of serving in the Royal Air Force as an Air-Commodore. All who were associated with him recognized his genuine honesty of purpose, his brilliant gifts, his desire to help others, and the further contributions to medicine which he would certainly have made if he had only been spared. One of the most delightful of his papers was published in *Guy's Hospital Gazette*, May, 1930, and was entitled, "The Writing of Medical Papers." In that paper he urged all authors to emulate the concise simplicity of Dr. Gee, as exemplified in that medical classic "Auscultation and Percussion"; he discussed grammar and style, and stated, "To know how to end (a paper) is the last accomplishment of style." In closing his paper he gave an example of what he described as "one of the most charming farewells in literature," which he had chosen from Colet's *Accidence*, and which seems to me to convey in a singularly appropriate manner the spirit of the man whom we all mourn:

"Wherefore I praye you, al lytel babys, al lytel chyldren, lerne gladly. . . . Trustyng of this begynnyng that ye shal procede and growe to parfyt lyterature, and come at the last to be grete clarkes. And lyfte up your lytel whyte handes for me, which prayeth for you to God; to whom be all honour and glory. . . . Amen."

D. K. HENDERSON.

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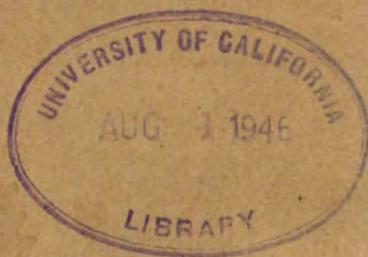
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VOL. XCII

Part I.—Original Articles.

THE TWENTIETH MAUDSLEY LECTURE: PSYCHIATRY AND
THE PUBLIC HEALTH SERVICE.

By Sir LAURENCE G. BROCK, C.B.,

Late Chairman of the Board of Control.

You will, I am sure, share my regret that this lecture is being given out of turn. It had been arranged that my lecture should follow that of Prof. Mapother, whose untimely death robbed psychiatry of a notable figure and the Association of a lecture, possibly provocative and certainly stimulating, which promised to be a memorable addition to the series. I sadly miss, too, my old friend and colleague, Sir Hubert Bond, ever the kindest and most charitable of critics.

It is proper and customary to begin a Maudsley Lecture by paying tribute to the Founder, and, though I am not competent to discuss Dr. Maudsley's services to psychiatry, I must at least record my admiration of his generosity in leaving those responsible complete freedom to select a layman if they think proper to do so. If in practice that discretion has been exercised sparingly in favour of the laity—only a few Maudsley lectures have been delivered by laymen—that fact should make me all the more conscious of the honour which the Association has done me in inviting me to follow in the footsteps of so many distinguished medical predecessors. At the same time I realize that it argues a certain temerity for a layman to address an audience of doctors on what are primarily medical issues, though they must also closely concern the general public. Indeed, a friend reminded me of the fate of Asa King of Judah, of whom it is written in II Chronicles, "Yet . . . he sought not to the Lord, but to the physicians"; and the chronicler adds, not without a certain grim satisfaction, "and Asa died and slept with his fathers."

In listening to many Maudsley Lectures I have noted that the lecturers commonly allow themselves a certain discursiveness in approaching their subject, and in this respect at any rate I propose to follow tradition. Those who have lived for years, as I have, among psychiatrists must have noticed one salient characteristic which distinguishes them from other specialists in medicine, I mean their profound pessimism. Several factors seem to have contributed to this. In the first place psychiatry has scarcely begun to share in the advances, often sensational advances, which have been made in other

branches of medicine. I need hardly remind you of the strides which surgery has made. Operations which a generation ago would have seemed incredible are now a commonplace of the theatre, and the optimism of the surgeon is fostered by the curious euphemism which allows an operation to be described as completely successful, even though the patient has, most regrettably, omitted to recover. Bacteriology and chemotherapy have made such an advance in recent years that it is no longer fantastic to look forward to a time when some remedy will be found even for a cold in the head. The public health experts, the prophets of preventive medicine, have gone from strength to strength. But psychiatry has no such triumphs to record. The aggregate recovery rate and the discharge rate have remained obstinately constant, and we are faced not infrequently by the paradox of a high recovery rate in hospitals so inactive as hardly to deserve any recoveries at all. There are, it is true, reasons for thinking that behind this apparent and baffling steadiness in the recovery rate there lies a statistical fallacy. For myself I believe that the results, if only it were possible to eliminate the seniles, are in reality far better than the aggregate figures would suggest. But who shall say at what point senility begins? I am far too conscious of having reached an age at which such a problem can only be approached with diffidence and reluctance. What is important is to note the pessimistic attitude induced by the apparent failure to improve on the results of a generation ago. Whether the statistics are misleading or not, there can be no question as to the psychological effect which they have produced on psychiatrists.

Another factor which has contributed to the pessimism of psychiatrists is the absence of any generally accepted gospel. The surgeon, the bacteriologist, the public health expert, and even to a considerable extent the general physicians, are agreed about what they believe and teach. But the psychiatrist has no such comforting certainty. On the contrary, psychiatry is a battleground for warring sects. On the one hand, there is the physiological school, who trace all mental disorders to physical and biochemical causes. On the other hand, there is the psychological school, who attribute all mental trouble to the unconscious, to complexes and to infantile eroticism. The one school see in St. Paul the typical epileptic, while they reduce Shakespeare to an accident of metabolism. The other school look for the cause of general paralysis, not in the spirochaete, but in the nursery.

Even the psychological school is far from being united. They are divided into sects, whose fanatical devotion to their cause and their chosen leader varies inversely with the number of his adherents. Each sect is convinced of its "calling and election sure," and each is doubtful, or even more than doubtful, of the claims of others to salvation. There are also the eclectics, who embrace Dr. Freud and Dr. Graves with equal, if restrained, fervour. Eclecticism is not an inspiring creed, but it is difficult to withhold sympathy from those who adopt a frankly pragmatist position and avow themselves ready to employ any method which promises results. This eclecticism was vividly illustrated once by a distinguished member of the Association who told me, in all seriousness, that my neatly rolled umbrella was unquestionably a phallic symbol, and then passed from the sinister implications of my umbrella

to a convincing discourse on the mental reactions resulting from intestinal stasis. Happily, it is not necessary for my purpose to attempt to evaluate the competing claims of rival sects. I am content to believe that the real value of Freud's concept of the unconscious is not invalidated by the almost mystical obscenities of his more esoteric disciples, while the reality of a causal relation between infection of the sphenoid sinus and mental disorder is not invalidated by the failure to explain why many people with an infected sinus appear able to retain their mental stability. For the purpose of my argument I am only concerned with the psychological effect, both on practitioners and on the public, of the absence of any generally accepted body of dogma. For myself I find comfort in a noble passage from Sir Charles Sherrington's Gifford Lectures :

"Mind, for anything perception can compass, goes therefore in our spatial world more ghostly than a ghost. Invisible, intangible, it is a thing not even of outline ; it is not a ' thing.' It remains without sensual confirmation, and remains without it for ever. Stripped to nakedness there remains to it but itself. What then does that amount to ? All that counts in life. Desire, zest, truth, love, knowledge, ' values,' and, seeking metaphor to eke out expression, hell's depth and heaven's utmost height. Naked mind."

Yet another factor which has contributed to the pessimism of psychiatrists is entanglement with the law. The necessity of placing restrictions on the mental patient's liberty has led to the imposition of legal safeguards, more rigorous in our own country than in most others, which are inevitably prejudicial to mental medicine. The fact that restrictions necessary in the patient's interest, as well as sometimes (but by no means always) for the protection of the public, cannot be imposed without the authority of a lay justice has far-reaching reactions. It perpetuates an attitude of suspicion which prejudices the relation of the patient and the doctor, but much worse than this is its reaction on the general public.

However, it is beyond the scope of this lecture to discuss the necessity for the present legal safeguards. I am merely concerned to note the reaction which entanglement with the law has had on psychiatrists. It makes them feel that they do not enjoy the confidence of the public to the same extent as other branches of the profession. This inevitably puts them on the defensive, and it tends to emphasize the isolation in which so many psychiatrists live, an isolation fostered by the remoteness of many mental hospitals and the ignorance of psychological medicine which marks the great majority of general practitioners. It is unfortunate that many mental hospitals are " off the map." Mental hospital doctors have too often little opportunity of contact with practitioners in other branches. They live " over the shop," and their physical isolation tends to become a spiritual isolation. The essential unity of medicine is forgotten, and the consequences of this isolation are none the less serious for being nobody's fault.

It may seem that I have unduly laboured the disabilities under which psychiatry suffers to-day, but the problem of securing for the mental health service its proper place in the scheme of public health services is primarily a question of co-operation, and it is surely germane to this to consider the psychological factors which affect, if they do not indeed determine, the relation

of psychiatrist to other doctors, and more particularly to other doctors engaged in public health work. Handicapped as they are by their sense of isolation and by the consciousness of the distrust of the public and the indifference of the rest of the profession, it is small wonder if some psychiatrists view with suspicion any attempt to unify the control of the various health services, and if they feel that they will not be given a "square deal" by the Medical Officer of Health. That some measure of unification is urgently needed is now generally admitted. The haphazard creation of different mental health services administered by different statutory bodies is merely a historical accident. But it is unnecessary now to elaborate a thesis discussed at great length in the report of the Feversham Committee.

So much by way of preamble, a preamble which is necessary if we are to appreciate the psychological factors which react on the organizational problem. That problem, as I see it, is not the development of individual institutions, but rather the devising of a system under which psychological medicine can be effectively integrated with general medicine and mental hospitals and ancillary institutions, with their staffs, brought into closer co-operation with the rest of the public health service. The difficulties are formidable, though, as I shall hope to show, not insuperable. On the one hand, there are the men in the mental hospital service, conscious of their aloofness from other health services in their area, and exhibiting that sensitiveness to criticism which isolation tends to produce. At the same time, they find themselves faced under the White Paper* with new responsibilities which they have never contemplated, and for which not all of them are adequately trained. On the other hand, there are the general hospitals, desperately in need of the help psychiatrists can give them, though they are not yet in many cases conscious of the extent of the need.

The question therefore can be approached from two angles—how to train the men who are needed, and how to secure that when they are trained their services are fully utilized. I accept the view that given the right machinery men can always be trained to work it. The first question to be considered is what do we want the psychiatrist to do? Once we know for what purpose or purposes the psychiatrist is to be trained, the problem of devising a method of training, though it may and will involve questions of time, money, the selection of recruits and the settlement of conditions of service, need not present any insuperable difficulty. If we can be clear in what we want a way of getting it can always be found.

What do we want the psychiatrist to do? Here I suggest that the White Paper and the report of the Royal College of Physicians give us in broad outline the answer. First we have to rid our minds of the old idea that the psychiatrist is primarily an institutional doctor. That is altogether too narrow a conception to be fitted into the new scheme. In the future psychiatrists of the public mental health service will be in the service of the health authority, and available for whatever duties may be required of them. They will provide the consultant service in conjunction with such psychiatrists in private practice as may wish to take a share in this work. But more important than the con-

* This is the White Paper issued by the Coalition Government.

sultant service is the reorganization and extension of the out-patient service. While great progress had been made before the war in the development of this service, the sessions were far too infrequent and the centres too few. In future it will not be left to a harassed superintendent to decide how many sessions he or his deputy can take, too often at the expense of their scanty leisure. The question for the health authority to decide will be where centres are needed, not how many can be staffed. In other words, the staff will be determined by the needs, instead of the needs being conditioned by the availability of staff. Of course, not every doctor in the mental health service is suited temperamentally or by past training for out-patient work. Obviously the young men must begin in mental hospitals under proper supervision and guidance, and even among the older men there are bound to be some who can best be employed in institutional work. But the point I want to stress is that in recruitment and training the object is to produce men who can take a full share in extra-mural work. In fact the problem is the staffing of a service and not of a particular hospital. Admittedly this means some modification in the doctor-patient relationship. Many doctors will only be part-time in the hospital, and their relationship to the patients in the wards for which they are responsible will approximate to that subsisting in a general hospital. The old time paternalism will tend to disappear, and with its disappearance something valuable will be lost. But that is inevitable. The only alternative would be a complete separation between the institutional and the extra-mural staff, which, even if it were practicable, would be thoroughly bad for both.

If this is agreed, the problem of training, which includes post-graduate medical education as well as actual clinical practice, becomes clearer. The objective is, as I have suggested, to recruit and train men qualified both for in-patient and out-patient duties, and in the later years of their service for consultant work and for administrative work as expert advisers to the Health Authorities. Given this as the ultimate objective, it remains to consider how training can be so planned as to meet these organizational needs. Clearly it cannot be done at once or by a stroke of the pen. The process must be gradual, and there will be a long interim period during which men, the scope of whose training has been more limited and perhaps almost entirely unsystematized, will have to be fitted into the new machine as best they can.

It is a habit of mind which mental hospitals share with public schools to assume that the best way to learn a job is to be left to do it as best one can. As a method of education it is painfully like pushing a boy into the deep end of the bath to teach him to swim. In other spheres such a rudimentary method of training is generally discredited, but so long as the new recruit had to be counted as part of the authorized establishment it was natural that he should be expected to do his share of the work, whether he was competent to do so or not. There are no doubt duties in a mental hospital which a young doctor is competent to perform, but there is much to be said for the view that the new entrant should be treated as a cadet—that is, someone having the status of an officer, but still needing instruction and supervision. I confess I have been startled sometimes in visiting mental hospitals to find what very responsible duties are allotted to doctors with little experience or training in psychiatry.

There are hospitals where regular staff meetings are held to discuss cases, and where the superintendent takes real pains to coach his young men. But there are still too many in which no systematic training of the novice is undertaken. To leave the young doctor to learn his job by a process of trial and error is unfair both to him and to the patients under his care. At the same time, so long as most public mental hospitals are understaffed the novice cannot get the regular training which he needs, and I cannot help thinking that there would be less wastage among new entrants if they were better taught. What, then, is the remedy? I suggest that for a time, whether a year or more, the beginner should be treated as a cadet and not reckoned as part of the normal establishment. While he will have definite duties to perform, they will not take all his time and he will have some time for study. But this is only a partial remedy, and it should be regarded as part, and an important part, of the duties of the superintendent to supervise and train his young men, a proposal which incidentally reinforces the case for relieving him of some of the purely administrative duties which now occupy so much of his time. If after a sufficient trial the novice shows promise and an aptitude for psychological medicine, he should then be drafted to a centre of post-graduate instruction. I feel strongly that this should be the second stage and not the first, as it is difficult, if not impossible, to determine whether a young doctor is worth post-graduate training until he has lived in a mental hospital long enough to decide whether he likes the life or not.

So far I have been considering only the training necessary for ordinary in-patient and out-patient work. This brings me to the far more difficult question of the proper training of consultants. Here I venture to suggest that the proposals put forward in exalted medical circles for defining the qualifications required before a psychiatrist is to be recognized as of consultant standing are too remote from reality to be altogether helpful. The Olympians of Harley Street forget that there are only a handful of men in the country who fulfil the conditions which it is proposed to prescribe. Yet under the White Paper health authorities will be required to provide a consultant service everywhere, not merely in the fortunate cities which possess a university and a medical school. This service must, in fact, be supplied mainly, indeed almost entirely, from the mental health service. Quite apart, therefore, from the consideration that the mental hospital staff have the advantage of a far wider range of clinical material, outside of a few special areas the mental hospital men are bound to monopolize the consultant service for the simple reason that there is no competition. If, therefore, almost all the consulting work is done by psychiatrists from the mental health service, why not call them consultants? Common sense demands it, and it is an administrative necessity, since they are in fact the best men available for the job. As the French put it, *à force de forger on devient forgeron*.

At the risk of digressing still further, I must guard myself against misunderstanding. There is much in the report of the Committee of the Royal College of Physicians which will command general agreement. I imagine that everyone will agree, at least in theory, that there ought to be a uniform D.P.M. It is indefensible that some of the examining bodies, whatever their motives, should offer the students a "soft option," with the inevitable result that all

but the most ambitious are tempted to take the easiest course. Few will dissent from the suggestion that candidates should be required to spend a longer period in psychiatry before being allowed to sit for the examination ; and there is much to be said for requiring more time to be spent on a study of the neuroses. So far the Committee are on strong ground. As a general proposition the need to raise the standard will hardly be contested. The real difficulty is to determine how far the standard can be raised without producing repercussions in the mental health service, which the Committee appear to have ignored. The D.P.M. was not meant to be, and ought not to become, an honours examination. On the contrary, it is a qualification which all future entrants into the mental health service should be required to take as a condition of promotion to a senior post. But there is danger if any attempt is made to go beyond this point. There can be, I suggest, no objection to the institution of an honours examination as such. Indeed, there would be obvious advantages in providing a higher qualification for men who intended to seek professorial or other teaching posts, or to become advisers to the mental health committee of the new health authorities. But to convert the D.P.M. into an honours examination will limit the number of candidates. Only the keenest students will take it, and the rest will lose the incentive to study which the present D.P.M., unsatisfactory as it is, has hitherto given them. Nor is this the only danger. It seems to be implied in the report of the Committee that only men who take the five years' course are to be regarded as psychiatrists. This, in my view, would be disastrous. It divides the medical staff in the mental health service into two castes, a small number of high caste men, who are to be graded as psychiatrists and to rank as consultants, and a much larger number of "untouchables." In fact the service on such a basis would resemble an army consisting solely of field marshals and pioneer units. As a basis of organization it is thoroughly unsound, and its psychological effect would be disastrous. I venture to suggest that, leaving out of account pre-registration house appointments, all doctors working in the mental health service ought to be psychiatrists or on their way to becoming so.

Personally I find many reasons for hoping that private practice in psychiatry will continue, not the least important being that it would facilitate a scheme which I have long had in mind for putting some of the staff of at least the larger mental hospitals on a part-time basis. Here I am conscious that I am touching on a subject in which controversy is all the more embittered because, up to a point, both sides are right. Many mental patients will spend the rest of their life in institutions and, therefore, what may be called the custodial aspect of the work assumes an importance which does not obtain in any other type of hospital, even a tuberculosis sanatorium. From the point of view of custodial care, the conception of the mental hospital as a compact family unit, in which the staff share the recreations and, indeed, the life of the patients, has a real value. Doctors who live in can and often do acquire a knowledge of their patients which no visiting staff can ever possess. This sense of solidarity, the feeling that staff and patients alike belong to one great family, has at its best many valuable features. But I am convinced that, however much living in conduces to better custodial care, a long price has to

be paid for these advantages. I have seen too much of the effects of the non-resident system in continental hospitals to advocate putting all the staff on a visiting basis. But I am not convinced that because some part of the staff must be resident, all need be. I see no reason why some compromise should not be possible which, in some measure, would combine the advantages of both systems. On one point I think there will be general agreement. No doctor should be allowed to live out until he has had some experience of living in. Young medical officers cannot properly understand the special difficulties of life in a residential institution until they themselves have lived in one.

Part time employment and freedom to live out would increase the number and improve the distribution of psychiatrists in private practice, and it would help to improve recruitment by bringing in men who are attracted to psychiatry, but who are not prepared to accept an institutional life for themselves and their families for the whole of their career. Admittedly this involves some differentiation of function in the higher ranks of the mental health service, but I am convinced that it would bring in an element—the independent and adventurous types—which is at present lacking.

I hope I shall not seem to disparage institutional service. Such a life suits some men; others become accustomed to it, and acquiesce in what has come to seem inevitable. We can all recall cases of men whom one could not imagine living apart from their patients. The late Sir Pendrill Varrier-Jones was a case in point. Such men live for, as well as with, their patients; they are the salt of the earth. But it is foolish to organize on the assumption that there will always be a saint to fill the top post, and even saints do not always remain celibate, as they should; and the normal man benefits by not living all the time with his work.

If we are to aim at making the mental health service more attractive by offering a choice of alternatives in the later stages, there is one other change which calls for consideration. At present far too many of the prizes go to successful administrators. The man who can run the machine and manage the committee gets the top post. Under the present system that is inevitable. Men and women in public life are shrewd enough judges very often of administrative capacity, and even if they were competent to appraise clinical skill, which they usually are not, they would still prefer the man who can manage staff and who exhibits good judgment in administration to the man who is a clinician pure and simple. Who can blame them when we remember what a mess brilliant clinicians have sometimes made of their hospitals? Yet it remains true that good clinical work is not at present adequately rewarded. I suggest that the difficulty might be met by creating a post of senior physician without any administrative duties, except perhaps in the absence of the superintendent, such post to carry the same salary as that of superintendent, though the latter might be given an allowance in the nature of "table money" to cover the expenses of hospitality which fall upon him. I recognize that this involves a kind of dyarchy, and a dyarchy brings its own difficulties and is not always a stable form of government. But I cannot believe that a proper demarcation of function is unattainable, and the suggestion gives a fairer chance to the clinician.

Turning now to the question of machinery, I want to make it clear that I have no authority to make any definite statement in regard to details of the layout. I can only indicate what seems to me the implications of the White Paper. I assume that under the Health Authority, which has a general responsibility for the control of all health and hospital services in its area, there will be at least two committees—a Public Health Committee, with the Medical Officer of Health as its expert adviser, and a Mental Health Committee, also with an expert adviser. The Health Authority itself, at least in the larger areas, will presumably have as its adviser and chief executive officer a Director of Medical Services. This should be the ultimate objective, but at the start it may be impracticable in some areas. It is a feature of the mental health service that it requires for its economical administration a large unit of population. To secure proper classification without resort to small wards, which are needlessly expensive to staff, a mental hospital of about 800 beds is necessary, a figure which corresponds closely to a population of 250,000. Indeed, except for a few highly specialized services, such as neuro-surgery and orthopaedics, no service needs for its efficient organization a larger unit than mental health. There may be areas in which the desirable minimum population may not exist. In such cases the medical officer of health may become also the Director of Medical Services. But these cases will, I hope, be comparatively rare, and it is better for present purposes to consider the organization in what may be called the normal areas which can afford the kind of staff I have adumbrated. Even in these areas there may have to be all kinds of provisional arrangements in the transition period, for the reason, among others, that men with the all-round qualifications needed for the Director of Medical Services hardly exist at present and will have to be trained. Once their functions are defined and the need is understood, training is only a question of time. The fear expressed in some quarters that the new organization will put the mental health service under the control of medical officers with no experience of mental health problems seems to me exaggerated. At the start it may happen here and there, but I believe it to be merely a temporary difficulty incidental to the transitional stage. Human nature being what it is and medical officers of health being what they sometimes are, occasional friction, especially at the start, is inevitable, but this does not invalidate the principle.

Once this is agreed the difficulties of the transition period will gradually disappear. There may be, indeed there almost certainly will be, some cases of individual failures to adapt to the new conditions. Such difficulties, inevitable in any transition period, will be cured by effluxion of time if in no quicker way. Incidentally, this has a bearing on the question of training. I feel bound to assume that no substantial addition to the undergraduate curriculum is practicable at present, desirable as it certainly is. There is general agreement that the present curriculum affords pitifully little training in psychological medicine, but there appears to be no escape from the dilemma that little addition can be made to the present curriculum without lengthening the period of training, which in turn means increasing its cost and narrowing the field of recruitment. It is true that the Goodenough Committee have made valuable proposals for the development of a psychiatric department in every teaching

centre, and for giving the undergraduate some grounding in the importance of psychosomatic conditions and some clinical clerking in out-patient clinics, where he will see the beginnings of mental trouble, in partial substitution for the demonstration of acute psychoses, which the general practitioner will not often meet, and will still less often attempt to treat. These proposals, if they are adopted, will mark a substantial advance, but the material point for our consideration now is that they will not lessen the need for post-graduate training of men entering the mental health service. At the same time, the Goodenough Committee's proposals for a pre-registration year to be spent in clinical work in hospitals will be of great value if students can be induced to spend at least part of the year between qualification and registration as clinical assistants in mental hospitals or psychiatric departments. But even allowing for this, men who intend to take up psychiatry will have to get their training for the most part in the post-registration period.

In what I hope I may be forgiven for calling their rather sketchy chapter on training in psychiatry, the Goodenough Committee, as might have been expected from their composition, have approached the question from the point of view of the general hospital. I suggest that the question needs to be approached from a wider point of view. If we are to produce men qualified for the varied duties of medical officers of mental health—a clumsy title for which no one has yet found a simpler substitute—they must be given opportunities of gaining experience in all branches of mental health work. Such a comprehensive training is equally necessary for those who are to take charge of psychiatric units, teaching centres or of child psychiatric clinics. Experience in a mental hospital is not enough. It would conduce to this end if every medical officer were required, as a condition of promotion to the rank of deputy, to have spent a minimum period, say two years, in a mental deficiency institution. Similarly, medical officers on the mental deficiency side should be required to spend a minimum period in a mental hospital. As the majority of local authorities now possess both types of mental institutions, this interchange need not present any great practical difficulty. I am not suggesting that the two branches should be regarded as convertible. On the contrary, they naturally appeal to different types of mind. What is wanted is that the younger A.M.O. should have an opportunity of gaining experience of all types of mental abnormality and of modern methods of dealing with them.

A change which follows from this, and is indeed a corollary of it, is the need for some modification of the D.P.M. curriculum. If all medical officers are to be given experience both of mental disorders and of mental deficiency, the D.P.M. should include both instead of offering alternatives as at present. It is scarcely necessary to add that the possession of a diploma or of some other evidence of post-graduate study in psychiatry ought ultimately to become a condition precedent of promotion to the higher ranks in the mental health service. I say "ultimately," because the immediate enforcement of such a rule would be unfair to many men who have passed the age at which examinations afford any true test of knowledge and experience.

This brings me to the difficult question of how such a rule can in practice be enforced. Probably few would question the desirability in the abstract

of requiring candidates for the higher posts to obtain some post-graduate qualification in psychiatry, though I can imagine sharp differences of opinion as to what qualifications should be recognized. But medical officers of public mental hospitals are the servants of, and appointed by, local authorities. How, then, is this rule to be reconciled with the traditions of local autonomy and the right of local authorities to choose their own men? To give the Board of Control the power to appoint is clearly inadmissible. This would be repugnant to the spirit of local government, and it would impose on the Board a responsibility which ought not to fall to any central department. But I suggest that there would be nothing incompatible with local autonomy in requiring the Board's approval to all appointments of superintendents and deputies, subject to an appeal to the Minister if the local authority felt that the veto had been unreasonably exercised. An alternative which might be more acceptable to public opinion would be to provide for the appointment of an independent selection board to draw up the short list of candidates from whom the local authority would make their own selection. The principle of an advisory committee for appointments to hospital staffs has been endorsed by the Good-enough Committee, and there is no reason why it should not be extended to mental hospitals, with suitable provision to secure that advantage is taken of the unique knowledge and experience in this matter of the Board of Control.

A point of great importance is that the establishment of a mental health committee will secure what the Feversham Committee recommended, and the Board of Control have long advocated—the unified control of all mental health services, with the exception of child guidance, which will be shared with the local education authority. But this is not the only advantage. As the new Health Authorities will be responsible ultimately for all hospital services, it will be possible to secure far more effective co-operation between mental and general hospitals. The general hospitals will be able to provide consulting physicians and surgeons, besides specialists, such as gynaecologists, ophthalmologists and ear, nose and throat surgeons, who will visit the mental hospitals regularly as part of their ordinary duties, instead of being called in only in emergency and not infrequently too late. Similarly the psychiatrists from the mental hospitals will be on the staff of the general hospitals entering as of right, and not just occasionally by invitation. As under the Mental Treatment Act any mental case, provided the patient is not certifiable, can be treated in an approved general hospital, there will be a wider choice of institution to which the patient can be sent, a choice determined solely by clinical considerations. The experiment of treating in general hospital wards cases presenting no behaviour difficulties and not likely to need prolonged treatment has already been tried with sufficient success to warrant its development; and this may prove to be the best way of dealing with those patients suffering from neuroses or psychoneuroses sufficiently serious to call for in-patient care who would refuse to enter a mental hospital. The closer linkage between the mental and general hospital ought to mean that the psychiatrists on the staff will be given control of a certain number of beds. They will no longer be regarded merely as occasional visitors, and though they may have fewer beds

at their disposal they will rank as full members of the staff, including representation on the medical committee where there is one.

This co-operation between mental and general hospitals becomes far more important in the case of the medical school, or as the Goodenough Committee prefer to call it, the teaching centre. It has long been a reproach that our medical schools, at least until the York Clinic at Guy's was established, did not include a psychiatric unit. I say "include," because it is essential that the psychiatric unit should be an integral part of the school and not merely something more or less loosely attached to it. It is not necessary for me to enlarge on the value of such a unit for teaching purposes. What I am concerned to point out is how the White Paper scheme facilitates the attainment of an ideal, which I think all of you will regard as a desirable, and indeed a necessary, development in any comprehensive plan for the development of mental health services in the future.

But while in principle the idea of a psychiatric unit as an integral part of the teaching centre appears to be generally accepted, it is not without certain dangers. If too many hopeful and recoverable cases are concentrated in psychiatric units of teaching centres or in psychiatric wards in the larger non-teaching general hospitals, there is the danger that mental hospitals will lose many of their admissions and will be left mainly with seniles and the certifiable cases. It would be disastrous if mental hospitals came to be regarded as merely a receptacle for violent or hopeless cases. There must, therefore, be some means of securing a fair distribution of cases between the psychiatric units or wards and the mental hospitals in the area. A second difficulty is that as psychiatric units are required partly, though not entirely, for teaching purposes, there may be a tendency to pass on to the mental hospital any case which is thought to have reached a stage at which it has ceased to be of clinical interest. Clearly some measure of transference between the two is unavoidable. There must be a constant inflow into the teaching unit, and not all cases, however carefully selected, can be treated to recovery. But such transfers must be regulated with due regard to the welfare of the patients as well as the needs of the students. I mention the point because when some few years ago I had an opportunity of visiting Santpoort, Dr. Kraus complained bitterly of the difficulty of dealing satisfactorily with patients who were, as he put it, dumped on his hospital because they were no longer regarded as of sufficient clinical interest to be worth keeping in the psychiatric unit at Amsterdam. It is a problem which admits of no precise solution, but the difficulty is real, and points to the necessity for close co-operation between the mental hospital and the psychiatric unit. Perhaps at least a partial remedy may be found in arranging for the senior psychiatrists of the mental hospital to form part of the staff of the psychiatric unit, instead of the two medical staffs being entirely distinct as they are, or at any rate were, in Holland.

Another function of the psychiatric unit is to act as the focal point in the organization of clinical and laboratory research. As an abstract proposition, I imagine that few would deny that the university and its medical school form the natural and the best centre of clinical research, as they obviously form the best centre of laboratory research. Hitherto development in this

direction has been hampered by the difficulty of providing clinical material. In some schools the teacher of psychological medicine has been a consultant in private practice with control of perhaps five or six beds and without access to the mental hospital. In other cases he has been an overworked medical superintendent with access to almost unlimited clinical material and no time to use it.

I hope that what I have just said will not seem to imply any failure to appreciate the research work which has been and is being done in public mental hospitals. I recognize, of course, that good research work, including clinical research, has been and continues to be done in mental hospitals; but the fact that enthusiasts, often at the expense of what should have been their leisure time, have done valuable scientific work does not prove that the organization is sound. The problem is to create conditions which encourage scientific work: and to do this it is necessary to offer the research worker a reasonable career. The man who takes up research merely to make a living will never be worth much, but if the born research worker is not given a sufficient salary to enable him to live in decent comfort, and to educate his children, he will inevitably be tempted away into other and more remunerative work, not because he is a "gold digger," but by sheer pressure of domestic responsibilities.

I do not mean to suggest that there is necessarily any dichotomy between research workers and clinicians. Even in pure laboratory research the worker needs a clinical background, and in clinical research, experience, and often long experience, in the wards is essential. To my mind one of the great advantages of the psychiatric unit is that it gives the physician at the head of it time to study and to think, to write and to teach. How can this be expected of a busy superintendent who has to pacify the matron, listen to the clerk and steward, sign certificates and endless letters to anxious relatives, and perhaps spend the rest of the day grappling with temperamental architects or conscientious Commissioners.

While I have spoken of the mass of detailed work which falls to be done by the superintendent, I do not mean to imply that the present system should be accepted as satisfactory. We are far from having devised a satisfactory apportionment of responsibilities as between the superintendent and the lay administrative staff. In a few cases efforts have been made to relieve the superintendent by assigning to a lay administrator certain duties which elsewhere are discharged by the superintendent himself. Without wishing to involve myself in a discussion of technical and, unhappily, often controversial details, perhaps I may be permitted to record a purely personal view that some measure of devolution to a lay administrator is desirable, but that if such devolution is to succeed it will be necessary to recruit a more highly trained administrative personnel than is generally available at present.

So far I have spoken mainly of clinical research, but the case for linking the university and the medical school with the mental hospitals is even stronger in the case of laboratory research. Nowadays laboratory research is a matter of teams rather than of isolated individuals. It calls for organization and lavish equipment. The day of the lonely genius working feverishly in a leaky shed has ended except on the films. Of course, there may be another Madame

Curie, but it is unwise to count on miracles. To leave research to ambitious young men seeking material for a paper in some medical or scientific journal is to ignore all that the organization of research, largely under the guidance of the Medical Research Council and the inspiration of the late Sir Walter Fletcher, has taught us. What is needed in each area is a plan directed by the university through the Faculty of Medicine working in close collaboration with the psychiatric unit and the mental hospitals, under which what can best be done at the centre will be assigned to it, and the mental hospitals will co-operate by undertaking such part of the investigation as their staff and equipment fit them to undertake. Incidentally the co-operation of the professors in the Faculty of Medicine and their staff will not only help the individual hospitals, but it will act as a stimulus, and pathological laboratories will no longer be used, as I have occasionally seen them used, for the storage of bicycles. Of course I am not suggesting that routine testing should be subject to any kind of outside control, but even here it should be a great help to the mental hospitals to have the university to appeal to in any case of difficulty. Nor would I discourage young medical officers from working independently, provided they first consult the Research Bureau of the Association. Indeed, there is much to be said in favour of encouraging the medical staff to undertake any investigation which appeals to them, because it helps to keep their scientific interest alive, and so counteracts the soul-destroying effect of too much routine work.

Two directions in which the psychiatric service is likely to expand are worth noting here—contact with the courts and contact with the Ministry of Labour. As soon as parliamentary time allows it may be expected that the main provisions of the Criminal Justice Bill will be re-introduced, and the natural and most obvious method of providing the courts with advice and reports on any cases in which there is *prima facie* reason to believe that criminal acts have been due to the accused's mental condition would be through the psychiatric consultant service. I do not personally think that the health authority is the best body in all cases to provide any treatment that may be necessary. Indeed, such little experience as I have had confirms the view put forward by Dr. Blacker that the treatment of delinquency is best left to psychiatrists who have specialized in it sufficiently to have acquired an appreciation of the mentality of delinquents.

Contact with the Ministry of Labour is likely to become of increasing importance in the future. There is evidence of a growing realization by labour exchange officials that constant changes of employment and failure to get on with any employer may be due to psychological factors. The difficulty may be temperamental, but it may also be due to the wrong choice of employment. The matter is important, because the man who is constantly changing his job is apt to end by becoming a chronic unemployable whom nobody wants. Vocational guidance will probably remain, as it is at present, within the province of the industrial psychologist, but it may well be that psychiatrists will be increasingly used in civil life, as they have been in the Army, for personnel selection. These, in a sense, are minor or subsidiary developments, but they are significant as showing that public opinion is becoming more alive to the value of psychiatry, not merely as a method of treatment, but as a practical

aid in everyday life. All these new developments which I have outlined mean a gradual shifting of the centre of gravity. The mental hospital must remain a part, and a vitally important part, of the mental health service, but there will be a growing emphasis on the preventive side of the mental medicine, and institutional treatment will cease to dominate the picture as it has done hitherto. The preoccupation of visiting committees in the past with the mental hospital, which, in other words, meant to a large extent preoccupation with end-results, was contrary to the whole conception of preventive medicine. The mental hospital has an essential part to play in the scheme, but only as a part in something far bigger and more comprehensive.

There is one part of the field in which unification has not been achieved, and at present seems unlikely to be achieved at all completely, and this is the vitally important matter of child guidance. I say "vitally important," because it is in this sphere that the mental health service becomes preventive, or, to put it more accurately, since much out-patient work is preventive, comes nearest to preventive medicine. Unfortunately it is impossible to frame an ideal scheme because the problem is not purely medical. It is partly educational, as well as a problem for the psychiatrists. The educationists argue, not without reason, that the difficult child is primarily an educational problem. It starts with the child's failure to learn, and this failure, it is argued, is not always or necessarily indicative of mental instability. Consequently it is claimed that the non-medical educational psychologist is the best qualified person to examine the child in the first instance. It is also argued, again not without force, that the educational psychologist, having had experience of teaching, is better able than the psychiatrist to appreciate the difficulties of the teacher-pupil relationship, and still more perhaps the difficulties of the teacher-parent relationship. I do not suggest of course that these arguments are conclusive, but they are formidable, all the more so in view of the popular prejudice against psychiatrists. The result is that the claim of the local education authorities to provide and control child guidance centres cannot be contested with any hope of success. This means that there will be a two-fold organization, the child guidance centre under the education authority and the child psychiatric clinic under the health authority, to which the child guidance centre will refer children exhibiting *prima facie* signs of mental instability. Of course there must be some effective liaison between the two, and the simplest way to secure this may be to arrange for the psychiatrist to visit child guidance centres either by invitation or at regular intervals. It is not necessary for me to discuss possible methods of securing this co-operation. I am merely concerned to point out that here unfortunately is an exception to the unification of all aspects of the mental health service under the health authority and its mental health committee. It will be for you to see that psychiatrists are not treated as "back room boys" in this part of the service.

This survey would be incomplete without some reference to the functions of the central department. Whether that department is the Ministry of Health or the Board is for this purpose immaterial. In either case the functions and their rationale are fundamentally the same. There are those who take the view that under present conditions visitation is unnecessary, and they

can cite such a distinguished authority as Prof. Henderson in support of that view. Nevertheless, I venture with all respect to submit that such a contention will not stand serious examination. Let me say at once that I regard as negligible the risk of illegal detention in public mental hospitals of persons who are no longer proper to be detained. In my experience, which extends over 17 years, I have never found any case of a patient who was not of unsound mind being detained in a public mental hospital, nor did the Royal Commission under Lord Macmillan.

But the case for continuing visitation does not rest solely or mainly on the risk of improper detention. In my opinion it is justified and, indeed, necessary on legal, administrative and medical grounds. On legal grounds there is the natural demand that any encroachment upon the liberty of the subject shall be safeguarded, whether in practice such safeguards have been proved to be necessary or not. This aspect of the matter is too familiar to you to need any emphasis from me. On the administrative side there is the principle, which cannot be contested, that the taxpayer and the ratepayer are entitled to be satisfied that money spent on any public service is properly expended. Every type of public hospital must submit to inspection. It may sometimes be disagreeable, just as audits may be disagreeable, but the principle is so universally admitted that it cannot be challenged with the faintest hope of success. But quite apart from these considerations, I venture to suggest that visitation and inspection are valuable on purely medical grounds. Statutory visits are not paid merely because they are statutory. They are in fact the only effective means at present available of pooling experience. I have already referred to the isolation of many mental hospitals. Without the visits of Commissioners they would have little opportunity of knowing what new methods had been tried elsewhere and with what results. Nor is the Commissioners' experience limited to the strictly scientific subjects. There are many administrative problems in the solution of which the wise superintendent will be glad to know what has been tried elsewhere outside his own immediate neighbourhood. Here and there may be a few who say that they can learn nothing from Commissioners; if that is so the fault does not necessarily lie with the Commissioners. There are in every calling a few men who would learn nothing, even if they were visited by an archangel; and I make no claim to archangelic status, even for senior Commissioners.

This brings me to a delicate question, which I approach with some reluctance. Even if the value of a medical visit is granted, some critics may ask what is the necessity for visitation by a legal Commissioner? Apart from the fact that Parliament would not readily forego any of the established and traditional safeguards, my own experience convinces me that legal visitation can be justified on merits. It is significant that in other countries, notably in France, the necessity for a legal visitor has long been recognized. But I would go further and submit that legal visitation has a therapeutic value. There are many questions, particularly in relation to property, which patients find relief in discussing with the legal commissioner. Indeed, it is not uncommon for patients to ask to see the lawyer, and to justify their request by saying that they see quite enough doctors anyway. Whether this preference is in itself

indicative of unsoundness of mind is a question which I must leave the experts to decide. I would, however, suggest that the patients are not the only persons who benefit by the chance to talk over their difficulties with an experienced man of the world, whose logical training supplies a corrective to any unbalanced enthusiasm, and broadens the outlook of those doctors who suffer, as some inevitably do, from the cloistered life they lead in institutional work. At first sight it may seem an odd combination, but in fact it works. The rationale is pragmatist rather than theoretical, but it is none the worse for that.

I have dwelt at some length on visitation because it is the most debatable of all the functions of a central department. But it is, of course, not the only function or even the most important. That the Government must maintain some control over capital expenditure by local authorities is almost axiomatic. But apart from the necessity for some measure of financial control, there is in my judgment an overwhelming case for the approval of plans by the central department, a case which has been strengthened by the tendency in late years to leave the preparation of plans and designs to the county architect, often men of ability and high professional standing, but of necessity without experience of the special needs of the peculiar population of a mental hospital. Further, the experience of the Board's architects is nation wide. They know what has been tried and what has succeeded or failed elsewhere. It is, in fact, another aspect of the advantage of pooling experience.

The necessity for the examination of the documents which justify detention calls for no comment. This is a protection to the mental hospital as well as to the patient. Nor do I propose to discuss in detail the other functions of the central department beyond expressing my personal opinion that the administration of the Mental Deficiency Acts is over-centralized, and that the health authorities ought now to be given the same power of discharging mental defectives which they possess in relation to patients in mental hospitals. This extreme centralization was no doubt necessary in 1913, when local authorities possessed no experience of this work; but in my considered opinion it is no longer necessary. With this important modification, I believe that there is a strong case for retaining a central department with substantially the same powers and duties which have hitherto been exercised by the Board of Control. I recognize that this view may be challenged, but long experience convinces me that it is sound. Central supervision is not popular—indeed no form of supervision is popular—but this does not prove it to be superfluous.

One other point calls for a brief mention. If the mental health service is to develop on the lines I have suggested, its scope cannot be limited to those mental disorders which come within the Act of 1890. Happily no court has ever been asked to decide what is meant either by the term "unsoundness of mind" or the still vaguer term "mental illness." In practice it has been generally assumed, and in my opinion rightly assumed, that neuroses or psycho-neuroses sufficiently severe to call for in-patient treatment are mental illnesses. At the same time, the legal position is not free from doubt; indeed, few legal questions ever are; and although sensible people will proceed on the assumption that the law is what it clearly ought to be, there is always the possibility that the right to treat neurotics as in-patients in a mental hospital might be questioned.

I welcome the recommendation of Lord Moran's committee that the training of psychiatrists should include a much fuller study of neurology, and the relation between the two kindred specialties would no doubt be less exacerbated if neurologists had a better understanding of psychiatry.

I am conscious that this lecture will sound to you an egotistical pronouncement. I make no excuse for that. Indeed it could hardly be otherwise. I can no longer speak for the Board of Control, and I do not even know how far the present Board are in agreement with some of the views I have expressed. Since the honour of giving the Maudsley Lecture—and I feel it is a very real honour—has fallen to me after my retirement, I can only express my personal opinions, in the hope that after more than forty years spent in public administration and seventeen years, a record period, as the Chairman of the Board, the views I had formed in the light of that experience might be of interest to you. I know that I have said many things with which some of you will disagree, and perhaps some things with which many of you will disagree. But it is from the clash of opinions that true judgment emerges; and after all if we were all of the same mind a lecture, whether delivered by me or by anyone else, would be as futile as an impassioned speech on temperance delivered to an audience of Rechabites. If anything I have said has given offence I ask your indulgence. I have tried to look ahead, and to envisage some of the changes which lie before us. It is hard to plan the future without implied criticism of the past, but I should be the first to regret it if I seemed to have been unfair to you and your predecessors, or to have failed to appreciate the great work which some of them accomplished, often under the most discouraging conditions. It is not for me to play the historian and to mete out praise or blame. I am concerned with the shape of the things to come, and, however disturbing the coming changes may be for the moment, I am convinced that there is a great future for psychiatry. In the past you have had to struggle against much misunderstanding and prejudice, fantasies of illegal detention and silly jests about "loony-bins," and perhaps worst of all against public indifference and professional pessimism. But to-day a new spirit is stirring. New methods of treatment have given us fresh hopes. When I look back to 1928, when I first came to the Board, I am struck by the change of attitude. Everywhere men are ready and eager to try out new methods; their outlook is notably keener and more scientific. There never was a time when the public was so psychologically minded, never a time when the medical profession was so ready to recognize the part which the mind plays in what used to be regarded as purely physical illness. Psychiatry in the future has a great role to play in co-operation with general medicine. But if we are to realize our hopes, it is essential to attract into psychiatry a fair share of the best brains in medicine; and this cannot be done unless the young men entering the service now can be assured of adequate remuneration and conditions of employment comparing favourably with other branches of medicine. It is up to the Association to fight for that, and I believe you will succeed. I have never been a pessimist, though there have been times when it was hard not to be; but there has never been a time when I felt as sure as I do now that our hopes will be fulfilled. The night has indeed been long, but at last the dawn is breaking.

VITAMIN B COMPLEX IN RELATION TO NEUROPSYCHIATRY.*

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IN this paper it is my intention to give a broad survey of vitamin B complex deficiencies and their influence upon neuropsychiatric abnormalities generally, whilst Dr. Hardwick will discuss in greater detail the syndromes more specifically associated with such deficiencies, amplifying his remarks by reference to cases we have treated in recent years.

Throughout the war and in the uneasy days that have followed it, public propaganda has tended to over-emphasize the importance of vitamins generally, so that the thinking members of the community are somewhat sceptical when such deficiencies are discussed, and it is with this healthy scepticism that our investigations and studies on this subject have been carried out.

In mental ill-health deficiency in vitamin B may show itself in two ways. It may manifest itself in neuropsychiatric syndromes solely due to such deficiencies, which resolve after specific treatment; or it may colour and confuse the symptoms of the ordinary psychoneuroses and psychoses. I emphasize this latter state because I do not think it is generally recognized. In new admissions suffering from such unrelated mental disorders as arteriosclerotic dementia, manic-depressive psychosis, schizophrenia, general paresis, anxiety and hysterical states, one frequently comes across cases where a greater or lesser degree of vitamin deficiency has rendered diagnosis difficult. Only after the exhibition of appropriate B complex factors has the underlying basic psychosis been clearly revealed. In any case showing symptoms of some mental confusion, greater or lesser, it is, in my opinion, advisable to search for such somatic abnormalities as rawness of the tongue, even if only confined to the tip, rashes, particularly involving the face, back of the neck, back of the hands and wrists, sensory changes, muscular tenderness, tremors, etc.

Of the better known factors which make up the B complex—thiamine, nicotinic acid, riboflavine, pantothenic acid and pyridoxine—the first two are, in our present state of knowledge, predominantly the factors whose loss causes abnormal neurological and psychological states.

Thiamine plays an important part in the fundamental processes of oxidation in the living cell, as a coenzyme in the oxidation of carbohydrate by the cell. Since the C.N.S. obtains its energy chiefly from the oxidation of glucose, the importance of adequate amounts of thiamine for normal neuronal metabolism can be clearly understood. The study of the metabolism of cerebral

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tissues removed from avitaminotic animals reveals that there is a reduced oxidation of glucose and glucose breakdown products, such as pyruvic acid and lactic acid, whilst the addition of thiamine to these tissues restores the normal oxygen consumption. This diminished ability of avitaminotic tissues to oxidize carbohydrates is a result of their decreased cocarboxylase content, i.e. the diphosphoric ester or active form of vitamin B₁.

Nicotinic acid is chemically related to nicotine. In the body nicotinic acid amide combines with adenine, phosphoric acid, etc., to form a coenzyme essential for the transference of oxygen in the fundamental processes of the cell; animal cells cannot synthesize nicotinic acid, and without it coenzyme formation is impossible. The direct effect of nicotinic acid amide on brain metabolism is difficult to demonstrate. Investigations upon the cerebral tissues removed from dogs suffering from "black tongue"—a syndrome due to a nicotinic acid amide lack—show no decrease of the coenzymes, whilst cerebral oxygen utilization is unchanged. Other tissues hold on to the coenzyme equally as tenaciously, and in obvious pellagra the nicotinic acid content of whole blood may not fall below that found in normal controls. It follows that storage by the body of nicotinic acid appears better than that of thiamine.

Riboflavine is a component of the coenzymes essential in the intermediate stages of carbohydrate metabolism. Although at the present there is no definite evidence that it is directly responsible for neuropsychiatric conditions, it is found that dogs suffering from chronic riboflavine deficiency may show myelin degeneration of the peripheral nerves and posterior columns of the spinal cord, progressively increasing in severity with the length of time they are on the deficient diet.

It is probable that pyridoxine mobilizes riboflavine from storage, or dissociates it from some combination in which it is physiologically inactive, whilst pantothenic acid may have a similar action.

The pathological changes to be found in the C.N.S. in B-complex deficiencies are reversible, and the more obvious are most commonly due to thiamine lack. The nerves in a polyneuropathy show a degenerative demyelination, and at no stage is there evidence of an active inflammatory cellular reaction, and for this reason it is inaccurate to refer to the condition as a neuritis.

Regardless of the underlying cause of the deficiency, a small percentage of patients with a polyneuropathy develop demyelinating lesions in the spinal cord. Usually the posterior columns only are involved, the column of Goll being more frequently destroyed than the column of Burdach. These posterior column lesions are preceded by demyelination of the posterior nerve roots. The pathological appearances of these deficiency disease lesions are very similar to those of tabes dorsalis, and although no claim is made for a common aetiology in these conditions, it is possible that a common disturbance of cellular metabolism may result in such similar morbid changes. In Wernicke's encephalopathy, lesions of a haemorrhagic and later cellular invasive nature are found in the paraventricular grey matter of the third ventricle, the mammillary bodies, para-aqueductal region, the corpora quadrigemina beneath the ependyma of the fourth ventricle, the olives and in the cerebellum.

There are no specific changes to be found in the C.N.S. in nicotinic acid

deficiency, but the occurrence of primary irritation of large nerve cells, such as the Betz and the anterior horn cells, either alone or in combination with hyaline changes in cerebral blood capillaries and Wallerian degeneration of the posterior and lateral tracts of the spinal cord, are highly suggestive.

In experiments with chicks, it has been shown that pantothenic acid is essential for the preservation of the spinal cord, whilst other factors of the vitamin B complex are not able to compensate for such a deficiency, although it must be admitted that so far it has not been demonstrated that the health of the nervous system in other animal species is influenced by an inadequate supply of this factor.

To summarize: The distribution and order of frequency of lesions in thiamine deficiency is more or less the reverse of nicotinic acid lack. In some forms of B₁ loss (beri beri) the peripheral nerves are the primary seat of damage, while in pellagra the brain seems to be the early focus of disturbance. As the condition advances, the processes tend to extend centripetally in beri beri and centrifugally in pellagra.

As yet one cannot be assured as to the best methods for the biochemical estimation of deficiencies of the various B factors.

In B₁ deficiency states the thiochrome content of the blood or urine can be measured by the thiochrome method or by a yeast fermentation test, whilst the blood cocarboxylase content gives a good indication of the thiamine saturation of the body. At the present the estimation of the dextrose, pyruvic acid and lactic acid content and changes in the blood, following oral or intravenous glucose, appears to furnish the most reliable results.

The estimation of the urinary content of nicotinamide methochloride is probably at the present the method of choice in estimating nicotinic acid body saturation, but further reference will be made to the fallacies of such an estimation later in the paper.

One must now discuss conditions which may cause these deficiencies. Succinctly they are (1) a lack of the factors in the ingested food, (2) failure in their absorption, (3) an inability to store them, and (4) an upset in the body cell's ability to utilize them. An inadequate ingestion of vitamin B is likely to occur in food faddists, diabetics, dyspeptics, widowers or single people living on their own who neglect to cook for themselves or collect their rations, and in war time, commonest of all, mothers who have sacrificed their ration for the good of the family. In such chronic wasting diseases, as tuberculosis, diabetes, hyperthyroidism and neoplastic diseases, secondary deficiency states may occur even when an adequate diet is being taken.

Before dealing with defects in absorption I must mention the recent work of Ellinger, Coulson, Benesch and Kay on the biosynthesis of nicotinic acid in the human gut by the intestinal flora. Most of this research has been carried out at West Park Hospital. It had been found that thiamine could be synthesized by the intestinal flora, whilst the considerable discrepancies between the quantities of nicotinic acid daily ingested and eliminated suggested to these workers that a similar mechanism for the production of nicotinamide might be at work. They found that when the bowel was "sterilized" by succinyl sulphathiazole, the output of urinary nicotinamide methochloride

dropped, on an average 60 per cent., but returned to normal on the cessation of the "sulpha" drug. That this was not due to the destruction of nicotinamide by the drug was proved by the controls who received sulphathiazole only. Benesch found that aerobic cultures of caecal organisms synthesized considerable quantities of nicotinic acid, mainly after the third day of cultivation, whilst anaerobic caecal organisms destroyed two-thirds of the nicotinic acid present in the original medium. It is suggested that in the normal caecum an equilibrium is to be found between organisms producing and those destroying nicotinic acid. An upset in this equilibrium may play an important part in the causation of deficiency diseases.

This balance may be upset by such conditions as vomiting, chronic diarrhoea, dysentery, sprue, coeliac disease, tuberculous enteritis, neoplasm of the gut, etc., and probably explains the frequency of deficiency states found in such conditions. Again, the increasing use of sulphaguanidine and succinyl sulphathiazole for the "sterilization" of the bowel may precipitate a further number of deficiency cases in the future.

Some of the liver diseases have been shown to result in vitamin deficiencies by interfering with their storage.

It might be appropriate at this stage to point out that alcohol as a factor in deficiency states is concerned in (1) diminished ingestion, owing to the alcoholic's failure to eat adequately, in (2) failure of absorption due to gastritis, vomiting, etc., and in (3) failure of storage due to liver damage. In our experience, other drug addictions, such as with the barbiturates, bromide, morphia, etc., may produce deficiency states; whether by interfering with absorption or by liver damage, is at the present not clear.

In recent years many people have existed on a borderline diet adequate for their needs when their lives run smoothly; in such persons any stress, such as pregnancy infection, surgical procedure, fracture, etc., may precipitate a deficiency state.

Our experience has shown that in the treatment of acute deficiency syndromes it is essential to give the factors parenterally, and only when the acute phase has passed is it advisable to treat by mouth. Again, the findings that anaerobic organisms destroy nicotinamide may account for those not infrequent cases which fail to respond to treatment when given by mouth. Most deficiency conditions are of a mixed nature; for this reason it is better to treat patients by a combination of the B complex factors, the relative dosage of each depending upon which "factor defect" syndrome is most evident. According to some authorities the exhibition of one factor alone may be dangerous, in that it may light up an overt deficiency state of another factor. Cases of Wernicke's encephalopathy treated by thiamine alone may leave them with a residual Korsakow's psychosis unaffected by a continuation of therapy. It is usual after the deficiency state has cleared up to continue treatment with whole yeast, although it is fully appreciated that the balanced and relatively more plentiful diet of hospital is probably more than adequate for the patient's vitamin maintenance.

In conclusion, whilst our knowledge of inadequate nutrition and its relationship to physical and mental ill-health is still meagre, I think that the importance

of vitamin B complex in the maintenance of well-being is being increasingly established.

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VITAMIN B DEFICIENCY AND THE PSYCHOSES : CLINICAL ASPECTS.*

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IN 1943 I published a paper on pellagra, in which I described in summary form twelve clinical cases from amongst patients with a psychosis of long standing at West Park Hospital. I also referred briefly to two other cases seen at the observation unit at St. Pancras Hospital, one of whom died shortly after admission, the other being subsequently discharged recovered from West Park. Since then I have encountered from time to time further cases, both amongst the West Park patients and those of recent admission to the observation unit. The diagnosis in each instance was clinical, being based on the well-known symptomatology of symmetrical dermatitis, glossitis (and often stomatitis), malnutrition and, as a rule, diarrhoea. The frequent association of malnutrition with mental disease led one to suspect that milder vitamin-deficient states, i.e. intermediate between frank pellagra and healthy nutrition, existed. I think that our clinical observations, together with subsequent research along biochemical lines, go to support this. If one adds to the foregoing the major and minor B₁ deficiency states, one is forced to the conclusion that one is not dealing with academic rarities, but with a practical problem of interest to psychiatrist, physician and dietician. Moreover, recent research has yielded us powerful therapeutic weapons, such as nicotinic acid, aneurin and riboflavine, which, with certain reservations, have a specific curative effect in the corresponding deficiency conditions.

It is not my purpose to enter into the biochemical problems involved in deficiency states, but I must here mention that important and fruitful investigations have been carried out in the last few years by Prof. P. Ellinger of the Lister Institute and Mr. R. Benesch, late Maudsley Research Fellow, who utilized some of our West Park cases. The biochemical diagnosis of nicotinamide deficiency has proved a difficult task, but the nicotinamide methochloride elimination test recently described by these authors may well have surmounted a formidable obstacle, and eventually lead to earlier and more exact diagnosis.

Firstly, I shall relate briefly the histories of two recent cases of pellagra. The first patient, a female, aged 67, was admitted to West Park Hospital in July, 1945, in an agitated, remorseful and depressed condition. Her weight was 6 st. 3 lb. (normal weight 8 st.). Over her forehead and outer parts of the cheeks and over the back of the forearms and shoulders there was scaly, desquamating skin. Tongue was smooth, but not atrophic. No diarrhoea. The average 24-hourly urinary nicotinamide methochloride estimated by Prof.

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Ellinger was of the low value of 1.31 mgm. She was treated with a liberal diet and large doses of nicotinamide. The pellagrous rash took about three weeks to disappear, whilst the patient remained severely depressed for a further 3-4 weeks before she began to improve. She had completely recovered from her depression by October, was thereupon discharged, and has since maintained good health and regained her usual weight. This patient had had three depressive breakdowns in the past, each clearly following a precipitating factor, the present appearing to have been initiated by the death of her sister. During the six months prior to admission to hospital she had neglected herself, given her meat rations away, and forgotten to get her meals; and she admitted retrospectively, "I lived mostly on bread, margarine and potatoes."

My second case is a Jewess, aged 62, who was seen by Dr. Caldwell at Bethnal Green Hospital in consultation. She was admitted there in 1945 for investigation, as she was convinced she had a cancer. The history showed that she had been obsessed with this idea and depressed in consequence for nine months. During the last 3-4 months she had lost much weight, as she had subsisted mainly on bread and butter and cups of tea. She had suffered from occasional diarrhoea. Her psychiatric state was one of wailing melancholia, coupled with some degree of confusion. Physically she presented an acute glossitis, had a pellagrous rash over the exposed parts of her skin, and weighed 7 st. 1 lb. (normal weight 10 st.). She was treated with large doses of nicotinamide and vitamin B₁ and needed patient feeding. In two months she was free of pellagrous signs, and her agitation was much less pronounced. E.C.T. was not given as she suffered from severe essential hypertension (B.P. 240/145). She is still in hospital, disgruntled and mildly depressed, but she works hard, and no longer expresses any delusional ideas.

These two cases illustrate the production of pellagra by grossly inadequate dietaries over comparatively long periods. One has to bear in mind, however, the recent emphasis on intestinal bacterial synthesis of vitamins, including nicotinamide (*vide* Ellinger, Benesch and Kay), and I suggest that there is possibly an interference with the normal synthesis in certain psychoses. Thus, depressive states may be accompanied by "functional" disorder in the gastrointestinal tract, exhibiting itself in constipation and unpleasant subjective disturbances, which the patient often misinterprets as a blockage, etc. A further question arises, viz. how much of the psychiatric symptomatology is attributable to the pellagra; or, to what degree does the latter aggravate the mental signs? In the present state of our knowledge I am inclined to the view that these questions cannot be faithfully answered. However, Spies and his co-workers in America found varying degrees of mental disorder and disfunction in their series of pellagrins, and described amelioration with nicotinic acid. In the two cases I have described, specific therapy relieved the deficiency syndrome, removing an important factor in the total illness, and this may thereby—speaking figuratively—have broken a vicious circle.

I shall next relate briefly the case-history of a pellagrin, a patient at West Park with a long-standing mental illness. A. M. J.—, now aged 55, was first admitted to hospital in 1923. She is an interesting schizophrenic, who has had numerous recurrent phases of stupor. Her case was included in the series of

periodic catatonic patients which Dr. A. Stokes and I described a few years back. The weight record of this patient shows marked fluctuations: in 1923, 7 st. 3 lb; in December, 1933, 10 st. On readmission in December, 1939, 8 st. 4 lb., falling notably during a stuporose phase in October, 1941, to less than 6 st.; April, 1942, 9 st. In August, 1942, she contracted Flexner's dysentery during an epidemic at the hospital and was treated with sulphaguanidine. In October she had relapsed into a resistive stupor and looked ill. During early 1943 she had relaxed stools from time to time, and in September she developed a typical pellagrous eruption over the back of the forearms, hands and neck. This responded dramatically to nicotinamide. In April, 1944, during another stupor phase she had a bout of loose stools, and shortly afterwards developed an acute dermatitis over the lower half of the face. A little later marked glossitis was noted. Weight 6 st. 2 lb. Subcutaneous nicotinamide relieved the glossitis and dermatitis. This patient was also amongst those investigated from the chemical side, the average 24-hourly urinary nicotinamide methochloride excretion being only 1.45 mgm. during the relapse of pellagra in 1944. The record of this patient contains no suggestion of overt pellagra before she contracted dysentery, despite previous malnutrition associated with the stupor phases. It seems likely that the disturbance caused by dysenteric infection (and possibly by sulphaguanidine medication) might have interfered with the normal production of nicotinamide, etc., by the bacterial flora, and that when the intake by mouth was reduced, a pellagrous state was precipitated. Ellinger, Benesch and others have referred to the probable relationship between dysentery and the sterilizing sulphonamides and pellagra. There is one other point of importance: the reduction of bacterially produced nicotinamide may persist for a considerable period—perhaps indefinitely. At any rate, the clinical history and the chemical findings of the case I have quoted suggest this.

Apart from the support from the biochemical side of nicotinamide deficiency in our midst, there is a further important angle of approach, viz. the pathological. I think it is not generally realized that pellagra is associated with a fairly characteristic histological picture, and I am indebted here to Dr. A. Meyer of the London County Council Central Pathological Laboratory for the following short summary: "Various changes have been reported in the C.N.S. of patients dying from pellagra. Of these, retrograde degeneration of large nerve cells is the most important from the diagnostic point of view. Other pathological changes are hyaline degeneration of capillaries and fatty degeneration. Sclerosis of the lateral and/or posterior tracts of the spinal cord is frequent but not obligatory. It is more in the nature of a Wallerian degeneration than of the patchy honeycombed appearance of subacute combined degeneration. Affection of the peripheral nerves is inconstant."

Dr. Meyer and I have up to date collected 18 cases, chiefly from mental hospitals, of histologically verified pellagra. Ten of these were from West Park. A definite clinical diagnosis was only made in 9 out of the total of 18. Five of the 10 West Park cases only were diagnosed on clinical grounds as pellagra, although in 4 others this was suspected. Further discussion based on these findings is beyond the scope of this paper, but I think they do

shed light on some of the hitherto inexplicable illnesses encountered in psychiatric practice. Moreover, I am of the opinion that further analysis of our data will support the contention of some authorities that a pellagrin may show no acute pellagrous manifestations, i.e. the condition may be pellagra *sine* pellagra. One is familiar with the occasional problem of a young schizophrenic patient who comes to the autopsy table in a wasted state, with little or no subcutaneous fat, and with shrivelled, atrophic hypoplastic organs. He, or she may be "signed up" as "C.V.D.," or perhaps "exhaustion from excitement in dementia praecox." I submit that the cause of death in these patients is much more likely to be vitamin deficiency—perhaps some fall into the category of "malignant malnutrition," recently described.

The next cases I have to describe I saw in consultation with Dr. Eli Davis at St. Andrew's Hospital early in 1944. The first patient, a female, aged 58, gave a history of bronchitis two months previously and influenza three weeks before admission. She had lost weight during the past year and particularly during the last month. She felt too weak bodily to carry on with her job, and admitted that although when well she enjoyed food of all kinds, except green vegetables, she had eaten little recently. Physically she was pale, looked older than her age and had signs of bronchitis. The tongue had a raw, beef-steak-like appearance, whilst the lips were redder than usual, although there was no subjective complaint. She was mildly depressed, apprehensive, lacking in confidence, hypochondriacal, with a tendency to fixation on her bowels (was constipated). She had been upset by a recent recrudescence in enemy air activity. She was evacuated to Claybury E.M.S. hospital, where she was treated with nicotinic acid and iron, and was discharged therefrom to her home a few weeks later, apparently well.

The second patient was an elderly woman, aged 77, who had lost her husband three months previously. It was somewhat difficult to obtain a satisfactory history, but the impression I had was that she had been depressed during this period, and had neglected herself, particularly with regard to her food—making do with bread and butter, cups of tea and odd scraps. The physical signs indicating vitamin deficiency were interesting as, apart from rawness over the anterior half of the tongue, due to denudation of papillae, she presented an angular stomatitis (deep linear fissures at both angles of the mouth with a greyish sloughing base). Moreover there was bilateral circumcorneal injection, and with the aid of a hand lens Dr. Davis and I thought we saw one or two vessels actually running on to the corneal margin in the left eye. From the psychiatric point of view there were indications of mild senile dementia coupled with some confusion. On one occasion she had said her food was being poisoned. The patient was treated with large doses of nicotinic acid and riboflavin, and departed from hospital improved on 10.v.44. A barium meal taken before she left hospital excluded carcinoma of the stomach, which had been suspected on her admission.

Commenting on these two cases, the mental picture in the first is similar to that described in pellagrins by Spies and his co-workers. In the second case one might conjecture that a confusional syndrome was probably averted by prompt specific therapy. Neither case could be regarded as suffering from

pellagra. Probably the first was the subject of a nicotinic acid deficiency, whilst the other showed combined lack of nicotinic acid and riboflavine.

Thus far I have painted too rosy a picture of vitamin deficiency states in that I have selected examples where there was not only response to specific therapy measurable in physical signs, but also improvement in the mental state. My impression—from the very considerable material we have collected—is that there is a larger group of cases with evidence of nicotinamide deficiency showing varying responses to therapy. A few cases appear to show little or no response, i.e. as regards the physical and mental picture; others show amelioration in the physical signs, together with either no change in the mental state, or at most, a clearing up of a confusional syndrome with the unmasking of some underlying psychosis and/or gross organic physical disease.

I have not sufficient time to deal with this problem, but will quote another case, in brief, as an illustration :

Patient L. N—, a female, aged 50, had been always delicate and nervous, reserved, unsociable. She was said to have been ill since 1919 with neurasthenia, arthritis, etc. An uncle and brother had both attempted suicide. Just before admission to the observation ward she had been up all night screaming, saying she could not sit, stand or walk. She accused her husband of ill-treating her, e.g. said he had broken her arm. She said her back was broken. Her husband reported that she had never eaten meat or green vegetables because of a long-standing dysphagia—living mainly on potatoes, bread, margarine and jam. She had taken very little nourishment for three weeks and had become very thin. She had been depressed, absent-minded and confused. At the observation ward significant physical findings were a dry ichthyotic skin, a smooth tongue, angular stomatitis and flat nails. Subjective dysphagia present. Her mental picture was one of agitation, restlessness and confusion, with superadded paranoid features. She was treated vigorously, with a full diet and nicotinic acid. The angular stomatitis cleared in 2–3 weeks, but glossitis was still present six weeks later. Considerable amelioration was noted in the psychiatric syndrome, particularly as regards the confusion. She died, however, two months after admission to the mental hospital, and at autopsy was found to have a carcinoma of the pancreas with metastases.

Most of the cases I have observed and diagnosed as nicotinic acid deficiency states present similar features, and have similar diagnostic criteria to those previously described by Sydenstricker and his colleagues. I have only rarely encountered cases resembling those described by Joliffe (viz. an encephalopathic syndrome consisting of stupor or clouded consciousness, together with cogwheel rigidities of the extremities and grasping and sucking reflexes). While Joliffe's clinical data are highly suggestive, I think further work along clinico-biochemical lines is indicated. I have, however, observed occasionally a dramatic response to nicotinamide therapy in patients with few or none of the usual physical signs. Recently I saw a young married woman, aged 18, who had a history of influenza three weeks prior to admission to hospital. The initial illness was associated with high fever, headache and drowsiness so that an encephalitis was suspected. She got up after a few days in bed, but neglected her young baby. Her expression became vapid, her voice changed; she made

silly mistakes and weird statements, e.g. that the sirens were less frequent now. She had taken food indifferently. In hospital she was in a euphoric, carefree, hypomanic-like state, but was also poorly oriented and confused. There were no gross physical signs beyond notching of the lateral border of the tongue and obvious generalized wasting (2 st.). She received nicotinamide subcutaneously, and improved dramatically in her mental state within a few days.

Unfortunately, mainly owing to war conditions, it was found impossible to carry out laboratory investigations into vitamin B₁ deficiency states. Nevertheless, I have met with a number of cases, both at observation wards and in general hospitals, where the diagnosis of nutritional deficiency chiefly associated with vitamin B₁ lack was justified on clinical grounds. The majority of these cases were alcoholics, but the accompanying psychosis was not always of a confusional pattern. In the non-alcoholic cases gross gastro-intestinal disorder was the rule. I shall confine myself to brief reports on three examples only, the first two of which are almost certainly examples of the Wernicke syndrome. There has been a rejuvenated interest in this syndrome recently following Alexander's work, where comparable lesions were found in pigeons fed on thiamine-free diets. Campbell and his co-workers have contributed notable papers on the subject, and Dr. Meyer's recent paper stimulates further interest, since he describes therein lesions in the anterior hypothalamus, which were probably associated with manic-like symptoms.

The first case, F. P—, a male, aged 66, was admitted to St. Mary Abbotts Hospital on 2.viii.43 complaining of "hearing voices." He was reputed to have imbibed quantities of "red biddy" in the past, and gave as his recent alcoholic consumption at least four pots of ale daily. Recently he had been living on his own and neglecting himself regarding food. He was hallucinated for sight, seeing the faces of men and women, and he expressed grandiose delusional ideas—for example said he had a £100,000 bank note in the Bank of England. At the observation ward he was disoriented, confused, hallucinated for sight and hearing, suggestible and confabulating. Physically there was an old abdominal operation scar (? perforated D.U. in past), absent knee-jerks and ankle-jerks, tender calves, and some sensory changes over the lower limbs. Dysarthria present. No tremor of tongue or hands. The pupils were fixed to light and the convergence reaction was poor, but there was no external ophthalmoplegia. Blood and C.S.F. negative. He received aneurin 200 mgm. three times daily parentally and 50 mgm. nicotinic acid four times daily. Ten days later the psychotic features appeared to have cleared completely—no evidence of hallucinosis, no gross confusion and no confabulation. He was, however, still euphoric and boastful. He stated that before his illness he had been practically starving. The pupils now appeared to give reaction to light more readily. He was transferred back to the general hospital. Before his discharge home the tendon reflexes in the lower limbs were showing signs of recovery.

The next case presents features which contrast sharply with the former. E. H—, a male, aged 52, said to be a hard-working and successful publicity agent, had drunk heavily for years (10 pints daily). He had had no previous

breakdown. Just before admission he had eaten little and irregularly, and suffered from a succession of colds. At the observation ward he was somewhat muddled, not accurately oriented in time, exhibited mild memory defects, and was lacking in spontaneous conversation. He was elated at periods and depressed at others. Physically he looked unwell, with unequal irregular pupils, which gave a sluggish light-reaction; he was unsteady on his feet. No other gross finding. A week after admission he seemed much worse in his general physical and mental states. His memory had deteriorated in that he forgot recent events; he was reported by the nurse to be continually offering to give away large sums of money. Two days later he had sunk into a drowsy semi-stuporose condition, was incontinent and needed hand-feeding. Physical examination revealed some weakness of conjugate lateral movements, but there was no nystagmus. Knee-jerks and ankle-jerks were very brisk. There was questionable weakness of the right upper limb, and questionable diminution of sensation to touch and pain over all four limbs. Grasping reflexes were positive. Treatment with large doses of aneurin (50 mgm. 4-hourly by injection) was then commenced. A fortnight later, when at West Park, he had emerged partially from his stupor into a Korsakow-like state, in which he was completely disoriented for time and place, imagining he was at his home, and apologizing to the doctor for his inability to keep an appointment that day. Grasping and sucking reflexes were present and there was probably some glossitis. Parenteral multiple vitamin therapy was instituted (aneurin, riboflavine and nicotinic acid). One month later the patient's mental state had cleared and his physical condition was rapidly improving. Soon afterwards he was discharged from hospital care, appearing normal both mentally and physically.

The last case was that of a man, aged 61, who had had a gastric ulcer for years—had perforated nine years previously. A recrudescence of symptoms occurred six months before admission to general hospital. For three months he had taken slops only, and little at that. Ten days before admission he was restless, depressed, said he had muddled things up. He was said to drink moderately—one or two pints of beer daily. In hospital a barium meal showed a chronic pre-pyloric gastric ulcer, which gastroscopy confirmed. He was transfused before operation because of anaemia due to haemorrhagic leaking, and given prophylactic thiamine. After partial gastrectomy he was placed on the usual post-gastrectomy routine—small drinks of water, gradually increasing in amount, etc. Six days after operation he developed a psychosis—became restless, and said that he was being tortured and killed. When I saw him he had signs of peripheral neuritis in all four limbs—loss of power, particularly at the wrists and ankles, reduced knee-jerks and absent ankle-jerks, and reduction to vibration and pain sensation. There were no signs of ophthalmoplegia, nystagmus, etc. Probably there was collapse of the left lower lobe. Psychiatrically, he was hallucinated for hearing, saying that he was being hounded by people—being called names, and accused of such things as speaking German. He was treated with large doses of thiamine intravenously and subcutaneously. Four days later he was reported more amenable and had been moved back to the open dormitory. He was still hallucinated and deluded—said he had heard gramophone records representing him to be Hitler singing in opera.

Three weeks later the hallucinosis had apparently gone, but the patient still exhibited paranoid traits towards other patients. There was considerable improvement in the neuropathy—the tendon reflexes could now be elicited and there was improvement in power in the hands. Residual sensory disturbances in the lower limbs were still detected. The patient departed for his home shortly after this.

I think these cases provide interesting material for comparison, but I will only draw attention to one or two points. The first patient with a confusional-hallucinatory syndrome and with features reminiscent of G.P.I. presented signs of peripheral neuritis, and of a midbrain lesion. Moreover, he appeared to respond to thiamine and nicotinic acid. The second case, who passed from a confusional state into increasing stupor, also had evidence of a progressive mesencephalic lesion. Thiamine therapy alone appeared to check and ameliorate these conditions up to a point. The addition of nicotinic acid and riboflavin later may have relieved the residual signs—in fact, the patient's state at this time approximated closely to the encephalopathic syndrome described by Joliffe. The third case, which appeared to develop gross peripheral neuritis following a gastrectomy, had no physical signs suggesting a cerebral lesion, but nevertheless developed an acute psychosis, which responded *pari passu* with his physical improvement.

It is not my intention to discuss Korsakow's psychosis and delirium tremens. Peripheral neuritis seen in various alcoholic states is generally accepted as being due to B₁ lack. It may well be that centrally placed lesions may explain the psychosis in the Korsakow syndrome, and that the variable results of B₁ therapy are related to the severity and reversibility of these lesions. I am aware that there is no unanimity of opinion concerning this subject and the role of vitamins in delirium tremens.

It is impossible to cover comprehensively even major aspects of vitamin deficiency in relation to the psychoses in the short time at our disposal. The foregoing cases described were selected deliberately to illustrate points in etiology, symptomatology, etc. Moreover, although nicotinamide and thiamine deficiencies are well recognized and exemplified in our material, one has to remember that other fractions of the B complex, like pyridoxine and pantothenic acid, may be associated with syndromes yet to be described. No mention has been made of vitamins A, C, D, etc., since, so far as we are aware, they are not directly related to disease of the C.N.S.

In conclusion the following remarks will perhaps serve the purpose of a summary to our papers and indicate some present trends of opinion :

(1) Pellagra may accompany and complicate a chronic psychosis. Various factors probably operate in its production, such as (a) faulty feeding—inadequate vitamin intake in the food ; (b) diminished utilization of bacterially synthesized vitamin—itsself due to destruction of synthesized vitamin, non-production, or malabsorption, e.g. from a diseased mucous membrane ; (c) liver disease ; and (d) possibly non-utilization of available vitamins by the body cells.

(2) Severe vitamin B deficiency may cause death. Death from " exhaustion of acute mania," death in malnourished chronic psychotics, death asso-

ciated with certain gastro-intestinal disorders may have its explanation on such a basis.

(3) Pellagra and nicotinamide deficiency states may accompany and complicate an acute psychosis. There is evidence that deficiency itself produces mental symptoms which are explicable on the basis of a biochemical lesion in certain parts of the C.N.S. No serious attempt has been made with our material to correlate the pattern of the psychosis with the deficiency condition. Depressive, manic and paranoid reactions have been observed—similar to the experiences of others. Varying degrees of confusion are common in our experience. Probably a proportion of cases previously diagnosed as toxic-exhaustive psychoses are due to acute or subacute vitamin deficiency.

(4) Wernicke's encephalopathy, due to vitamin B₁ lack, is likely to be diagnosed more frequently when a more thorough analysis of its symptomatology and its variants has been established. The relationship between the Wernicke syndrome and organic disease of the upper gastro-intestinal tract is striking, and suggests destruction of normally available vitamin or non-absorption. In contrast I suggest that disease of the lower regions of the small gut is more likely to be complicated by nicotinamide deficiency states.

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PRINCIPLES FOR THE QUANTITATIVE STUDY OF STABILITY IN
A DYNAMIC WHOLE SYSTEM ; WITH SOME APPLICATIONS TO
THE NERVOUS SYSTEM.

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THE discovery of the nervous impulse established that the nervous system was fundamentally mechanistic, and that it was highly dynamic; and all subsequent work has confirmed these earlier views. The stabilities of inanimate dynamic systems are frequently of high importance and rich in applications. It would seem likely that an investigation of the stabilities of the nervous system would yield interesting results, but it is only recently that the importance of stability in the nervous system has been unequivocally recognized. But it has now been established that such properties are of central importance in the processes of integration and co-ordination. Advance has probably been hampered by the difficulties of the subject.

It is proposed here to give an outline of the basic principles relating to the stability of complex dynamic systems, stressing particularly the quantitative aspect. Though the subject is extensive, this paper will be confined to essentials.

COMPLETE DYNAMIC SYSTEMS.

Every physico-chemical system determinate in its behaviour has the property that its configuration at any instant specifies its subsequent configurations. In other words, given complete knowledge of its state at one instant, it is possible to predict what will happen subsequently. It may be shown that this is identical with saying that all such systems may be specified by equations of form—

$$\left. \begin{aligned} \frac{dx_1}{dt} &= f_1(x_1, x_2, \dots, x_n) \\ \frac{dx_2}{dt} &= f_2(x_1, x_2, \dots, x_n) \\ &\dots\dots\dots \\ \frac{dx_n}{dt} &= f_n(x_1, x_2, \dots, x_n) \end{aligned} \right\} \dots\dots(I)$$

where x_1, x_2, \dots, x_n are the variables specifying the state of the system, t is the time, and the f 's are functional forms. For example, the simple pendulum is specified by—

$$\begin{aligned} \frac{dx_1}{dt} &= x_2 \\ \frac{dx_2}{dt} &= -\frac{g}{l} \sin x_1, \end{aligned}$$

where x_1 is the angle of deviation from the vertical, x_2 is its angular velocity, l is the length, and g is the acceleration of gravity (though the equation is not usually written in this form). The important point is that the fluxions of x_1, x_2, \dots, x_n can be specified in terms of x_1, x_2, \dots, x_n themselves, 'no other functions of the time being needed'. Such a system is called 'complete.' Only a complete system can properly be said to have stability, the concept having no meaning in other cases. Equations (1) are, then, the fundamental means of specifying all dynamic systems capable of having stability (or instability).

It is well known that such a set of differential equations has a unique set of solutions :

$$\left. \begin{aligned} x_1 &= F_1(x_1^\circ, x_2^\circ, \dots, x_n^\circ; t) \\ x_2 &= F_2(x_1^\circ, x_2^\circ, \dots, x_n^\circ; t) \\ &\dots\dots\dots \\ x_n &= F_n(x_1^\circ, x_2^\circ, \dots, x_n^\circ; t) \end{aligned} \right\} \dots\dots(2)$$

where $x_1^\circ, x_2^\circ, \dots, x_n^\circ$ is a set of n arbitrary constants. This set of solutions (2) may be interpreted as specifying the behaviour of the set of variables x_1, x_2, \dots, x_n if started at a configuration—

$$\begin{aligned} x_1 &= x_1^\circ \\ x_2 &= x_2^\circ \\ &\dots\dots\dots \\ x_n &= x_n^\circ \end{aligned}$$

with t ranging from 0 onwards.

In n -dimensional space such a set of values of x_1, x_2, \dots, x_n depending on the single parameter t defines a line, and there is a one-to-one correspondence between such lines in the space and the modes of behaviour (i.e., changes of configuration) of the system. These lines are of fundamental importance because every property deducible by a direct study of the system's behaviour corresponds to a definite geometric property of the lines, and vice versa.

The fundamental definition of "stability" may now be stated: Given a complete system and its equations in form (2), and given $x_1^\circ, x_2^\circ, \dots, x_n^\circ$ and some arbitrary value of t , say T ; if we can find finite numbers $x'_1, x''_1, x'_2, x''_2, \dots, x'_n, x''_n$ independent of the time so that for all values of t greater than T we have—

$$\begin{aligned} x'_1 &< x_1 < x''_1 \\ x'_2 &< x_2 < x''_2 \\ &\dots\dots\dots \\ x'_n &< x_n < x''_n \end{aligned}$$

then the line from $x_1^\circ, x_2^\circ, \dots, x_n^\circ$ is *stable*.

In simpler but less accurate words, this means that, given the starting configuration, then however long the system is allowed to go on for, all the variables are to remain within some finite limits. It is easily shown that less general definitions are unsatisfactory. Most of the commonly used definitions apply only to systems of some restricted class. It will be noted that the

definition is essentially quantitative ; certain numbers either do, or do not, exceed certain other numbers.

The reader may be surprised that no mention is made of considerations of "energy" or of "force." These are in fact irrelevant in the general case, though often of use in more restricted investigations.

Perhaps more important from our point of view is the deduction that as one dynamic system can start from any one of many configurations, and as each resulting line of behaviour can be stable or not independently of the others, so *a single dynamic system may be stable to some disturbances and unstable to others*—a fact which will scarcely surprise a psychiatrist.

An important aspect of the line of approach is that it accords with one's common-sense approach to the subject. The differential equations are simply the most natural and direct way of writing down the way the individual variables affect one another, i.e., their physical relations, and this in turn is a direct consequence of the way in which the parts are assembled in relation to each other. The solution of these differential equations gives in direct form a description of how this same assembly of parts will behave when observed over some finite time. *The relation of the parts to the whole is therefore exactly the same as the relation of the differential equations to their solution.*

These theorems supply the basic requirements for a rigorous theory of stability in a dynamic system ; the parts and their interactions specify the differential equations, the solutions of these give the observable behaviour of the system, and this can be tested for stability by a direct application of the definition. An interesting example is given in Ashby (1945*a*).

ULTRASTABLE SYSTEMS.

Special types of dynamic systems will naturally have special types of stabilities. It has recently been shown (Ashby, 1945*b*) that dynamic systems which contain large numbers of step-functions have the peculiar and remarkable property of ultrastability—that they always undergo changes of internal organization until they are stable to any disturbances affecting them. (This property is quite different from the mere change of configuration after disturbance shown by every system which is stable : the "ultrastable" system will change from being inherently unstable to being inherently stable.) But this system is only of indirect interest to us now. It shows no quantitative gradation of stability as far as a given disturbance is concerned, since it is, in the limit, always just "stable."

If, however, the system is not only ultrastable but also contains large numbers of variables which are constant over finite intervals ("part-functions") then it may be shown that such a system, still ultrastable, can, and will, change instabilities to some disturbances into stabilities *without destroying previously established stabilities*. The only known examples of systems containing variables of these types (step- and part-functions) are the nervous system and certain types of social organization. It is possible, therefore, that it is to these particular peculiarities that the nervous system owes some, at least, of its remarkable properties.

APPLICATIONS.

That these stabilities are of fundamental biological importance to the organism has been noted repeatedly. Thus Pavlov (1927) writes: "(The animal organism) being a definite circumscribed material system, can only continue to exist so long as it is in continuous equilibrium with the forces external to it."

The theme has been discussed in more detail by Ashby (1940). The nervous system, like the other organs of the body, has been fashioned by natural selection; and survival implies that the organism can maintain constant (or within "physiological" limits) a number of important variables, e.g., body temperature, oxygen supply, food supply. But this "maintaining constant" conforms to the definition of stability given above. There is therefore little doubt of the basic importance of stability to the organism and therefore to the nervous system.

The principles outlined above apply equally to systems living or dead, and the distinction is, in this connection, irrelevant. That they will apply to the nervous system is a prime hypothesis of the physiologist, since they apply to all systems whose behaviour is determined at every moment by the state of the system at that moment. If it is granted that the nervous system is of this type, then the other conclusions follow, not of physiological, but of mathematical necessity.

The simple applications of these principles will be seen only in the simpler activities of the nervous system. In the reflexes are seen various types of mechanism whose sole activity is to restore a *status quo* after disturbance. No further discussion can be given without going into individual details.

More interesting, however, are the activities involving the cerebral cortex. It is here that the nervous system possesses both the step-functions which enable it to show the *self-stabilizing* features of an ultrastable system, and also the part-functions which enable it to *accumulate* stable neuronics arcs. The two aspects will be discussed in order.

(1) That the cerebral cortex must contain many variables behaving as step-functions may be shown decisively by the proof that certain forms of behaviour necessarily imply the existence of such variables. This proof, though in a sense indirect, is a direct mathematical deduction from the observed facts. To the existence of these step-functions must be attributed the recognized property of the higher nervous system that although it may at first produce inappropriate behaviour (i.e., a child trying to grasp at dancing flames), yet it invariably tends, after a time, to change to a mode more compatible with survival ("the burned child dreads the fire"). This change is a direct consequence of its ultrastability (Ashby, 1945*b*).

(2) The existence of part-functions in the nervous system is well known from more direct evidence. The facts that threshold values exist and that summation is usually necessary to excite a cell (e.g., Sherrington, 1931) are themselves merely examples of part-functions, as may be seen at once by comparison with the definition. These physiological features necessarily

make the nervous system multistable, since it has been proved that any ultra-stable system tends to the multistable form as the number of variables which are part-functions increases. The most important characteristic of a multistable system is that it will progressively improve its stabilization against disturbance, the essential point being that the later reorganizations necessary to improve stability against later disturbances can be made without disorganizing the stabilities previously established against previous disturbances. This is obviously of prime importance in the development of any really complex adaptation. It may therefore be suspected that the properties of "threshold" and "summation" are really of fundamental importance in neural adaptation, and that, far from being produced as by-products of other requirements, are really of importance in themselves, and that they have been established by natural selection, nervous systems without them being defective in powers of adaptation. Whether changes in these physiological features, made perhaps by disease, would produce the obvious maladaptations of mental disorder is a question which involves too much to be discussed here.

SUMMARY.

Stability of the nervous system is necessary both for biological adaptation and survival, and also for the production of normal behaviour. Investigation of the subject has been hampered partly by its complexity and partly by lack of suitable technical methods.

An account is given of the fundamental principles for handling such complex stabilities, the subject being treated by an extension of the methods of mathematical physics.

Reference is made to recent developments, and some applications to the nervous system are discussed.

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PERSISTENT ENURESIS: A PSYCHOSOMATIC STUDY.

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THE congeries of etiological theories and alleged cures that has accumulated round the subject of nocturnal enuresis in children proves only one thing—that we know little of the causes and treatment of enuresis. Since the war many cases of nocturnal enuresis persisting into adolescence and adult life have been seen. Presumably the sufferers were ashamed of their disability and concealed it in peacetime. But wartime conscription, often entailing absence from their homes, has compelled them to reveal it. Such cases of persistent enuresis represent the most severe form of the disorder, and an analysis of the factors involved would seem to be of more value than merely to study enuretic children in general. Once these facts are ascertained, they may throw some light on the universal problem of enuresis in children.

We have therefore studied all patients suffering from enuresis, who had reached the age of puberty, seen at the Jordanburn Nerve Hospital in recent years. Cases not fully investigated or with an I.Q. below 70 per cent. were excluded, and therefore a group of 67 remains. This is an unselected, representative series of persistent enuretics. All the case-histories were taken by one of us (H. S.) personally. If the figures upon which we base our conclusions are small, they nevertheless have a peculiar validity clinically, in that they are derived from these severe, persistent cases. Unfortunately every point was not always recorded in every case, and to prevent repetition in the text of the words "no record" we have usually given the totals recorded and omitted the balance. The ages of the patients were : From 12 $\frac{1}{2}$ to 15, 8 cases ; from 15 $\frac{1}{2}$ to 20, 38 ; from 20 to 25, 12 ; 25 to 30, 1 ; 30 to 35, 4 ; and 35 to 39, 4.

A long list of congenital, infective, parasitic, nephritic, diabetic and neurological disorders is usually given for the differential diagnosis of enuresis. We had few such cases to exclude, but whether that means that they were excluded by others and not referred to us, we cannot say. A lifelong history of enuresis strongly suggests the "functional" syndrome in the absence of any congenital disorder. One differential diagnosis of importance in this series was alcoholism. Excessive drinking may produce deep sleep, distension of the bladder and incontinence ; if alcoholism is denied, the negative physical findings may suggest

a true enuresis. Examination of the urine was negative in 42 cases, including microscopic examination of the centrifuge deposit; and negative in 9 other cases, including culture. In 16 we have no note of urine examination, but such an examination had usually been performed.

NOCTURNAL ENURESIS AS PART OF A LOCAL AUTONOMIC SYMPTOM-COMPLEX.

Psychological explanations of nocturnal enuresis as an emotionally determined, symbolic, symptom-formation ignore the fact that it is only one of a group of symptoms of disordered autonomic function in the pelvis—symptoms which may occur by day as well as by night. Previous clinical studies have shown some of these groupings of symptoms:

Author.	Total number of cases.	Nocturnal enuresis.	Diurnal enuresis.	Frequency.	Urgency.	Encopresis.	Remarks.
Grover (1918)	200	194	76	—	—	2	Children.
Anderson (1930)	148	144	21	—	—	10	"
Hubert (1933)	100	100	12	Very common	—	6	Children. Two other cases had diurnal enuresis only.
Addis (1936)	30	30	15	—	—	4	Children.
Stockwell and Smith (1940)	100	98	10	47	—	—	"
Bachus and Mansell (1944)	277	277	—	229	229	—	Soldiers. Precipitancy in 88. Pain in 12.

Kanner (1935) found in a large series of enuretic children that 63 per cent. had nocturnal enuresis only, 30 per cent. had nocturnal and diurnal enuresis, and 7 per cent. diurnal enuresis only; 10 per cent. had encopresis. On the other hand, all cases of encopresis had enuresis.

Certain authors described two types of nocturnal enuresis, one with and the other without diurnal symptoms, but none of those we have referred to give figures to support their views. The existence of a type of nocturnal enuresis without other local symptoms cannot be inferred from the gaps in the above table, as obviously all the possible symptoms had not been noted by the authors.

Our findings are as follows: One patient had never suffered from nocturnal enuresis, but had always had severe diurnal symptoms. Diurnal enuresis was noted in 43 out of 63 cases. It had persisted to not later than age 5 in 4 cases; not later than age 10 in 11; age 15 in 13; age 20 in 10; age 25 in 4; and existed from age 35 to 39 in 1. The diurnal enuresis was wholly involuntary in 29. In the remaining 14 it only happened when the patient was unable to get to a lavatory. Thus certain patients had never had diurnal enuresis except in school, where they had not been allowed out. In 9 patients the diurnal enuresis was small in amount, representing an overflow. In 24 the whole bladder was voided at certain times, although some of these had dribbling enuresis as well.

Urgency and frequency of micturition by day occurred together in 38 patients, urgency only in 4 and frequency only in 4 according to the patients,

but these symptoms may be expected to go together. Three patients had neither. Other cases were not fully recorded, but 10 were noted to have either urgency or frequency. In all but one these two symptoms were lifelong, and had shown less improvement with age than diurnal enuresis and even nocturnal enuresis had done. Occasionally the urgency and frequency were absent for a time, only to recur. The frequency varied from every 10 minutes in an acute phase down to such an estimate as 8 times a day. Where a low total figure per day was given by the patient, frequency could be demonstrated by asking him to compare his habits with those of his contemporaries or work-mates, or by finding that he was unable to sit out a cinema show.

Rising at night may not be common in enuretic children, but it was common in this series. It was usually a habit developed by the patient as he grew older to prevent enuresis. It was often so frequent as to form a major part of the complaint. Out of 58 cases 17 never rose at night; 20 rose on occasional nights; 6 rose two or three times a week and 15 rose every night. Of the 15 who rose every night, only 3 rose but once. All the rest rose more frequently, up to 2 who rose 6 times every night. In the 21 who rose every night or two or three times a week, the benefit varied. Only 3 gained complete freedom from actual bedwetting. It was also noted that those who were "raised," or wakened by others at night, usually in childhood, seldom gained complete freedom from bedwetting thereby.

Pain on micturition was very uncommon. In 3 cases occasional mild pain was reported, with difficulty in micturition in one. Two others had pain—but only after attempts to overcome urgency. 39 had no pain. The fact that patients denied pain shows that complaints of urgency and frequency cannot be attributed to leading questions. In 23 pain was not recorded, which is really a reflection of its absence.

Of 60 patients, 8 gave a history of encopresis. In 4 it had been frequent. It had ceased altogether at ages ranging up to 11 years. Encopresis was almost always a diurnal and not a nocturnal symptom. One other patient, aged 15, still had, not encopresis, but urgency of defaecation after every meal at times when he was also suffering from nocturnal enuresis.

Only 3 patients denied having ever had any diurnal symptoms—whether urgency, frequency, enuresis or encopresis.

AGE OF ONSET.

While it is often said by patients and by their parents that enuresis began after some emotional or physical upset, careful investigation shows that most have suffered continuously since infancy. Previous writers have stated that enuresis existed from infancy in 83 per cent. (Anderson), 79 per cent. (Grover), 78 per cent. (Kanner), 76 per cent. (Bachus and Mansell), 58 per cent. (Hubert), and 41 per cent. (Stockwell and Smith).

Of our cases, 54 had had enuresis regularly since infancy; one was said to have begun at 3 years, after being dry for 2 years; 7 gave a history of onset at anything from 5 to 13 years, associated with painful illness, wartime evacuation, etc.; one was said to have begun at age 35, during ill-treatment and

physical hardship as a prisoner of war in Greece, and in 3 cases symptoms recurred phasically at intervals of years.

HOW OFTEN NOCTURNAL ENURESIS OCCURRED.

Four patients had diurnal symptoms without nocturnal enuresis. It might be thought that they should be included in a different syndrome, sometimes called "the small irritable bladder." It was found, however, that three of them had wet the bed to ages 11 to 17; three still rose at night, and three had a family history of enuresis. We think that these cases belong to the same syndrome as the others, and a similar view is held by other writers, as shown by the table above.

Seven patients wet the bed every night and 15 nearly every night. Practically all the remainder, who had less frequent enuresis, showed marked phasic changes in its incidence. For example, enuresis might occur every night for a week and then be absent for a week. To express its frequency averages were made. 26 patients wet the bed once a week or oftener; 13 once a month or even less often.

The patients offered various explanations for the phasic nature of the enuresis. In 19 the enuresis was so frequent that there were no phasic changes. We are inclined to accept the statements of 11 patients that cold weather or a cold bed made the enuresis worse (one or two showed a summer-winter phase of incidence); and of 19 patients that disturbing emotions also made it worse. Other alleged causes for improvement or relapse were probably only coincidental. Eight patients reported that in the past new treatments had produced temporary remissions. This may be due to chance or to suggestion, but it is a warning to the therapist.

ABNORMALITIES OF THE LUMBOSACRAL SPINE AND ENURESIS.

The literature on this subject is both confused and confusing. Some authors found that spinal abnormalities were uncommon in enuresis; others found them common, but considered that they were of no significance, while others thought they were significant. We have therefore investigated the literature on this subject carefully and brought together the scattered reports. Two main types of bony abnormality have to be considered. The first are the phylogenetic variations of sacralization of the last lumbar vertebra, or lumbarization of the first sacral vertebra. The second is an ontogenetic disorder—*spina bifida occulta*. To increase the confusion, it is by no means clear what distinguishes *spina bifida occulta* from normal or delayed ossification and union of the vertebral laminae. It has been suggested—and at times demonstrated by operation—that *spina bifida occulta* is associated with constricting fibrous bands or accumulations of fat within the spinal canal. It is also said to be associated with a condition of *myelodysplasia*.

The following are the principal reports of examinations of the lumbo-sacral spine in control series of adults: Wheeler (1920) quoted Adolphi, who found incomplete closure of the first sacral segment in 12.7 per cent. and of the entire

sacrum in 3.08 per cent. of 292 skeletons; and Frets, who found incomplete closure of S.1 in 24.6 per cent. of 528 skeletons, and of the entire sacrum in 2 per cent. of 750 skeletons. Wheeler examined the radiograms of 1,000 consecutive patients suffering from irrelevant conditions. In 13.1 per cent. the dorsal closure of S.1 was considerably defective; in 4 cases S.2 was also defective; in 8 cases the sacrum was completely open. Incomplete union of the posterior laminae of the last lumbar vertebra was found in 2.3 per cent. Baetjer and Waters (1921), among a thousand "control patients," found congenital non-union of L.5 and S.1 in over 15 per cent., and also found that sacralization of L.5 and the rudimentary spina bifida of the sacrum were quite common. West (1927) found spina bifida occulta in 48 of 100 healthy soldiers. Brailsford (1929) examined the radiograms of over 3,000 patients, and found spina bifida occulta of L.5 in 6 per cent. and of S.1 and 2 in 11 per cent.; sacralization of L.5 on one side in 3.4 per cent. and on both sides in 4.7 per cent.; hemivertebrae in 0.3 per cent. and spondylolisthesis in 5 cases. Cushway and Maier (1929) made routine X-ray examinations of 931 men entering railway employment; 414 of these showed a total of 607 variations, including a number such as old fractures, not relevant to the present discussion. The relevant findings were:

Spina bifida occulta, from a mere line through the spine of S.1 to complete absence of the spine and arch of L.5 and of all the sacral segments	161
Sacralization of the transverse processes of L.5 varying from unilateral impaction to bilateral fusion	50
Incomplete union of first and second sacral segments (i.e. lumbarization)	21
Congenital deformity of sacrum	4
Spondylolisthesis	3

How many cases showed these variations does not emerge.

Köhler (1935) stated that one man in ten has some fissure formation, and regarded as normal the narrow median ossification defects affecting L.5 and S.1 or S.2, and also even a complete sacral hiatus. He accepted the views that spina bifida occulta can be found in 60 to 70 per cent. of cases of nocturnal enuresis, but that for the manifestation of the disorder a releasing stimulus is also necessary.

Laws (1937) quoted Schmore and Junghanns, who found spina bifida occulta in 15 to 20 per cent. of 10,000 spines examined radiologically.

Smith (1939) quoted Roederer and Lagrot, who found lumbosacral spina bifida occulta in one-third of 1,000 cases, and Ellis, who estimated that such a defect exists in 6 to 8 per cent. of adult working men. Langworthy, Kolb and Lewis (1940) studied 500 radiograms, and found some degree of defect of the vertebral laminae in 183, or 36.6 per cent. The defects were associated with symptoms in only 5 of the cases.

Next come the reports of examination of the lumbosacral spine in cases of enuresis in adolescents and adults. We have not considered reports of spina bifida occulta in children, as the normal time of ossification introduces an obvious error. There are very many reports of single cases or small groups of cases of enuresis associated with spinal defects, and we cannot quote all of these. Arnesen (1924) found spina bifida occulta in 15 out of 25 cases;

West in 41 of 81 enuretic soldiers; McLellan (1939) in none of 15 cases, aged 7 to 30 years; and Bachus and Mansell in 13 of 104 enuretic soldiers. Browne and Ford-Smith (1941) found spina bifida occulta in 7 of 13 boys, aged 14 to 20, another had a congenital anomaly of S.1, and another showed flattened vertebral bodies.

We have X-ray records of 67 cases, including 17 which were not included in the total series. Radiological abnormalities were present in 34 cases and absent in 33. The positive findings were:

A. Fusion Defects Only.

Defect of S.1 only	20
Incomplete fusion of neural arches of upper sacrum	4
" " of L.5 and upper sacrum	2
The two parts of the neural arch of S.1 unified but not completely developed	1

B. Lumbarization and Sacralization With or Without Fusion Defects.

S.1 shows lumbar characters (neural arch incompletely fused i)	2
Partial sacralization of L.5, with incomplete fusion of its arch and of the arches of the upper sacrum	1
Sacralization of L. 5	2
Left transverse process of L.5 sacralized and lower sacral spines bifid	1
Sacralization and fusion defect of L.5	1

Most interesting figures emerge when the X-ray findings are correlated with age:

Age.	Sacralization, etc.	Fusion defects only.	Negative.
Up to 15 years	2	7	1
" 18 "	1	14	10
" 21 "	1	2	9
" 25 "	1	3	6
" 30 "	0	0	1
" 35 "	1	1	3
" 40 "	1	0	3

Small though the totals are, the figures suggest that sacralization and lumbarization are equally distributed among the age-groups, as one would expect, but fusion defects are concentrated in the younger age-groups, and the proportion of negatives rises with age.

Whereas the text-books of anatomy usually say that the last vertebral laminae to unite are the sacral ones and that they do so at the 7th to the 10th year, we prefer to accept the view of Jemma (1930) that in the normal, although all the vertebral arches except S.1 have fused by the 10th year, the latter may not fuse till the 20th or even the 30th year.

Two other points should be noted before excluding vertebral causes of enuresis. Firstly, there is a type of failure of union, unilaterally or bilaterally, between the junction of the superior articulating processes and the laminae, which it is almost impossible to visualize radiologically (Wheeler, Brailsford, Willis, 1924). Willis found this condition in 4.8 per cent. of 850 spinal columns in a museum. It is therefore not very common. He believed that it might

progress to spondylolisthesis. Secondly, according to the operative findings of Delbet and Léri (1925) a transverse fibrous cord may be found compressing the lower end of the dural canal in the absence of any spina bifida occulta.

We believe that the figures we have given from the literature and from our own cases show that many fusion defects in young persons may later unite in the normal process of ossification; that those which persist do so in normal persons as much as in enuretic persons; and that sacralization and lumbarization are also as common in the normal as in the enuretic.

True spina bifida occulta is uncommon, and should be demonstrated, not only radiologically, but also by associated lesions of three groups, which are described in the literature: (1) In the back, over the spina bifida occulta, there may be hypertrichosis, telangiectasis, pigmentation, hyperhidrosis, a dimple or scar, and benign tumours. None of our patients showed any such. We do not think that absence of a vertebral spine on palpation is proof of a true spina bifida occulta, as such absence was observed in many of our patients. (2) Motor and sensory anomalies in the "saddle" or perineal area. Again, none of our cases showed any convincing evidence of such lesions, although in three the cremasteric reflexes were doubtful. (3) Deformities and motor, sensory or trophic disturbances in the lower limbs. Only one of our patients had any such—a case of bilateral pes cavus.

CEREBRAL CONTROL OF MICTURITION AND THE CYSTOMETROGRAM.

We do not intend to discuss the neurophysiology of micturition and the technique of cystometrography in detail in this paper. Recent accounts will be found in the books of Langworthy *et al.* and of McLellan, and in a paper by one of us (Band, 1945). Cystometrography records in continuous graphic form the bladder sensation, pressure, capacity and detrusor activity. Sphincter function is secondary to detrusor activity, and is of much less importance in itself than has been thought in the past. Cystometrography is not so much a urological as a neurological study of bladder function. It distinguishes the normal bladder and four types of neurogenic disorder: (1) The atonic, in lesions of the posterior sacral roots; (2) the autonomous, where both sides of the spinal bladder reflex are interrupted; (3) the spinal reflex bladder, where cerebral sensation and inhibition are completely cut off and the bladder behaves purely reflexly, as it does in the infant; (4) the uninhibited, where cerebral inhibition is cut off or lacking, but sensation is preserved.

Cerebral control of micturition is apparently purely inhibitory in type. The motor control of the bladder rests in the spinal centres, and the infant gradually acquires the power of cerebral inhibition based on perception of bladder sensation and effected through the motor pathways. To will micturition is to release cerebral inhibition. The cerebral control is spread diffusely in both hemispheres.

The majority of cystometrographic studies in enuresis show the uninhibited neurogenic type of bladder—just the same type as is found in subtotal organic disease of the higher cerebral centres or spinal cord pathways. Stockwell and Smith's series apparently included a good number of this type. McLellan

found two types of cystometrograms among 15 enuretics—the normal and the uninhibited neurogenic.

Cystometrograms were made on 15 of our patients. Two were normal (see Fig. 1). Two others were doubtfully normal, showing a little evidence of uninhibited contractions and desire to void at low degrees of filling. Of these four cases, one was recovering spontaneously. The other three had the lowest I.Qs.—77, 82 and 84 per cent.—among these who had cystometrograms done. From such a small number we would not care to say whether the low I.Qs. indicate a type of failure of inhibition different from that found in persons of normal intelligence. These three patients had diurnal symptoms.

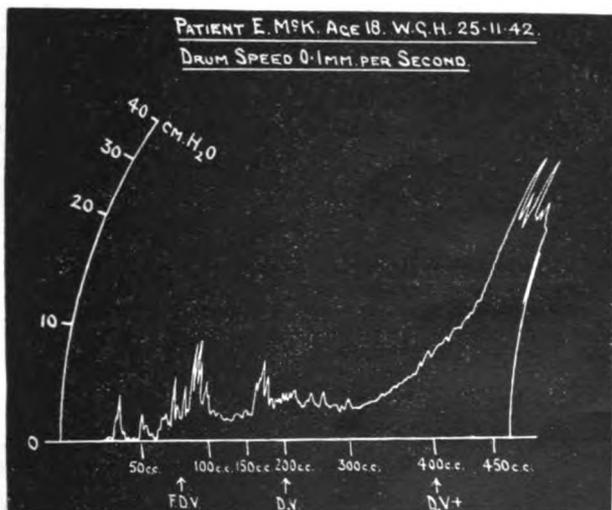


FIG. 1.—Normal cystometrogram showing early contractions of the detrusor muscle associated with the first desire to void (F.D.V.), but subsequently inhibited. Powerful contractions of the muscle occur at 400 c.c. filling associated with a strong desire to void (D.V+).

The other 11 all showed typical uninhibited neurogenic bladders (see Fig. 2). The cystometrogram of the uninhibited bladder with high pressure, low capacity, early uninhibited contractions and early desire to void, corresponds with the clinical findings of urgency, frequency and diurnal enuresis. The nocturnal enuresis or rising reflects the same bladder state. It follows that although large series of cystometrograms may reveal other types of bladder, the majority will be of the uninhibited type.

The preponderance of uninhibited neurogenic bladders further diminishes the alleged importance of spina bifida occulta in enuresis. In severer forms of spina bifida, the autonomous neurogenic bladder is usually found (McLellan). The cystometrograms suggest that the disorder of function is cerebral and not spinal in origin. We do not rule out the possibility of a local over-activity of the spinal reflex as well, but we do not see how spina bifida occulta could produce such over-activity, especially when enuresis is capable of spontaneous recovery.

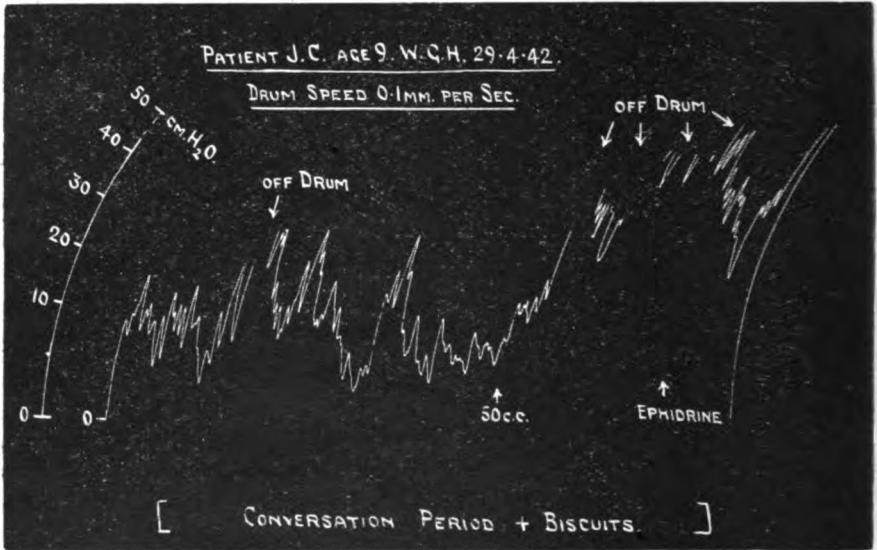


FIG. 2A.—Cystometrogram of uninhibited neurogenic bladder of enuretic type showing uninhibited contractions of the detrusor muscle at an early stage of filling. Following the injection of ephedrine the contractions are temporarily inhibited.

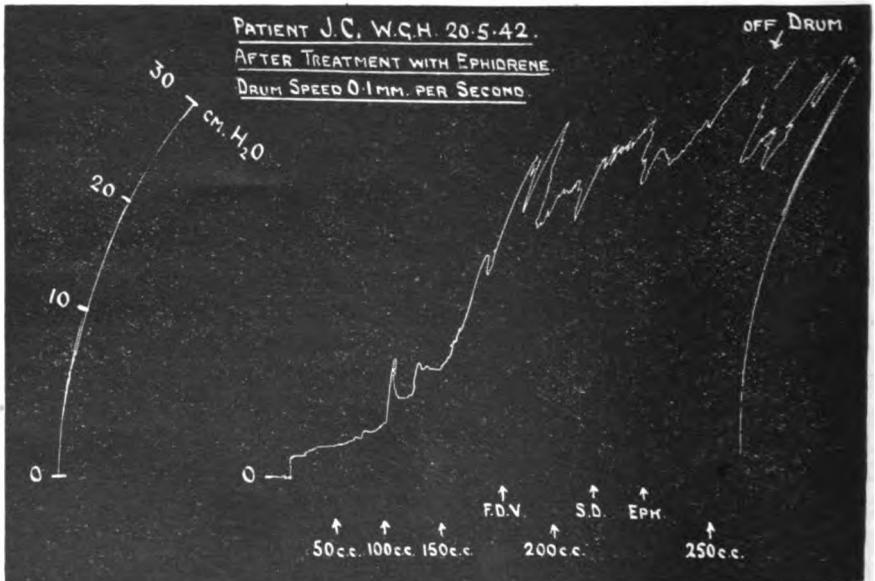


FIG. 2B.—Cystometrogram of uninhibited neurogenic bladder of enuretic type. Following a course of three weeks' treatment with ephedrine by mouth, the first desire to void (F.D.V.) does not occur till after a bladder capacity of 150 c.c. has been attained, and is followed by powerful contractions of the detrusor muscle. The bladder capacity has been increased to 250 c.c. (Cf. Fig. 2a.)

CONSTITUTION AND ENURESIS.

It might be argued that the cystometrograms of uninhibited, almost reflex bladder activity only confirm the old view that enuresis is due to lack of training. The diurnal symptoms are one answer to this, and a consideration of the constitutional aspects is another.

I. *The Patients' Psychiatric States.*

The psychiatric diagnoses made were divided into three self-explanatory degrees of severity—"clinical" (this group includes 17 patients who came complaining of general psychiatric symptoms and not primarily of enuresis); "sub-clinical"; and "normal" where a definite type of personality could be recognized, but was not abnormal in degree.

Anxious personality (normal)	16
Anxiety state (sub-clinical)	17
" " (clinical)	7
Mixed anxious and hysterical state (clinical)	2
Hysteria (clinical)	1
Obsessive personality (sub-clinical)	1
Psychopathic states (aggressive: alcoholic types 2, sexual type 1, epileptoid 3. Inadequate: petty delinquents 9, neurotic types 2 (all clinical)	17
Schizophreniform states (clinical)	3
Intellectual retardation. I.Qs. 76 to 78 (clinical)	3

All the diagnoses were amply justified; there was no attempt to give patients a label not fully justified by their states. To illustrate this, nine of the patients classified as psychopathic states and one classified as intellectually retarded had appeared in Court charged with offences.

If the first three groups are taken together, then a general "anxiety" group is the biggest one—40 cases. Next come the psychopathic states—17 cases.

Michaels and his collaborators (1938 to 1944) have published an important series of papers on the constitutional aspects of enuresis. They found that the incidence of enuresis was greater in the histories of delinquent and psychopathic persons than in normal children. They attached particular importance to the age to which enuresis persists, and found that enuresis was most persistent in the delinquents and psychopaths, less so in the psychotic, and still less so in the normal. They observed that the triad of psychopathy, male sex and persistent enuresis was a frequent association worthy of serious consideration. They regarded enuresis as a reflection of an ill-balanced personality, and saw the same lack of inhibitory control in the persistent enuresis and in the delinquency. Finally, they showed that a history of enuresis in children with behaviour disorders was associated in a positive manner with electroencephalographic abnormality, whereas behaviour disorders without enuresis were not positively associated with electroencephalographic abnormality. Thus the constitutional aspects of enuresis are linked with personality in its fullest neuropsychiatric or physical sense. Wexberg (1940) also noted the association

of enuresis and delinquency. In this paper psychopathic states are diagnosed as described by Henderson (1939). Henderson (1942) has accepted Michaels' views.

2. Sex Incidence.

Almost all who have studied the facts report that enuresis is much commoner in the male sex. Here is a table of figures all referring to children :

Author.	Male.	Female.
Grover	124 .	76
Hamill (1929)	54 .	26
Anderson	108 .	40
Frary (1935)	128 .	90
Addis	188 .	126
Movitt (1936)	5 .	19
Brookfield	20 .	18
Stockwell and Smith	63 .	37
	<hr/>	<hr/>
	690 .	432

Calvin (1928) said that the sex incidence was about equally distributed early, but that from six years on boys predominated. Kanner reported that 62 per cent. of enuretic children were boys. He quoted Thom as saying that enuresis was found in both sexes equally, and Thursfield as reporting predominance in girls.

Of our patients, no less than 51 were males and only 16 females—and this was not due to any recognizable chance of selection.

3. Family History.

(a) *Psychiatric Conditions Generally.*

Kanner found a family history of alcoholism in 25 per cent. of the fathers and 2 per cent. of the mothers ; serious emotional instability or social maladjustment of one or both parents in 80 per cent. ; 21 per cent. of the children had illiterate or mentally defective parents ; 22 per cent. showed a family history of major psychoses ; 4 per cent. of suicide ; 7 per cent. of epilepsy ; 10 per cent. of criminal records ; 4 per cent. of the parents had been sexually delinquent. Grave though these figures are, they are paralleled by the findings in the present series. Levine (1943), among 150 naval cases, aged 17 to 27, found psychiatric abnormalities, such as somnambulism, nervousness, psychogenic fainting and "nervous breakdowns" in 70 per cent. of the families.

In the present series no information was available about two families, and in six others only partial information. A total of 153 affected relatives was found as follows (p. 335).

The affected relatives were : 56 parents, 22 siblings, 3 half-siblings, 1 offspring, 26 grandparents, 29 uncles or aunts, 1 half-uncle, 1 nephew and 1 niece, 4 cousins, 6 great-uncles or aunts, 1 cousin once removed, and 2 great-grandparents.

Unspecified psychoses (treated in mental hospitals)	8
Manic-depressive psychoses	3
Schizophrenia	2
Senile dementia	2
Infantile convulsions (fatal in 5 cases)	6
Idiopathic epilepsy	8
Other organic psychiatric states	2
Aggressive psychopaths, alcoholic	36
" " epileptoid	2
" " sexual types	5
Inadequate psychopaths, petty delinquents	4
" " others	8
Suicide	2
Anxiety states	18
Hysteria	2
Nervous breakdown—unspecified	2
Nervous temperament	34
Mental defect	7
Intellectual retardation	2

Only one diagnosis was entered for each relative, e.g. where a person suffered from infantile convulsions and a psychosis in later life only the psychosis was entered. "Nervous temperament" was used as an omnibus term to cover minor nervous disorders, minor hypochondriacal tendencies, emotionally unstable personalities, etc.

The number of affected relatives points to a strong constitutional tendency. The 16 patients classified as themselves being "anxious personalities of a normal degree" had family histories as bad as the average, and five, in fact, were worse than the average.

(b) *Psychosomatic Diseases.*

Addis found among 30 enuretic children that 9.7 per cent. of all their relatives showed "allergic" diseases—asthma, eczema, gout, hay-fever, recurrent headaches, or nettlerash. Gordon (1942) found among 128 enuretic children a history of allergic diseases in the child or in the family, in 85 cases (migraine, asthma, hay-fever, eczema). Of 200 normal controls 56 gave a similar history.

We found 67 cases in 61 families :

Chronic dyspepsia	3
Peptic ulcer	16
Hypertension, strokes or degenerative heart disease occurring before the age of 70 years	23
Hay-fever	1
Urticaria	2
Migraine	8
Asthma	11
Hyperthyroidism	3

The affected relatives were 19 parents, 4 siblings, 2 half-siblings, 14 grandparents, 23 uncles or aunts, 3 cousins and 2 great-uncles. These included four persons who were also listed under (a) as suffering from psychiatric conditions.

(c) *Nocturnal Enuresis.*

Enuresis shows a definite familial incidence.

Author.	Number of cases.	Family history of enuresis.	Remarks.
Grover	200	112	Children.
Addis	30	18	"
Hubert	50	20	Children. Controls, 7 out of 50.
Levine	150	112	Sailors, aged 17 to 27.

Kanner, in his series of enuretic children, found a history of enuresis in one or more relatives in 52 per cent. Stockwell and Smith found, among 100 enuretic children, that 63 gave histories of parents, and 21 of siblings who had enuresis. Bachus and Mansell found a family history of enuresis in parent or sibling in 21 per cent of 277 enuretic soldiers.

Frary studied 59 clans, including 221 fraternities, in which, of a total of 787 individual members, 239 were, or had been, enuretic. Most careful and exhaustive investigations were made. Frary gives detailed statistical studies, and has made a claim that enuresis is primarily determined by a single recessive gene substitution. We are not able to confirm or deny this claim, but we have been much interested in her conclusions. Although she found a greater incidence in males, Frary did not think that enuresis was a sex-linked character.

In 7 of our cases the family history of enuresis was not recorded; in the remaining 60 cases enuresis in relatives and its approximate age of persistence were noted: Over age 3 up to age 5, 20 cases; age 5½ to 13, 46 cases; 13 to 20, 28 cases; 20 to 30, 9 cases; 30 to 50, 2 cases; and over 50, 2. There were also 5 cases of lifelong diurnal bladder symptoms without nocturnal enuresis—total 112. Many of the affected relatives, therefore, had enuresis of long duration.

The affected relatives were 12 parents, 25 siblings, 2 half-siblings, 33 uncles or aunts, 2 grandfathers, 1 great-aunt, 26 cousins, 7 nephews or nieces and 4 offspring. Omitting 5 cousins whose sex was not recorded, the sex incidence was 56 males to 51 females. The difference is not significant in itself, although it is in line with previous observations of greater incidence in males. We interviewed mothers mostly, and they might not know about enuresis in male relatives outwith their own immediate family.

Nine of the enuretic relatives also figure under (a) or (b).

Our finding of an average of almost two other affected persons per case confirms the familial incidence. The material has not been analysed from a Mendelian point of view, but there was one other notable point. In the small number of cases who showed more than one affected relative outside the sibling group, these relatives were usually all on one side of the family.

4. *The Autonomic Nervous System.*

The earlier analysis of the symptom-complex of enuresis suggests that it is a local autonomic syndrome released by lack of cerebral inhibition. We have looked for other evidence of instability of the autonomic nervous system, as shown by a family history of psychosomatic diseases (see above), and as shown

by the patients' own histories of such diseases. Gordon found that enuresis was present in 7 per cent. of 200 control children, in 6.9 per cent. of 73 asthmatic children, but in 31 per cent. of 58 migrainous children. Bray (1931) has seen cases of enuresis along with such "allergic" manifestations as asthma, hay-fever, eczema, urticaria and migraine. Levine found vasomotor instability of the extremities in 42 per cent.

Psychosomatic diseases were found in 13 out of 66 patients: Severe dysmenorrhoea, 8; bronchial asthma, 2; asthma and eczema, 1; migraine, 1; local allergy to an antiseptic, 1.

Autonomic symptoms, mostly of a type secondary to anxiety, were found in 33 out of 63 patients. These included dyspepsia, vomiting, diarrhoea, tachycardia, excessive sweating and a number of others.

Whether or not the incidence of psychosomatic diseases and of other autonomic symptoms is significant, the prevalence of deep sleep seems important, and it can be regarded as belonging to the same group of symptoms as an autonomic or hypothalamic manifestation. Deep sleep is an associated hypothalamic symptom and not the "releasing" cause of the enuresis, because normal persons who are deep sleepers can still control the bladder at night, and because the "releasing" mechanism exists also by day. Some writers have found deep sleep prevalent in enuresis, while others have not. Our findings were: No record, 6; not applicable (patient never had nocturnal enuresis), 1; light sleep, 8; average depth, 7; heavy sleep, 45.

Patients and their relatives usually stated without hesitation that sleep was deep. This was usually confirmed by statements that the patient never wakened at nights; that he slept through loud noises, including air raid sirens; that when raised at night he was very confused and heavy, as if still sleeping; that he was difficult to get up in the morning; that, in some cases, he could sleep 12 hours if given the chance; and that one or two patients were not wakened by an alarm set to get them up by nights, while their parents in the next room were awakened.

5. *Associated Congenital Defects.*

Among 64 patients 27 congenital defects were found in 21 cases. Many were of a minor character, such as skin melanomata, and highly arched palates; others were conditions only predisposed to by congenital influences, such as hernia; and we do not think that the presence of any of these defects has any bearing on the constitutional aspects of enuresis. The family histories of such conditions appeared quite unimportant.

PSYCHOPATHOLOGY AND ENURESIS.

As can be inferred from the list of psychiatric diagnoses, abnormal and complicated life histories were recorded in many cases. Nevertheless, to demonstrate psychopathological factors in enuresis it is necessary to show that such existed before the age of three years, when urinary control is normally established. Disturbances in later life may be partly reactions to the enuresis.

In 4 cases there was no record of these years. In 12 no traumatic events were listed (but see later). The remaining 51 showed a total of 74 such events:

Posthumous child	1
One parent ill for a long time	3
Pathological (not merely difficult) labour	7
Born in the street	1
Seriously underweight at birth	1
Incomplete breast feeding ($\frac{1}{2}$ to 5 months)	13
No breast feeding	14
Unduly prolonged breast feeding (10 to 17 months)	3
Malnutrition needing medical attention	5
Prolonged illnesses	2
Severe burn or scald	2
Father's conduct difficult	5
Brought up (a) in institution, (b) by grandparents	2
Father working abroad	1
Mother out working	2
Resented by mother as conceived before marriage	1
Mother fatally injured in his presence	1
Paraphimosis	1
Illegitimate	9

Even this impressive list is incomplete. Disturbing family emotional influences are not covered by the one small entry of "father's conduct difficult." A fuller idea of such influences is obtained from the family history of psychiatric disorders in 56 parents. In the illegitimate cases, only that fact was entered in the table, as otherwise the many other positive findings in them would have overloaded the table and obscured the findings in the remainder. A high proportion of illegitimate children among enuretics was also noted by Wexberg.

If we assume, as is probably correct, that none of the illegitimate children were breast-fed, then abnormalities of breast-feeding occurred in 39 cases in all—a very significant finding.

Freud's original view (1930) that enuresis nocturna corresponds to a pollution is apparently disproved by the observations of Cameron (1927), Anderson, Kanner and Wexberg that masturbation and nocturnal enuresis can occur in the same child. In the present series of older persons the majority have had some sexual experience, whether as nocturnal orgasms, masturbation or intercourse.

There are, of course, other psychoanalytic explanations of enuresis. We believe that enuresis can be a source of libidinal gratification, but that this is a secondary development, to which enuresis is primary.

Other Features of the Cases.

1. Micturition Dreams.

These occurred in 25 out of 61 cases. Some patients had such dreams frequently, others only occasionally. In 21 these were simple, stereotyped dreams of micturating in the right place. Dreams symbolic of micturition were found in only one patient, who dreamt that she was in the bath, and awoke, requiring to micturate. In three patients vivid and complicated micturition dreams occurred, but they were still quite straightforward in their content.

One patient dreamed frequently about a river or the sea. He saw a group of people who seemed to be pointing at him and laughing at him for wetting the bed. (He often had similar ideas of reference by day.) Sometimes he awakened up at this point, and after going to sleep again, wet the bed. Another patient dreamt he was at a choir practice and went to the w.c. The door remained open and the minister's wife said "There's water coming down your arm." He awoke and found that this was so. The history showed that in real life the minister's wife was a mother figure to him. Another had complicated dreams, in which he often stopped half way through the act of micturition and looked round to see if anyone were looking. He would think not, and continue the act. The interruption of micturition was often associated in the dream with a sensation over the lower abdomen which was in fact due to the urine passing over it.

These dreams are a help in differential diagnosis from enuresis due to epilepsy. Little is said about them in the literature—it may be that they are not so common in children.

Anderson noted these dreams in older children, and said it was uncertain whether they were the cause or the result of the enuresis. Levine found such dreams in a few cases.

We think that these dreams are the result and not the cause of enuresis, because (1) they apparently develop in older subjects, (2) a few patients learned to wake and check the enuresis when the dream began, (3) enuresis can occur by day. The dreams, however, do serve the function of "preserving sleep" postulated by Freud.

2. *Local Lesions of the Skin.*

Patients who frequently wet the bed often develop lesions of the skin of the buttocks or over the greater trochanters of the femora if they sleep on their sides. Such lesions may be useful in diagnosis from malingering, but their absence does not exclude enuresis.

In 15 cases enuresis was infrequent and there were no skin lesions. In 14 cases of frequent enuresis there were no skin lesions. In 26 cases such lesions were present, varying from erythema only (14 cases) to papules and old scars. In one patient, who always slept on his left side, the skin over the left greater trochanter was much affected—keratinized, cracked and erythematous.

3. *Circumcision.*

In 47 male patients, 13 had been circumcised and 1 had had a minor operation of stretching the prepuce. Most of the operations were done for enuresis, and in this series, of course, they were all unsuccessful.

4. *Dissociative or Hysterical Symptoms.*

In 63 cases dissociative symptoms were present in only 20. Tics and sleepwalking accounted for all but 3. The sleepwalking was sometimes a result of attempts to rise to micturate. This, and the previous observation

of the frequency of anxious types, suggests that enuresis is not a symbolic, dissociative symptom.

5. *Diseases of the Ear, Nose and Throat.*

For those interested in focal sepsis, especially in this region, we record that 19 out of 63 patients showed active disease—usually confirmed by an ear, nose and throat surgeon. We do not think, however, that this has any connection with life-long enuresis. It is more probably a result of malnutrition and neglect.

TREATMENT.

One of us (H.S.) tried all the usual psychiatric methods of treatment with little success. A few patients were improved by hypnotism. It was only after these failures that he was introduced to the use of ephedrine and found that, while it was no panacea, it gave better results than other methods. Each patient continued to have a full psychiatric review of his case.

Ephedrine was first used by Parkhurst (1930), who found that $\frac{1}{2}$ gr. at night for a child of 10 or 12, with limitation of fluids in the evening, was "almost specific" for the cure of enuresis. Christopherson and Broadbent (1934) found among 12 children, aged 3 to 13, that ephedrine $\frac{1}{4}$ to $\frac{1}{2}$ gr. and pseudo-ephedrine (the dextro-rotatory isomer) $\frac{1}{2}$ to 1 gr. were effective. Brookfield (1937) noted that in asthmatics ephedrine might produce inability to urinate for several hours. He therefore treated 38 cases of enuresis of varying ages with ephedrine alkaloid at night. The dose was increased by $\frac{1}{2}$ gr. every three or four nights to as much as 5 gr. sometimes. In 10 the enuresis ceased, and in 14 it improved. The ephedrine sometimes caused restlessness or sleeplessness at night, vomiting and palpitation. A boy, aged 5, receiving 2 gr. at night complained till noon next day that he saw fishes everywhere and that they were biting him. It was adolescents and young adults who benefited most from ephedrine. Browne and Ford-Smith made controlled experiments on 12 enuretic males, aged 14 to 20. Ephedrine sulphate, 0.06 to 0.24 gm., dry extract of belladonna 0.06 to 0.24 gm., and all the other drugs tried had no effect whatever on the enuresis. Stockwell and Smith found ephedrine of no value, but atropine was of benefit. With the sleepy, slow child, benzedrine sulphate, 2.5 mgm. twice daily, had some success.

We have used ephedrine hydrochloride B.P. In adults one begins with the maximum official dose of $1\frac{1}{2}$ gr. at night, increasing by $\frac{1}{2}$ gr. every few nights, according to tolerance and therapeutic effect, to a maximum of 3 gr. The dosage for children is modified according to age. Smaller doses may also be given by day, especially if diurnal symptoms are severe. Fluids are restricted in the evenings.

Twelve patients did not have this treatment, as they were recovering spontaneously. These were mostly in the younger age-groups, with one or two who had been conscripted to industry or to the Forces.; 19 did not continue attendance for treatment—a characteristic reaction in enuretics; 9 are still on increasing doses, but this number probably includes some failures; 4

showed no benefit. In the others, the improvement was measured on a rough percentage scale: 25 per cent. improved, 3; 50 per cent. improved, 6; 75 per cent., 6; and 100 per cent., 8. No serious toxic symptoms were observed, but in some patients minor symptoms prevented use of the bigger doses. The beneficial effect of ephedrine can be shown in the cystometrogram (Fig. 2a and b).

It is clear that ephedrine can help enuresis in certain cases. The pharmacology of the bladder is so complicated, and at times so variable and paradoxical, according to the description of Langworthy *et al.*, that further study of drugs which "paralyse the parasympathetic," or "stimulate the sympathetic," used in maximum doses, is needed.

CONCLUSIONS.

The literature on enuresis was reviewed and 67 cases of enuresis in adolescents and adults were studied. Such persistent cases are the most severe, but many of our conclusions can probably be applied to enuresis in children too.

Abnormalities of the lumbosacral spine, such as fusion defects and lumbarization and sacralization, are common in normal persons and have no relation to enuresis. Fusion defects disappear in the normal process of ossification. Spina bifida occulta should not be diagnosed unless other signs of it are present.

Enuresis is firstly a local autonomic symptom-complex, including several of the following: Nocturnal enuresis (which itself may not always be present), rising at night, diurnal enuresis, diurnal frequency and urgency, and encopresis. There is little evidence that this syndrome is due to local over-activity of the spinal micturition reflex, but the beneficial effect of large doses of ephedrine might suggest this.

The cerebral control of micturition consists of a release of inhibition when micturition is desired. The majority of enuretic patients have cystometrograms of the uninhibited neurogenic type, showing a lack of cerebral inhibition just the same as that found in some organic cerebral diseases.

Psychiatric abnormalities are found in the majority of enuretics, the two biggest groups being the anxious and the psychopathic, but other types occur. Disorders of autonomic function are very common in all anxiety states. The correlation between psychopathic states and enuresis is striking; the same lack of inhibitory control is seen physiologically in the enuresis and emotionally and socially in their behaviour. Electroencephalographic abnormalities are common in children with behaviour disorders and enuresis, but not in such children without enuresis (Michaels and Secunda). The electroencephalographic and cystometrographic findings link enuresis with personality in its fullest neuro-psychiatric sense.

The constitutional aspects of enuresis are further shown by its predominance in the male sex, by associated autonomic disorders, especially heavy sleep, by the serious family records of psychiatric conditions and of enuresis, and possibly by the family history of psychosomatic disorders.

Psychopathological causes should be, and were, shown to exist before the

age of 3 years, when bladder control should be established. They were so numerous and serious as to appear almost as important as the constitutional factors. Abnormalities of breast feeding were especially frequent.

The enuresis syndrome is not purely emotional in origin, as has been widely believed, but has important physical components. It is the total personality which is involved, in its constitutional, neurophysiological and emotional aspects. Nevertheless the enuresis usually disappears, either spontaneously or as a result of treatment. We agree with a previous writer that enuresis is not just a symptom, but is a disease in itself.

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THE MENTAL HEALTH OF SUBMARINERS, WITH SPECIAL REFERENCE TO 71 CASES EXAMINED PSYCHIATRICALY.

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THE life of those sailors who are called to tasks of special peril under the sea is recognized as being strange, unnatural, full of hazard, and of necessity involving considerable strain. It is hardly remarkable, therefore, that the infrequency of mental breakdown among submariners has given rise to comment and conjecture by various authorities. Colonel Cutler (1944) of the U.S. Army, in a lecture entitled "A Surgeon Looks at Two Wars," states that the lack of neurotic illness amongst submariners is due to the fact that there is no escape route. He points out that "there are statistical data to support the fact that where there is no escape route, these psychological casualties do not arise, or arise but rarely. Thus they are not reported for crews of submarines, and surely this might be thought of as a place for psychological strain . . ." This view is not accepted by all, and quite different explanations have been put forward. Surgeon-Captain Curran, R.N.V.R. (1944) believes that effective pre-selection and early elimination of the unsuitable are the two principal reasons for the small number of submariners who reach naval psychiatrists.

During a period of over sixteen months with a home-based Submarine Flotilla in the years 1943-1944 I had the opportunity of studying psychiatric disability in submariners. The series of 71 cases commented on here included even minor cases. They were drawn from boats "working up," operational boats, and boats arriving from other theatres of war. The cases were seen during the course of general sick bay work. It is not suggested that they are necessarily representative of the Submarine Service as a whole, or at all stages of the war. Submarine warfare in the Far East, for example, probably raises very different psychiatric problems.

Psychiatric illness was also seen in the ship's company of the Depot Ship. The psychiatric attending list at the sick bay for the general service ratings was about twice as long as that of the submariners. This observation loses some of its significance when it is realized that a depot ship is regarded, rightly or wrongly, as a suitable environment for those who have broken down elsewhere.

CLASSIFICATION OF PSYCHIATRIC CASES.

Classification of the psychiatric cases seen was carried out according to (1) the aetiological factors at work, (2) the nature of the reaction, and (3) the disposal of the case.

Firstly, in approaching and assessing each case, an attempt was made to gauge the relative importance of aetiological factors. In particular those environmental psychical factors grouped together as "submarine stress" were carefully estimated and distinguished from the non-submarine factors, such as constitution (physical and psychical) and environmental factors (physical and psychical) of a more general nature. The significance of each factor (in particular, "submarine stress") was estimated as being of "primary," or of "contributory" importance, or "irrelevant," in precipitating the psychiatric condition. Such an estimation was, of course, necessarily subjective.

Secondly, after the manner suggested by Stephenson and Cameron (1943) in describing anxiety states in the Navy generally, the type and stage of the psychiatric condition was classified as *early stress*, *established tension* or *anxiety with exhaustion*. This scheme was applicable to most of the conditions seen, as they were nearly always of a reactive nature, developing along the same general lines. Further subdivision on a clinical basis is described below.

Thirdly, the disposal of each case came under one of the three headings, "permanently unfit for submarines," "temporarily unfit for submarines" (for periods of from a few days to several months), and "treated on the attending list." In addition, it was noted whether or not the patient was referred to the Naval psychiatric specialist, and whether it was necessary for him to be admitted to hospital, or even to be discharged from the Navy. In a few instances in which it was not possible to verify the ultimate disposal of a patient, classification was in accordance with our provisional decision regarding disposal.

The results of this survey are shown in the following table (Table I) :

AETIOLOGICAL FACTORS.

Firstly, heredity and constitution were, of course, of great importance, although always difficult to assess, for the reason that even an extensive knowledge of the personality was not in itself sufficient to predict the mode of reaction to the highly abnormal submarine environment. The qualities of temperament required by the ideal submariner are matter for discussion by the men themselves, rather than by their doctors. On the other hand, the negative factor of unsuitability of temperament is at least in part a medical problem, for it is of enormous significance in predisposition to breakdown. It is an undoubted fact that there are men temperamentally unsuited for submarine service, although apparently normal in other respects. Moreover, basic unsuitability is not always obvious or even discoverable without the actual experience of service in submarines. Even the keen volunteer (e.g. Case 53) may be the possessor of a wholly unsuitable make-up. Such facts make preselection of men with a suitable temperament very difficult.

Secondly, physical factors not infrequently played an important part in psychiatric breakdown. Those most commonly found were toxic-infective processes and post-concussional states. The routine medical examination of a man for fitness for submarine service should normally be sufficient to detect the former. As regards post-concussional states, it is undesirable to direct such a patient to submarines, especially if he is unwilling. This is so even if a

TABLE I.

Case.	Rating.	Diagnosis.	Significance of aetiological factors.				Type of reaction	Disposal.
			Heredito-constititutional.	Environmental.				
				Phy-sical.	Psy-chical.	S/M stress.		
15	Ord. Sea.	Inadequate personality	1	—	—	1	Fear neuro-sis.	a
34	Sto.	" "	1	—	—	1		aN
53	Lieut. R.N.V.R.	Acute anxiety state	1	—	—	1	Fear and conflict neuro-sis.	aN
1	A/P.O.	Tension state	← 1 →	—	—	2		bN
12	A.B.	Anxiety hysteria	2	—	1	0	" Early stress."	aN
21	Lieut. R.N.	Tension state	2	—	1	2		aN
22	Ord. Sea.	Constit. inferior	← 1 →	—	—	0	Fear and conflict neuro-sis.	a
33	A.B. (L.T.O.)	Anxiety state	—	—	1	2		aN
41	E.R.A.	" "	1	—	2	2	aN	
45	Telegraphist	Tension state	1	—	—	1	" Early stress."	c
47	A.B.	Anxiety state	1	—	2	2		bN
49	E.R.A.	Post-concussional	2	1	—	2	aN	
54	Petty Officer	Anxiety state	2	—	1	0	Fear and conflict neuro-sis.	b
57	A.B.	Tension state	—	—	1	0		bN
60	Ldg. Tel.	" "	1	—	2	1	aN	
62	Ord. Sea.	Effort Syndrome	2	—	1	0	Fear and conflict neuro-sis.	c
68	A.B.	" Claustrophobia "	2	—	—	1		a
3	A.B. (gun layer)	Post-concussional	—	1	—	2	Anxiety neurosis (fear and conflict).	aN
6	A.B.	Tension state	2	—	1	0		c
8	P.O.	Acute anxiety state	—	—	1	0	" Established tension."	b
10	C.P.O.	Post-concussional	—	1	—	2		b
16	Ldg. Sea.	Anxiety depression	—	—	2	1	Anxiety neurosis (fear and conflict).	b
19	A.B.	Tension state	—	2	1	2		c
25	A.B.	" "	—	1	1	2	" Established tension."	c
29	C.P.O.	" "	2	—	—	1		aN
36	Sto.	Anxiety state	—	—	1	0	Conversion neurosis.	bN
39	A.B.	" "	—	—	—	1		bN
51	Ldg. Tel.	" "	2	—	1	1	" Established tension."	aN
52	Lieut. R.N.V.R.	Tension state	2	—	1	0		c
59	Ldg. Sig.	" "	—	—	—	1	Conversion neurosis.	c
66	Ldg. Sea.	Anxiety state	—	—	2	1		aN
69	E.R.A.	" "	—	—	1	0	" Established tension."	b
7	A.B.	Hysterical tic	2	—	1	2		b
9	A.B.	" " fit "	—	—	2	1	Conversion neurosis.	b
13	E.R.A.	Hysteria	2	—	1	0		c
18	A.B. (radar)	Hysterical amaurosis	2	—	1	0	" Established tension."	aN
28	E.R.A.	Fugue	—	—	—	1		aN
30	A.B. (L.T.O.)	Hysterical " fit "	—	—	2	1	Conversion neurosis.	b
21	P.O.	Hysteria	—	—	1	2		c
22	A.B.	Hysterical " fit "	—	—	2	1	" Established tension."	aNH
40	C.E.R.A.	Tension state	—	—	2	1		bN
56	A.B. (S.D.)	" Claustrophobia "	2	—	2	1	" Established tension."	aN
61	A.B. (H.S.D.)	" "	2	—	—	1		aN
2	C.P.O.	Exhaustion state	—	1	—	2	" Anxiety with exhaustion."	b
4	Sto.	Depressive state	← 1 →	—	—	2		c
11	A.B.	Schizophrenic reaction	1	—	2	2	" Anxiety with exhaustion."	aNHI
17	P.O.	Depression	2	—	1	0		aNH
20	Sub-Lieut. R.N.R.	Endogenous depression	1	—	—	2	" Anxiety with exhaustion."	aNHI
23	Lieut. R.N.V.R.	Depression	2	—	2	1		bNH
24	Tel.	Reactive depression	—	—	1	0	" Anxiety with exhaustion."	aNH
27	Sto.	" "	2	—	1	0		bN
35	A.B. (gun layer)	Depressive state	1	—	1	2	" Anxiety with exhaustion."	bNH
37	E.R.A.	Depression	2	—	1	0		c
46	Sto.	" "	1	—	2	0	" Anxiety with exhaustion."	c
48	Ord. Sea. (Radar)	Reactive depression	—	—	1	0		c
55	A.B.	Depression	2	—	1	0	" Anxiety with exhaustion."	c
58	A.B.	Reactive depression	—	2	1	0		aN
64	C.P.O.	Depression	—	1	2	2	" Anxiety with exhaustion."	b
65	Lieut. R.N.	" "	1	—	1	2		b
67	A.B.	Endogenous depression	1	—	2	2	" Anxiety with exhaustion."	aNHI
70	Sto.	Reactive depression	—	—	1	0		c
71	Sto. P.O.	" "	2	—	2	1	bN	

TABLE I—*cont.*

Case.	Rating.	Diagnosis.	Significance of aetiological factors.				Type of reaction	Dispos:
			Heredito-constititutional.	Physical.	Psychical.	S/M stress.		
5	E.R.A.	Psychopathic personality	. 1	—	2	0	" Other states."	c
14	A.B.	" "	. 1	—	—	0		c
26	Sto.	Hypomanic psychopath	. 1	—	—	0		c
38	Sto.	Schizophrenic reaction	. 1	—	2	0		a,N
42	P.O.	Obs. (N.A.D.)	. —	—	—	0		c
43	E.R.A.	Psychopathic personality	. 1	—	—	0		c
44	P.O.	Hypomanic psychopath	. 1	—	2	0		c
50	A.B.	Cyclothymia	. 1	—	2	0		c
63	Sto.	Psychopathic personality	. 1	—	—	0		c,N

Key to Table I.—1, Aetiological factor considered to be of primary importance; 2, of secondary importance; 0, of no significance; a, permanently unfit for submarines; b, temporarily unfit for submarines; c, treated on attending list; N, referred to neuropsychiatrist; H, admitted to hospital; I, invalided.

post-traumatic neurosis is more in evidence than an organic deterioration. It was found that such cases passed as fit usually broke down fairly soon. In the rating who was already a submariner imperfect physical health was, especially in the older hands, frequently sufficient to upset a precariously balanced psychic equilibrium.

Thirdly, psychical factors of a more general nature than "submarine stress" (which is discussed below) were of great aetiological importance. These have been adequately described by other writers on war psychiatry.

Worthy of special mention, however, are domestic anxieties and conflicts. Tooth (1944) has stressed the importance of these factors, and the poor prognosis with which they are associated. A particularly difficult situation frequently arose, for example, when a wife's understandable dislike of submarines reacted unfavourably on a man of otherwise excellent morale. The conflict was often more severe in the excellent type of man. Previous war stresses, both in civilian life and in general naval service in surface ships prior to entry into the submarine service, were also, of course, of importance in some cases.

Although these "non-submarine" factors were so important, psychiatric preselection for submarines was not practised in the formal sense. Nevertheless, preselective processes were at work on the embryo submariner. Entry into the Navy is itself one such process—for most sailors have taken the initiative to express a preference for the Senior Service. Moreover, many submariners are volunteers. At one time it was an exclusively volunteer service, although now many ratings are "directed"—with every degree of willingness. Volunteering is, of course, a potent preselective device, although here one must discount the pathological volunteer, who usually makes a poor submariner. In this category one includes the histrionic psychopath and the restless person, who is unable to adjust himself to the discipline of other branches of the service. Finally, the man who is entering the submarine service has to pass another general medical examination when, in addition to physical contra-indications, even psychiatric disabilities may be detected. In one depot the candidates

were required, as a routine, to visit the neuropsychiatrist, but this practice is unusual—even if the rating himself complains to the examining medical officer of “nerves.”

“SUBMARINE STRESS.”

Submarine life and warfare differ in numerous important respects from that of any other combatant group. Although the physiological problems involved lend themselves to experimental study, the psychological problems, which are no less distinctive, are more elusive. The doctor usually only learns of them, and then often in a biased form, from his sick patients. The healthy submariner is usually unwilling to talk on the subject of “submarine stress.”

There is, first of all, the general background of the inherent dangerousness of submarines, as shown by the relatively high casualty rate. In this service, if in any, a slight mistake is liable to have disastrous consequences. Older hands, more fully alive to the facts, often interpreted the light-heartedness of inexperienced ratings as dangerous irresponsibility. The knowledge of former submarine disasters, and the type of death they entailed, is always at the back of the submariner's mind.

On the other hand, the life has its compensations—among these being the high rates of pay in the submarine service. In addition, there is usually a healthy cycle between duty and generous leave, whereby the corroding effect of long-term monotony is avoided. The diet is good and well balanced. There is also the less irksome (but no less effective) discipline, and finally the natural pride of belonging to a small, distinguished and dangerous service—possibly even to a particular boat, with many triumphs recorded on its “Jolly Roger.” Moreover, it is possible to exaggerate the physical discomfort (if not the danger) of submarine life. Life on the heaving and swilling mess decks of some “hard-lying” surface ships, for instance, with but slight prospect of leave, is hardly more acceptable.

Specific stresses peculiar to submarines are of importance. These include such unpleasant experiences as being depth-charged, sticking in a muddy seabed, getting an angle or “losing trim,” and a host of other imaginable disasters. From the psychological point of view such stresses are in themselves usually of a more or less acute, transitory and superficial nature.

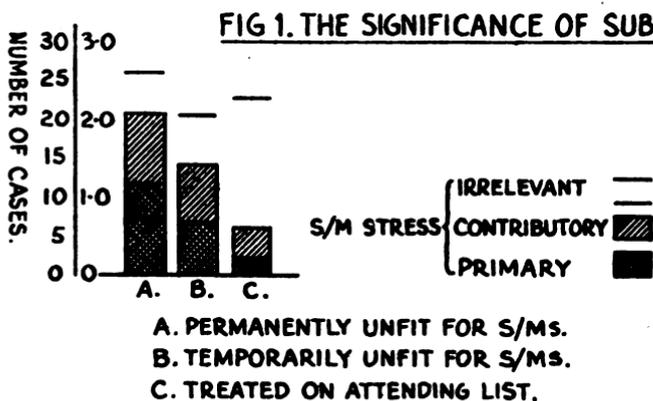
More important, on the whole, is the chronic form of stress. Apart from the foul atmosphere, the incredible overcrowding, and the other prolonged physical conditions, there is the constant knowledge of the presence of danger, without direct sensory perception of its nature or source. The presence of threatening agents (such as attacking surface ships) and the knowledge that there is no outside help is often accompanied by enforced physical inactivity, and a consequent lack of opportunity for an aggressive relief of the state of tension and preparedness induced. The tension-tempo ratio is thus greater probably than in any other combatant group. An exception to this is the occurrence of a surface gun action. Such an event has been described as a sort of catharsis for the psychic counterpart of the submariner's usual constipation. A gun action is, however, usually followed by the order “Dive! Dive! Dive!” and a return to inactivity.

The cramped and crowded conditions of a submarine make it difficult to conceal the physical manifestations of normal tension and even fear. In addition to this, the frequently monotonous nature of the life provides unique opportunities for brooding, and thus for the conditioning of neurotic reflexes once they have appeared. In this way it is understandable how the constant environment of the inside of a submarine can, in certain circumstances, become a conditioned stimulus for an anxiety reaction.

TABLE II.—*The Significance of "Submarine Stress" as an Aetiological Factor.*

Disposal.	Total cases.	"Submarine stress."			
		Irrelevant.	Important.		Total.
			Primary.	Contributory.	
Permanently unfit S/Ms	27	6	12	9	21
Temporarily unfit S/Ms	21	7	7	7	14
Treated on attending list	23	17	2	4	6
Totals	71	30	21	20	41

Table II shows the significance of "submarine stress" as an aetiological factor in the various groups classified according to their disposal. It will be noted that more than 50 per cent. of those patients in which "submarine stress" was considered to be a factor in their illness were rendered permanently



unfit for submarine service. Again, in more than half of those of this group discharged from the submarine service, "submarine stress" was considered to be the primary aetiological factor. The significance of "submarine stress" is shown by the graphic transcription of Table II in Fig. 1.

PSYCHODYNAMICS OF BREAKDOWN.

In understanding the psychodynamics of psychiatric breakdown among submariners, the conception of the anxiety neurosis as described by Air Commodore Symonds (1943) was found to be of help. According to this conception a specific psychopathology is rejected, and the anxiety neurosis is regarded as a disturbance of function in that part of the mind or at that physiological

level which is concerned with the generation of affect. The aetiological factors in such a disturbance may be hereditary-constitutional or environmental (physical or psychological). This theory relates the anxiety neurosis to other varieties of affective disorder. Moreover, it regards it as being separable in varying proportions into two components, viz., "conflict neurosis," and "fear neurosis," the affect in each case having a distinctive quality.

The development of such neurosis in this series of submariners was also regarded as passing through the following three phases, in any of which actual neurotic breakdown is a possibility :

- (1) Early stress.
- (2) Established tension.
- (3) Anxiety with exhaustion.

The criterion of the presence of neurosis was, at any rate theoretically, fairly straightforward. It was that the reaction of the personality was out of proportion in intensity or persistence to the environmental circumstances.

It was recognized, however, that many men were able to carry on at their jobs in spite of some measure of neurosis. Curran and Garmany (1944) have even recommended, for surface ship sailors, an early return to sea, with the purpose of increasing the "tempo" and so restoring the normal tension-tempo ratio. Such a policy did not seem to be so applicable to the submarine service. From the peculiar nature of submarine warfare the "tempo" is not strikingly increased by a return to sea, although the tension is certainly increased.

The criterion of what constituted a neurosis severe enough for the patient to be taken off duty was relative, and varied according to the prevailing circumstances (e.g. the manpower situation, the demands of the war, the permissible lowering of efficiency, etc.). It depended ultimately on a social, and not a medical, estimate of how severe or persistent an affective reaction should be in the "normal" person. It was the duty of the medical officer to relate that social estimate to his clinical material.

1. *Early stress.*—In this, the first phase, the submariner has undergone his preliminary theoretical training, is informed of the dangers and possible disasters to which he will be exposed, and has started his practical training in a submarine. It is at this stage that he experiences uneasiness, apprehension or even fear—with or without conflict. It is partly the fear of being afraid, and partly the fear which is the normal immediate response to the "submarine situation." The degree of intensity varies according to the individual. Conflict arises only when opposing instincts and desires (such as the spirit of adventure and the desire to carry out one's task with credit) arise in opposition to the fear. Normally, after a time the fear reaction becomes completely inhibited by these other feelings, and conflict then also ceases. A state of poise and fearlessness is achieved. Again, the time taken to achieve this state varies according to the individual (e.g., longer in the case of the unenthusiastic non-volunteer). It should be noted that conflict is not experienced if fear is either uninhibited or completely inhibited. The achievement of fearlessness without conflict in the "submarine situation" marks the end of the first phase, but before this is reached the unpleasant affective states outlined above, viz., of fear or of

conflict, or of a combination of the two, may become abnormally strong or unduly prolonged—sufficiently to constitute a neurosis. In this first phase, therefore, two main types of neurosis may occur.

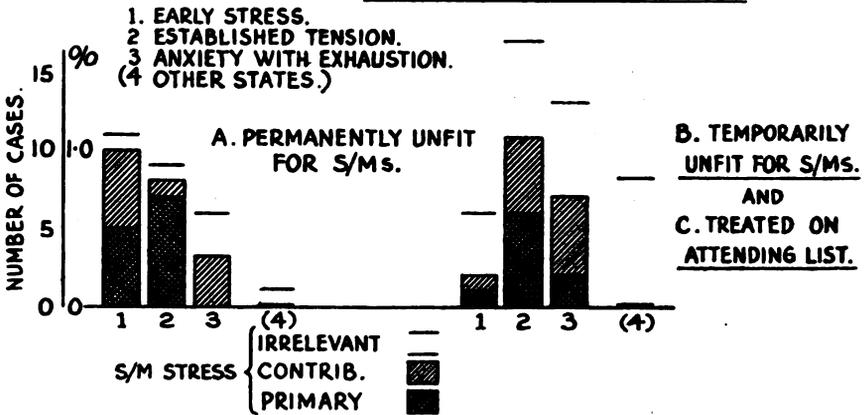
The first type of neurosis in the first phase is a form of acute situational fear reaction, in which fear is more or less completely uninhibited, and there is, therefore, little or no conflict. Such states were not common in a severe form, and were usually unpredictable. They were seen not only in men adjudged to be of poor moral fibre, but also in men of unquestionable keenness and integrity. The following two cases serve as contrasts :

CASE 53.—An officer volunteer who had done considerable service in destroyers, and had looked forward to service in submarines, was quickly surprised and disappointed. At his first experience of "being dived" he was overwhelmed with intense fear and disabled by its physical manifestations. After several attempts at overcoming this, he found it necessary to report his condition with shame, and he was to his disappointment returned to general service.

CASE 34.—A stoker, unwillingly directed to submarines, and considered to be of low morale, developed similar symptoms of terror when in a submarine. He would conceal himself in the depot ship when his boat was due to sail. He preferred any form of disposal, even detention, to going to sea in a submarine. He was considered to be unsuitable, and was returned to general service.

The second and less immediate type of neurosis of the "early stress" type is the more common condition in which there is a good deal of conflict as well as fear—the fear reaction never having been completely inhibited. Cases in this group formed the majority of those who became permanently unfit for submarines by reason of "early stress" (see Fig. 2), and were thus of consider-

FIG 2. TYPES OF REACTION.



able relative importance. Most of the patients were, in fact, men who had entered or had been directed to the submarine service with an undetected neurotic disability already present. Most of the group were, therefore, predictable, and could have been eliminated before the commencement of their submarine training. The following cases are examples of this second type of "early strain," showing both fear and conflict to a pathological degree :

CASE 41.—All his life this timid, over-conscientious and hardworking E.R.A. had shown gross nervous traits—in particular a pronounced lifelong claustrophobia. In a submarine all his symptoms became very severe, and he suffered greatly from headache, vomiting, dizziness, earache and sleeplessness—symptoms which would remain for days after returning from sea. He failed in a valiant attempt to overcome his disabilities, and was returned to general service.

CASE 49.—An E.R.A., shortly after being directed to submarines, complained of tiredness, depression and headaches when in a submarine. He was of depressive temperament, and had been subject to headaches since concussion in civil life. Depression was the main symptom in this case, with a situational anxiety with conflict. The condition was considered to be basically a post-concussional state. The patient was transferred to surface ships.

CASE 33.—A seaman L.T.O., after two and a half years' foreign service in surface ships was finally sunk in a cruiser. This experience made him very nervous. On return to this country he was directed to the submarine service. In addition, there was chronic domestic worry, and he had also been made very nervous by earlier civilian blitzes. Normally an efficient rating, he became inefficient at his work fairly soon after joining a submarine. He showed all the physical signs of a fairly severe anxiety state, and was on these grounds returned to general service.

2. *Established tension.*—The middle phase of the submariner's career, the phase of "established tension," may be said to begin only after the inhibition of fear has been established, i.e., after he has become an adjusted submariner. The essential psychopathological process which may occur in this phase is the failure of inhibition—with re-emergence of fear and therefore of conflict. If inhibition is not rapidly regained, prolonged fear and conflict may become abnormally severe or persistent, and again a neurosis may be said to exist. The common causes of failure of inhibition were firstly physical factors (Case 3); secondly, more severe or too frequently repeated stresses (Cases 66 and 29); and thirdly, specific severe stresses (Case 51):

CASE 3.—A gunlayer, who had been a volunteer for submarines, saw considerable action in the Mediterranean, particularly during the bombardment of Greece, and was concussed and unconscious for 24 hours in his submarine. On return to submarines after hospital treatment he continued to have headaches, and never fully regained his self-confidence. Finally, he reported sick, complaining of headache and a fear of submarines. His condition was considered to be an anxiety state on the basis of a true post-concussional state, and he was returned to general service.

CASE 66.—A leading seaman (L.T.O.) developed nervous symptoms after a good deal of depth charging in a Russian convoy. He then spent six months ashore, doing an L.T.O.'s course, and recovered his equilibrium. Two months after returning to active submarine service he found it necessary to report on account of severe anxiety symptoms, with obsessive-compulsive features. The usual physical signs of an anxiety state were very prominent, and he was considered unfit for submarine service.

CASE 29.—A petty officer, of experience in the submarine service, was referred to the sick bay by his commanding officer. He complained of anxiety symptoms when in his boat, and felt no confidence in his shipmates, who, he felt, were very inexperienced and even careless (this boat has since had a most distinguished career). Recent disasters in two submarines on exercises had also unsettled him. His condition was considered to be a purely situational neurosis, and on his own request he was transferred to the Commandos. The condition had been of insidious onset.

CASE 51.—A leading telegraphist of the R.N.V.R. had always been of a very nervous temperament. After a long period in general service in the Far East prior to the fall of Singapore he became depressed and anxious while on a lonely signal station. On return to the United Kingdom he was directed to submarines, and after some months felt he was settling down. On one occasion his submarine

became stuck in the mud in an almost vertical position. Hope was almost abandoned. During subsequent weeks in the Depot Ship he developed a severe anxiety state with nightmares and obsessive thoughts. He eventually reported his condition (with self-reproach) and was returned to general service.

The above group of cases, showing a mixture of fear and conflict as the main affect, are the most closely related to the classical "anxiety state." They illustrate perhaps the most typical psychopathological effect of "submarine stress" on otherwise stable personalities (Fig. 2, col. 2). The cases in this group were nearly all unpredictable and unpreventable. They showed as their main complaint the usual symptoms and signs of an anxiety state.

An important sub-group, suffering from "established tension" neurosis, showed conversion phenomena with a corresponding reduction in subjective discomfort. The use of the actual term "hysteria" has been avoided, because, although the disorders in these cases showed a dissociative escape mechanism, the personalities involved were often strikingly different from those generally described as "hysterical." The commonest syndrome in this group was the hysterical headache, associated with a variable degree of "claustrophobia." The following two cases are typical :

CASE 61.—A higher submarine detector rating who had volunteered for submarines reported headaches some months after he had been in the submarine service. For the next ten months his symptoms got worse, and he was investigated and treated from every physical angle with only temporary relief. His condition always improved when he was on leave, and also when he was taken off patrols for a period. He also complained of a feeling of "everything closing in," especially when on the Asdic set. His commanding officer described him as being an exceptionally efficient operator—especially in a crisis. On account of his claustrophobia he was considered unfit for submarines.

CASE 56.—A submarine detector rating, who had volunteered for submarines, had been a contented worker, an intelligent and efficient seaman, keenly interested in submarines. After considerable service he married, and on his next commission he developed headaches and other neurotic symptoms, including claustrophobia. These symptoms were viewed sceptically by some of his officers. After careful consideration, however, it was decided that his previous good adjustment had been precarious, so that when his main personal interest was transferred to his wife, inhibition began to fail, and a true neurosis developed.

The significance of claustrophobia in submarines is worthy of special mention. As a primary symptom it occurred in the comparatively rare panic reactions already described under "early stress." It also occurred quite commonly as a subsidiary symptom in more generalized neurosis. In Asdic ratings, as the two cases just quoted indicate, claustrophobia was unusually prominent as a symptom. The Asdic rating at the set is normally one of the few individuals whose sensory perception (by means of instruments) extends beyond the confines of the submarine to the potential source of danger. It is probable, therefore, that by contrast, the sense of being shut in is for him intensified, so that claustrophobia can confidently be predicted when an Asdic rating breaks down.

Anxiety equivalents, with or without hysterical elaboration referable to the alimentary tract, were not seen. Although constipation was the general rule, dyspepsia seemed to be a surprisingly rare complaint amongst submariners.

No exact figures on this subject are available at present, however, and no explanation can therefore be put forward.

3. *Anxiety with exhaustion.*—The third and final phase is eventually reached if “established tension,” not of an incapacitating degree, continues indefinitely. A condition of true exhaustion develops, usually with depression as a prominent feature. It was especially common in men of stable and conscientious personality, who had carried on despite a long-continued state of tension. Such patients were often unwilling to admit even to themselves the reactive nature in their condition, and this gave rise to misleading obscurity from the aetiological point of view. The end-result of a long reactive process frequently gave the false impression of being endogenous.

Depression was the usual presenting feature of this final phase of “anxiety with exhaustion,” and, in one case in which there had been prolonged strain frank schizophrenic features accompanied the depression (Case II).

The following are some examples of this phase :

CASE 20.—A sub-lieutenant, who had evidently had a depressive illness following a sinking (and shrapnel wounds) in the Merchant Service, volunteered for submarines in 1943. He served most efficiently in his submarine for five months, but finally began to feel run down and depressed, and was unable to rouse any interest in his duties, which, however, he continued to carry out by an effort of will. He reluctantly reported sick, assuming there was a physical cause for his condition. There were few physical signs of anxiety, and depression was the main feature, with unnecessary self-reproach. He was discharged to hospital, and eventually invalided out of the Navy.

CASE 71.—A stoker petty officer, who had served in a number of submarines, was normally of a cyclothymic disposition. His wife worked in a factory in connection with submarines, and learned of the loss of several submarines in which her husband had already served. Her anxiety was eventually reflected by an attack of fairly severe depression in the patient, with feelings of futility and meaninglessness. He was an over-conscientious person, who was further depressed by the critical attitude of senior officers. He was taken out of submarines for three months, made an excellent recovery, and later in a new boat was regarded as being the most reliable and hardworking of the stoker petty officers.

CASE 11.—This rating spent a considerable time in the submarine service. He was a quiet, shy type of person with few friends. His best friend was killed in a submarine, and this upset him a good deal. He himself also underwent much stress in the Mediterranean, and eventually requested to leave submarines as his nerves were bad. This request was apparently refused. Some months later he appeared to be depressed when under treatment for some trivial physical complaint, and on further investigation a fairly severe depression with a strong schizophrenic colouring was revealed. He complained, for instance, that he could hear the voice of his dead father mocking him, and that his father was influencing his mind adversely. He was admitted to hospital, and discharged from the Navy as a case of schizophrenia with depression. It seems that such an illness as this was largely reactive and attributable.

TYPES OF REACTION.

The types of reaction seen in various groups of the cases under discussion are shown in the following table and diagram (pp. 354, 355).

The more serious types of neurosis, viz., that rendering a man permanently unfit for submarines (Group A) occurred more frequently in the phase of “early stress.” In these cases (Group A, column 1), which were eliminated early, “submarine stress” was a prominent aetiological factor (to the extent of signifying a “situational neurosis”).

TABLE III.—*Types of Reaction.*

Group of cases.	Total cases.	Reactive neurosis.			4. Other states.
		1. Early stress.	2. Established tension.	3. Anxiety with exhaustion.	
Permanently unfit (S/M stress primary)	12	5	7	0	0
" " (S/M stress contributory)	9	5	1	3	0
" " (S/M stress of significance)	21	10	8	3	0
" " (" irrelevant)	6	1	1	3	1
Cases permanently unfit for S/Ms	27	11	9	6	1
returning to S/M duties	44	6	17	13	8
Total cases seen	71	17	26	19	9

On the other hand, it will be seen that the milder forms of neurosis (i.e., Groups B and C—remaining in the submarine service) occurred in all three phases, but mainly in the middle and late phases.

In the 41 cases in which "submarine stress" was considered to be of importance, the percentage (of each group of cases) which was discharged from the submarine service was as follows:

Early stress	83 per cent.
Established tension	42 " "
Anxiety with exhaustion	30 " "

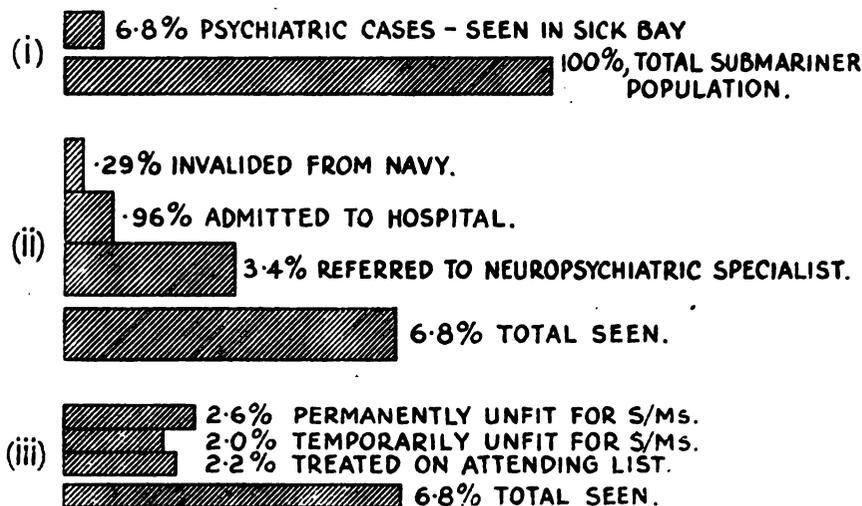
It is thus confirmed that the unsuitable tended to be eliminated at an early state, and that those who broke down at a later stage were more likely to return to submarine duties.

INCIDENCE OF PSYCHIATRIC CASES.

The 71 cases discussed here were seen over a period of roughly 16 months, and were drawn from a floating population estimated at 780–800. The annual rate for psychiatric cases (attending at the ordinary sick bay and including minor cases) over the period in question was thus only 6.8 per cent., a half of whom (3.4 per cent.) were referred to a neuropsychiatric specialist. The composition of this 6.8 per cent. is shown in the diagrams of Fig. 3.

TREATMENT AND DISPOSAL OF CASES.

Active psychiatric treatment was very limited in scope and followed the usual lines. Patients suffering from the milder conditions which could be treated on the attending list benefited most from talks, explanation and the simpler forms of psychotherapy in general. Those who required to be relieved of their duties in submarines for a period (a line of treatment especially useful and effective in the phase of "anxiety with exhaustion") sometimes required sedation as well. Patients suffering from the more severe conditions were either admitted to hospital for treatment or returned to general service, where, of course, they ceased to be classified as "submariners" before they could reach a Naval psychiatrist.

FIG 3. DISPOSAL OF CASES.

Half of the psychiatric cases (3.4 per cent.) of submariners were referred for consultation to a Naval neuropsychiatric specialist. A third (2.6 per cent.) were permanently unfit for submarines. The rate of admission to hospital was less than 1 per cent. per annum, and the rate of invaliding from the Navy on psychiatric grounds in this group of submariners was less than .3 per cent.

Although only 6.8 per cent. of submariners required psychiatric examination, a high proportion of these were unfit to carry on their work in submarines. In view of the small numbers involved, this fact may be taken as an indication of high morale in that only the more severe cases reported for psychiatric advice and help. Over a third of them (2.6 per cent.) were permanently unfit for submarines, and were, as a rule, drafted back to general service. Another third (2 per cent.) were unfit for a long or short period (varying from a few days to many months), and eventually returned to service in submarines. The remaining third were adequately treated on the attending list.

SUMMARY AND CONCLUSIONS.

It has been a commonly accepted belief that in spite of the strain associated with submarine warfare the incidence of serious psychiatric illness amongst submariners has been very small. Various theories had previously been advanced to explain this. In order to verify the belief, a series of 71 patients examined psychiatrically has been analysed. An attempt has been made to gauge the relative importance of aetiological factors (particularly the strain peculiar to service in submarines), to study qualitatively the development of reactive disorders in submarines, and to describe the incidence and disposal of such cases.

It has been shown (Fig. 1) that "submarine stress" played a very big part in the majority of cases discharged from the submarine service, and, conversely,

that those cases in which "submarine stress" played an important part were mostly discharged from the submarine service.

Neuroses of more severe prognostic significance (from the point of view of further service in submarines) occurred most commonly in the phase of "early stress," whereas cases occurring in the later phases (of "established tension" and "anxiety with exhaustion") had a correspondingly better prognosis for a return to submarine duties.

In this group of submariners it has been shown that the incidence of psychiatric illness was small (only 4.6 per cent. per annum required to be relieved even for a short period from full duty in submarines). Moreover, most of the patients who did not return to submarines remained suitable for other forms of Naval service, and less than .3 per cent. were invalided from the Navy on psychiatric grounds.

The indications are that the submariner is a stable type of person. Less stable personalities do not reach the submarine service, or are eliminated in the phase of "early stress." The fact that "there is no escape route" in a submarine at sea has no bearing on the matter; it merely postpones breakdown until there is an escape route (*viz.*, when alongside the depot ship).

The institution of a measure of deliberate preselection appears to be advisable, particularly as regards pre-existing mild anxiety states, post-concussional states, etc., and especially when dealing with an unwilling or constitutionally inferior rating. Drafting routine to submarines should include a visit to the neuropsychiatrist.

Facilitation of honourable discharge on medical grounds of ratings who have completed a predetermined period of good service in submarines and have begun to develop vague neurotic symptoms is seen to be a justifiable, and indeed desirable, procedure.

I wish to thank my Flotilla Medical Officer, Surgeon-Commander Stubbs, R.N.V.R., and the other medical officers of the flotilla for their help and encouragement in collecting the clinical material for this paper. I also wish to thank the Medical Director-General of the Navy for permission to publish this paper.

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ON THE AETIOLOGY OF STUTTERING.

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NUMEROUS writers, doctors, psychologists and laymen interested in the cure of speech defects have discussed stuttering, a condition also known by various other names.* Literature on this subject has been published by Kussmaul (1877), H. Gutzmann (1911), Froeschels (1925), Brown (1932), Hahn (1943), among others.

As far back as 1877 Kussmaul† was deprecating the increase in the number of publications on stuttering; this increase has grown since then. But it is a curious fact that although all experts now maintain that stuttering is a "nervous" disorder, many text-books on nervous diseases do not mention it at all (e.g. Bing (1939), Grinker (1943), Wechsler (1943)).

Opinions differ very much on the *aetiology* of stuttering. McAlister (1937) was certainly right when she said "to plunge into the literature upon stuttering is to be engulfed in a turgid sea of confusion and controversy. There are almost as many theories as there are exponents . . ."

The majority of writers in this country as well as elsewhere maintain that stuttering is a neurosis, and not the result of an organic affection of the nervous system, but if stuttering really resulted as a rule from a psychic cause, we should expect psychic abnormalities in the majority of stuttering children at the beginning of their disability.

The following are the results of some investigations on this subject:

Orton (1937, p. 122) maintained: "The emotional and personality factors which are so striking later on and which have led many observers to classify all stutterers as neurotics are notably *absent in childhood*. Many early stutterers when seen within the first year of their difficulty show *no demonstrable deviation in the emotional sphere* and present no history of environmental or psychological difficulties which seem at all adequate to explain the disorder." H. Gutzmann had already said, 23 years earlier (1914), that abnormal psychic factors are not concerned in stuttering. West (1929, p. 114) expressed the same opinion: "Many cases also show dysphemia (= stuttering) without any discoverable inferiority feelings or any other emotional problems or disorders clearly distinguishing them from the non-stutterer." Stinchfield (1933, p. 122), too, maintained that "stuttering is found among children who appear quite normal

* E.g. dyslalia (Still, 1927), stammering (Boome, 1931), dysphemia (West, 1924), (Peacher, 1945), dysarthria syllabaris (Kussmaul, 1877), (H. Gutzmann, 1911), spasmophemia (Stinchfield, 1923), associative aphasia (Hoepfner, 1922; Froeschels, 1925).

† Kussmaul (p. 226): "The literature on this defect of speech has increased out of all bounds, as nearly every proprietor of an institution for stutterers thinks that, in its interests, he ought to come forward as an author. These publications have the average value of balneological publications."

in all other respects," and Stein (1942, p. 115) said: "There are cases in which chronic stammering remains unaltered during the whole life and is not complicated psychically." This frequent exemption of young stutterers from psychic abnormalities is not in favour of the opinion that stuttering is the result of a psychic disturbance. The frequency of psychic abnormalities observed in adults who have stuttered since childhood is explained by the mental agony from which the stutterer suffers in consequence of his inability to speak, which often comes on in most critical situations.

Some writers maintain that the disappearance of stuttering during singing and low speaking proves that stuttering is not the result of an organic affection, but, as a matter of fact, stuttering does not always stop on singing or low speaking.

The majority of stuttering children either begin to stutter when they first attempt to speak, or, more often, between the ages of 3 and 6 years. In favour of an *organic* cause of stuttering in this second category it may be mentioned that many of these children have suffered from an infectious disease just before the onset of stuttering. H. Gutzmann observed this relation between infection and stuttering in more than 13 per cent. of his cases, and other writers as well as I (1903) have noticed it too, e.g. Still (1927, p. 913), Scripture (1923, p. 8), Froeschels (1925, p. 324).

E. W. Scripture (1923, p. 8) supposed that in these cases stuttering resulted from exhaustion produced by the infection. Still (1927, p. 912), not believing that the infection was of great importance for the production of stuttering, maintained that "the basis of stuttering is defective nervous control, or that ill-defined, but very real entity, the nervous temperament." My own opinion is that in these cases the infectious disease probably produces organic damage to the speech area in the nervous system. Peritz (1902 and 1932) established that in pseudobulbar and bulbar affections the first, and in mild cases, often the only symptom is a disturbance of speech. H. Gutzmann (*l.c.*, p. 209) observed stuttering in several children suffering from pseudobulbar and bulbar paralysis. These children often did not speak at all for several days between the beginning of the infectious disease and the onset of stuttering. The short interval between the infectious disease and the beginning of stuttering in many of these cases is in favour of an aetiological relation between infection and stuttering.

We know nothing at all about the aetiology of stuttering in infants, in whom the defect seems to be congenital. As a hypothesis it may be said that in such a case stuttering might be the result of a birth injury of the brain, or perhaps an inherited abnormality in the speech area. (Brain injuries during and after birth as possible causes of stuttering were mentioned by Travis (1931)).

On *examining* stuttering children numerous abnormalities have been found, both in the speech area and in other parts of the nervous system.

West, Kennedy and Carr (1937) observed (p. 55) "slowness of diadochokinesis of the stutterers' articulatory muscles and lack of vocal inflection." It cannot be decided at present whether this slowness results from spastic paresis of the "speech" muscles or from a cerebellar affection; in any case it most probably results from an organic affection of the nervous system.

On examining stuttering children I observed (1903) deviation of the protruded tongue certainly much more often than in non-stuttering children. I supposed this to be the result of organic damage to the central neurons of one 12th nerve, as often seen in cases of hemiplegia. Froiep (1843) had observed deviation of the tongue in stutterers long before, but he had given a different explanation of the symptom. H. Gutzmann (1911, p. 123) mentioned this abnormality; Froeschels (1925, p. 314), however, observed it only as a rare exception, and did not attach much importance to it. Peritz (1932, pp. 598 and 599), albeit he believed that stuttering usually resulted from nervousness ("Nervosität"), thought that in a certain number of cases stuttering was caused by an organic affection of the nervous system. As far as I know, Siirde (1939) is the only writer who has since published the result of his examination for this symptom. He examined 103 stuttering children, and observed deviation of the protruded tongue in 40·7 per cent. of his cases. Perhaps this deviation of the tongue, which often increases when the children protrude the tongue for several seconds, disappears at a more advanced age. Abnormalities outside the speech area have also been observed, especially a rather frequent inequality of the arm-swing while walking, as reported by B. C. Meyer (1945). This author said that no explanation for this symptom could be given, control studies of the non-stuttering population not being available. He examined 116 stutterers, and found inequality conspicuous in 10 cases and slight in 18 cases.

Disturbance of associated movements is a well-known symptom in organic lesions of the central nervous system. Gordon Holmes (1939, p. 24) mentioned it in affections of the cerebellum, and Foerster (1921, p. 52) in cases of affection of the nucleus pallidus of the corpus striatum (*cf.* Kinnier Wilson, 1928).

It cannot be decided at present whether stuttering in children results from a lesion of the cerebellum or of the corpus striatum; in any case the frequency of organic abnormalities observed in numerous stuttering children favours the opinion that stuttering may be the result of organic damage to the nervous system.

Meyer observed (*l.c.*, p. 134) a dorsal plantar reflex, mentioned also by Froeschels (p. 356); a defective plantar response, unelicitable abdominal reflexes, anisocoria, and some other abnormalities have been observed in a few cases, which, however, might be the result of functional disturbance.

Several authors (e.g. Still, *l.c.*, p. 913) attached great aetiological importance to the frequent finding of left-handedness in stutterers, some of them also to the observation that stuttering in left-handed children started when they were compelled to use the right hand instead of the left, as they had been accustomed. Russell Brain (1940) said "the close association of stuttering with left-handedness indicates that in many cases it possesses an anatomico-physiological basis," though he did not regard stuttering as a result of organic nervous disease; not all writers, however, are convinced of the frequency of the association of left-handedness with stuttering (*cf.* Boome (1934) and Meyer (1943, p. 135)).

Whereas stuttering may be observed in many adults in whom it began in childhood, relatively few cases have been reported in whom it started in adult

life. These were patients suffering from an organic disease of the brain or a severe injury to the skull. Such cases were described by Cornil (1864), Déjerine (1885), A. Pick (1890), Abadie (1902), Peritz (1902), Moutier (1908), Foerster (1921), Froeschels (1925), Peacher (1945) (*cf.* Kussmaul (p. 152), Gutzmann (1911, p. 111), Froeschels (1911, p. 349)). I think it is proved by these cases that stuttering may be the result of an organic affection of the central nervous system, but it is not proved that stuttering arising in infancy also results from an organic lesion. It is noteworthy, however, that Foerster (1921, p. 116), having observed a disturbance of speech which very much resembled stuttering ("eine grosse Aehnlichkeit mit dem Stottern") in affections of the corpus striatum, expressed the opinion that certain cases of stuttering probably resulted from a localized affection in this part of the central nervous system. Perhaps encephalography will, in the future, show if stuttering in children is the result of an organic affection of the brain (*cf.* Orton and Travis (1929), Orton (1937), Meyer (1945, p. 144)).

Meyer (p. 141) was much impressed by the variability of stuttering under varying conditions; he maintained that "any satisfactory theory concerning the cause of stuttering must explain the high degree of variability of the symptom under varying conditions." Marked variability, however, may be observed in other symptoms which are of organic origin. I have observed great variability in one symptom which is certainly the result of organic disturbance and in which I have been interested for many years, namely, myotonia. On active movement this abnormality of striated muscle may be quite absent in warm weather but very marked in cold weather; it may be absent on active movement but very conspicuous on mechanical excitation of muscles, and it may be absent on active movement and on mechanical excitation but present on electrical examination. So the well-known variability of stuttering is certainly neither exceptional, nor does it speak in any way against an *organic* cause of stuttering.

Parsons and Barling (1933, p. 374) said: "Sometimes there appears to be a relation between stammering in the parent and pyloric stenosis in the child"—an observation which certainly is not in favour of a functional aetiology of stuttering.

It is impossible at present to say anything about the place in the nervous system in which damage produces stuttering. We do not even know whether it results from a *one-sided* lesion of the brain or whether *both* sides must be damaged. Probably lesions of different parts of the nervous system may cause stuttering; the cases collected by Gutzmann (*l.c.*, p. 111) favour this opinion. The lesion may even be situated outside the speech area, in analogy to some cases of hemiplegia, in which the pyramidal tracts are undamaged, but affected by a lesion in the "higher motor centres" of the cortex cerebri (Hoestermann (1912), Bielschowsky (1916)).

Although I suppose an *organic lesion* of the nervous system is the fundamental, primary cause of stuttering in the majority of cases, psychic affections *resulting from* the disturbance of speech *aggravate* the trouble, so that organic and functional disturbances are combined in those patients who have suffered from stuttering for a long time.

But besides these primarily organic cases of stuttering, there are certainly also some of psychic origin, the result of imitation (though as shown by Gutzmann (1911, p. 106) imitation is not of great importance in the production of stuttering) and of strong emotion (either the result of fright or continual domestic trouble). The effect of fright was demonstrated by so-called shell-shock cases.

Whether and how far *heredity* (*cf.* Meyer, *l.c.*) may be responsible for the production of stuttering is unknown at present. It is well known that myotonia, although *usually* an inherited affection, may be an acquired affection in rare cases. Perhaps stuttering, although *acquired* in the majority of cases, may result, in rare cases, from inherited under-development of the speech area. In favour of heredity as a cause of stuttering, it may be said that there are families in which many persons have been reported as stuttering. I do not know how often these different persons belonging to one family were examined by experts, so that stuttering in all was really proved. There is also the possibility that in some members the stuttering was the result of imitation, although, as has just been said, stuttering by imitation seems to be rare. Whether the fact that *boys* are affected more frequently than *girls* is the result of heredity cannot be decided at present.

Exercise and various methods of psychic treatment often lead to a diminution, or even the apparent abolition of stuttering. This good effect may be explained by the fact that stuttering is the *cause* of psychic disturbances which, in their turn, increase the speech defect, so that by improving the psychic condition speech is improved as well.

Kussmaul (*l.c.*, p. 230) and Meyer (*l.c.*, p. 141) observed a diminution of stuttering after taking *small* doses of alcohol. We do not know whether this good effect results from a psychic influence or from a reduction of spasm in the speech muscles. If the latter were the cause of the improvement other chemicals might have a still better effect on stutterers and systematic research might be useful.

CONCLUSIONS.

Stuttering is not a disease, but a symptom of various disorders in the nervous system (*cf.* Kussmaul (1877), Ziehen, quoted by Gutzmann (1914, p. 510), Gutzmann (1911, p. 104), Boome (1934)). Stuttering may become obvious as soon as an infant makes the first attempt to speak; in the majority of cases it starts between the ages of 3 and 6 years. Nothing definite can be said on the aetiology. When stuttering children are examined at the time of onset of stuttering no psychic abnormality is observed in the majority of cases. This fact is not in favour of the idea that stuttering is a neurosis, as most writers maintain. Many children who have begun to stutter after their earliest infancy have suffered from a severe infectious disease just before the onset of stuttering. I assume an organic affection in or near the speech area of the brain is the cause of stuttering in these cases, producing pathological function in the central neurons of the speech nerves. This opinion is supported by the observation that these children often do not speak at all before stuttering begins. On examining these stuttering children abnormalities may often be

observed which are presumed to be the result of organic damage in the central nervous system. These are (1) within the speech area, dysdiadochokinesis of the speech muscles and deviation of the protruded tongue, and (2) outside the speech area, abnormality of the arm-swing when walking, perhaps also left-handedness, and sometimes other symptoms as well.

Where stuttering is observed in early infancy, when the child first attempts to speak, an injury to the central nervous system during delivery may be the cause of the disability.

In some cases stuttering starts in adults affected by an organic disease of the brain, or after a severe injury to the skull. Post-mortem examination of such cases has revealed extensive lesions in various parts of the brain. In these cases the *organic* aetiology of stuttering is proved, which favours the opinion that stuttering in children may also result from an organic lesion in the nervous system.

We do not know whether stuttering may be in some cases the result of an inherited congenital malformation in the speech area.

There are certainly purely functional cases of stuttering, resulting from emotion, but they are unusual apart from war and similar conditions. The rarity of stuttering by imitation has been shown by Gutzmann (1911, p. 106). Only in rare cases is emotion the primary cause in young children, but emotion certainly aggravates stuttering in very many cases. By improving the nervous condition of these patients, stuttering is diminished, or apparently abolished.

To sum up :

1. Stuttering is probably a congenital affection in some cases, perhaps the result of a brain injury during delivery.
2. Stuttering usually starts in infancy, probably as a result of organic damage in the speech area or in speech centre association tracts.
3. Stuttering is observed in adults affected by a severe affection of the central nervous system.

Stuttering is a pure neurosis in rare cases only, but neurotic symptoms arise in the majority of stutterers later on. It is not known whether hereditary malformation may be the cause of stuttering.

I am indebted to Dr. C. Worster-Drought for helpful advice with regard to this communication.

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THE EPILEPSY OF FYODOR DOSTOIEVSKI.

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KRETSCHMER, in his *Psychology of Men of Genius*, drew attention to the frequent association of psychopathy in the mental make-up of individuals so gifted and so able as to be readily included in the class of "men of genius." Of all the individuals whom Kretschmer discusses, Dostoevski is the only one who is known for certainty to have been epileptic. Both the prophet Mohamet and the apostle Paul are mentioned as being traditionally regarded as having suffered from this malady, but for obvious reasons it is impossible to be certain of this. That an individual who ranks amongst the world's greatest novelists should, throughout his life, have suffered from epilepsy is in itself a remarkable and possibly unique thing. It is therefore of some interest to inquire in what manner epilepsy manifested itself in Dostoevski, how it influenced his work, and what light, if any, the manifestation of this condition in an individual of such intellectual power, throws on the nature of the epileptic state itself.

Little is known of Dostoevski's family apart from a somewhat brief survey of his more immediate relatives provided by his daughter, Aimee Dostoevski. One is immediately struck, however, even in this fragmentary description, by the high degree of psychopathy which must have been present in the family.

His father was a doctor. He had quarrelled with his parents, and at the age of fifteen had run away from his home in the Ukraine and gone to Moscow, where he studied medicine. He would never speak of his family spontaneously, nor make any answer when questioned about them. He served in the army in the war of 1812, and later became superintendent of a large state hospital in Moscow. He was apparently a heavy drinker, and in his cups became very suspicious and violent. He was avaricious and extremely mean. Eventually he deteriorated to such a degree, and his drinking became so heavy, that he had to give up work, and retired to his country estate. Here he was eventually murdered by some of his serfs, apparently as a result of his cruel behaviour in his dealing with them.

Dostoevski's mother is described as "very delicate" and retiring. They had seven children, four boys and three girls. Barbara, one of the girls, is described in the following terms by her niece:

"But the most miserable of the family was certainly my Aunt Barbara. She married a well-to-do man, who left her considerable household property in Moscow. The houses brought in a good income, my aunt's children were comfortably settled in life and lacked nothing, and she had therefore everything that was necessary to ensure her comfort; but the unhappy woman was the victim of a sordid and diseased avarice. She opened her purse with a kind of loathing; the smallest expenditure was a torture to her. She finally dismissed her servants to avoid paying their wages. She had no fires in her apartments, and spent the winter wrapped in her cloak. She did no cooking; twice a week she went out and bought a little bread and milk. There was a

great deal of gossip in the neighbourhood where she lived about her inexplicable behaviour. Eventually two peasants got into her home one night and murdered her in the hope of finding her hoard of money."

Mihail the eldest and Nicolas the youngest of the brothers are described as having been very heavy drinkers. Though the former seems to have been able to work and support himself, the latter, after a brilliant course of study, was never able to do anything, and had to be supported for the rest of his life by the family.

Mihail's sons are all referred to as "drunkards." Barbara's son is said to have been "so stupid that his folly verged on idiocy."

There is no reason to suppose that Aimee Dostoevski set out with the deliberate intention of showing all her father's family in an unfavourable light. When, therefore, she remarks in conclusion the "the whole Dostoevski family suffered from neurasthenia," she is presumably only drawing attention to a very obviously high incidence of psychopathy among his immediate relatives. There is no evidence that any other member of the family suffered from frank epilepsy, nor is there any suggestion that any of them was outstandingly gifted intellectually.

Fyodor Dostoevski was born in 1820. According to family tradition it was when he heard of his father's violent death that he had his first epileptic fit. This was in 1839. However, the fits did not apparently occur with any frequency till about ten years later, when he was imprisoned in Siberia, and after that time they continued for the rest of his life. Most of the attacks he had were typical *grand mal*, but it is probable that at times he suffered momentary alterations of consciousness corresponding to *petit mal*. Thus in a letter to his brother Mihail in 1854 he refers to "strange attacks resembling epilepsy and yet not epilepsy," and in his novels one occasionally comes across a description of a typical *petit mal* which is presumably culled from his own experiences. His second wife, in the diary which she kept, gives a detailed account of one of his major seizures. It is of particular interest because of the post-epileptic confusion and automatism that it describes.

"After dinner Fyodor had a cup of coffee, lay down at fire and asked me to wake him at half past. I also fell into a doze. But at twenty minutes past five Fyodor got up, came up to my bed and kissed me. I said 'What is the matter Fyodor?' He turned back, but suddenly fell into an epileptic fit. I got very frightened; I wanted to take him to his bed, but I could not manage it in time. So I propped him up against my bed for I had not the strength to put him on it. He half stood all the time the convulsions lasted (and that is why his right leg is now aching, because he had leant against the wall). When the convulsions were over, Fyodor began tossing about, and although I tried my best to keep him quiet, I had not the strength to manage it. Then I put two cushions on the floor and quietly placed him on them, so that he should lie more comfortably. I unbuttoned his clothes so that he could breathe more freely. To-day I noticed for the first time that his lips turned quite blue, and his face unusually red. How unhappy I was! This time he did not come round for a rather long time, and when he began to do so, however bitterly and painfully I felt, I had a desire to laugh, for any words he uttered were spoken

in German. He said 'Was? Was doch? Lassen sie mich,' and went on with a long string of German phrases. Then he called me by my pet name and asked for forgiveness; but he could not make out what I was saying to him. He also asked me for money to go off to the tables. A fine player, I thought, to play in this state! When Fyodor recovered he got up from the floor, buttoned himself up and asked me to give him his hat. I thought, does he want to go somewhere now? and I asked him, 'Where are you going?' 'Comme ça,' was his reply. I could not make out and asked him to repeat what he said, for I thought he was going out for sausages. Then I persuaded him to lie down, which he did not want to do, and even began grumbling. 'Why was I trying to put him to bed, why was I fomenting him?' At last he lay down, but slept by snatches, waking every ten minutes. At seven o'clock we went out for a walk, but Fyodor suddenly wanted to kiss my hand in the street, and said that if I did not let him do it, he would not consider me his wife. Of course I tried my best to dissuade him; in the middle of the street, with people looking on—it would be terribly ridiculous. Then Fyodor said he would very much like to have some chocolate. Although a glass of chocolate costs eighteen kreutzer, I agreed and we went into a café." It is worth mentioning that Dostoievski spoke German very poorly, and also that at this time the Dostoievskis were in a state of absolute poverty, and buying a glass of chocolate would have been in his normal senses an unheard of luxury.

After each attack the muddling of his thoughts and temporary loss of memory persisted usually for several days, and this, of course, when the fits occurred with any frequency, played havoc with his work. Thus we find him writing to his friend, A. N. Maikov: "Of my work I will write you nothing, for I have nothing to say about it yet. Only one thing: I have to go at it hard, very hard indeed. In the intervals my attacks rob me of all vitality, and after each one I can't collect my thoughts for at least four days. . . . And the novel is my one means of salvation. The worst of it is that it must absolutely come off. Nothing less will do, that's a *sine qua non*. But how can it when all my capabilities are utterly crippled by my malady! I still have my power of vision intact, of late my work has shown me that, and nerves I have still. But I have lost all memory."

The fits appear to have occurred at their best every three or four months, and at their worst every few days. It is therefore of some significance to record that despite the fact that after the age of 25 or 30 he had repeated *grand mal* for the rest of his life, and that after each one a certain degree of confusion or memory defect occurred for a few days, no obvious permanent intellectual deterioration seems to have developed. Thus, perhaps his greatest work of all, *The Brothers Karamazov*, was published in 1880, at the age of 60, and only one year before his death. Most psychiatrists consider that intellectual deterioration in epileptics, particularly those in whom the fits are uncontrolled, is a fairly frequent occurrence. Curran and Guttman, for example, state that at least two-thirds of all epileptics show progressive deterioration, and that there is a correlation between the deterioration and the number of fits. Furthermore, one would expect theoretically that such deterioration would be more immediately apparent and perhaps a more gross thing, in a

highly gifted and sensitive intellect, than in one which is only average or perhaps dull.

What is of most interest, however, is the peculiar psychic aura which appeared to precede the fits. It was an alteration of consciousness associated with a feeling of exaltation, and a sense of time, as it were, standing still. He gives the clearest account of this in *The Possessed*, where the character Kirillov says, "There are seconds—they come five or six at a time—when you suddenly feel the presence of the eternal harmony properly attained. It's something not earthly—I don't mean in the sense that it's heavenly—but in the sense that a man cannot endure it in his earthly aspect. He must be physically changed or die. This feeling is clear and unmistakable; it's as though you apprehend all nature and suddenly you say, 'Yes, that's right.' God when he created the world said at the end of each day of creation, 'Yes, it's right, it's good.' It . . . it's not being deeply moved, but simply joy. You don't forgive anything because there's no need of forgiveness. It's not that you love—Oh there's in it something higher than love—what's most awful is that it's terribly clear and such joy. If it lasts more than five seconds the soul could not endure it and must perish. In those five seconds I live through a lifetime, and I'd give my whole life for them, because they are worth it. To endure ten seconds one must be physically changed . . ." 'Kirillov, does this often happen?' 'Once in three days, or once in a week.' 'Don't you have fits perhaps?' 'No.' 'Well you will. Be careful Kirillov, I've heard that's just how fits begin. An epileptic described just that sensation before a fit, word for word as you've done. He mentioned five seconds too, and said that more could not be endured. Remember Mohamet's pitcher, from which no drop of water was spilt while he circled Paradise on his horse. That was a case of five seconds too; that's too much like your eternal harmony and Mohamet was an epileptic. Be careful Kirillov, it's epilepsy!'"

It is such a rare event to come across anyone suffering from alterations of consciousness which are known to be associated with specific pathological conditions, and who is also sufficiently gifted to be able to describe with any precision the quality of that state, that the above description would seem to be well worthy of a place in the literature of epilepsy.

It is quite clear that these transient alterations in consciousness associated with such feelings of exaltation made a profound impression on Dostoievski. It is also apparent from the above quotation that he appreciated the central problem common to all religious and mystical thinkers who base themselves on unusual and peculiar states of consciousness, that is, whether such states are pathological curiosities or are manifestations of divine or occult inspiration.

Another aspect of the fits to which Dostoievski refers is an overpowering feeling of guilt as though he had committed some crime which then kept on haunting him. This feeling developed after the fit and had, not surprisingly, a very depressing effect.

Most authors dealing with essential epilepsy draw attention to a group of personality traits, which tend not infrequently to be seen in epileptics. While these are by no means always detectable, the clinical association is sufficiently

frequent for this group of traits to have become regarded as typical of the epileptic personality. Selfish egocentricity, excessive suspiciousness of the motives and actions of others, hyperirritability, and quarrelsomeness; these are the main features of this sort of personality. They are often outwardly submissive and in a peculiarly circumstantial way polite, and this may give the impression of great humility. They fall into violent and uncontrollable rages. They very frequently become religious and devout, but this is more usually a religiosity without deep feeling, and a devotion without zeal. They are intolerant or bigoted. "They are considerate without being kind, . . . they will work for praise but not for love" (MacCurdy).

We know that Dostoievski understood the way the epileptic temperament characteristically manifests itself, because in the character Smerdyakov, the epileptic in *The Brothers Karamozov*, he drew a careful picture of this. Here is the typical epileptic personality of the psychiatric text-book. He is egotistic, conceited, irritable and sanctimonious. He grew up "with no sense of gratitude." "He seemed to look at the world mistrustfully." He is asocial, and yet interfering and aggressive. Dostoievski gives us here a detailed and rich picture of the many facets of this type of personality. Whether or not he derived it from observations of other epileptics or by an intuitive process from experience of inner tendencies in his own personality it is not possible to say. However, there is no doubt that he connects it closely with the epileptic process, and does not regard it as something fortuitous.

How far are such personality traits to be discerned in Dostoievski himself?

Clearly in a personality so complex and in many ways so fortuitous as his, this is an extremely difficult question to answer in a balanced manner. One has the impression however that, in his waywardness, his irritability, his frequent differences with his associates, the persistent turbulence and difficulties which he encounters in his various social and family relationships, his uncontrollable mania for gambling, and his abject and at times almost grotesque humility, there is an underlying stratum in his personality closely akin to that regarded as typically epileptic. Of course in an individual of such intellect and sensitivity, one would not expect such traits to approach the crudity of expression that is seen in the more usual type of epileptics.

In this connection it is worth considering in a little more detail one aspect of Dostoievski's personality, which perhaps dominates more than anything else his outlook and his work. We refer to his peculiar religious mysticism, and his sense of profound humility that emanated from this. It is difficult to describe briefly the contents of Dostoievski's religious thought. It is essentially individualist and personal, and to a large extent hostile to the organized Church. His position is perhaps best summed up by André Gide, himself a Catholic and also a distinguished literary critic:

"Dostoievski abhors all Churches, the Church of Rome in particular. He claims it his right to accept Christ's teaching directly from the Scriptures and from them alone. . . . Neither behest nor ruling; simply the secret of the supreme felicity revealed by Jesus Christ in the Gospels: 'If ye know these things, happy are ye, if ye do them.' (John XIII, 17). Not 'happy shall ye be,' but 'happy are ye.' Here and now we can share in that perfect bliss.

What serenity! Time indeed ceases to exist: eternity lives, we inherit the kingdom of God.

"Yes, here is the mysterious essence of Dostoevski's philosophy and of Christian ethics too; the divine secret of happiness. The individual triumphs by renunciation of his individuality. He who lives his life, cherishing personality, shall lose it; but he who surrenders it shall gain the fullness of life eternal, not in the future, but in the present made one with eternity. Resurrection in the fullness of life, forgetful of all individual happiness."

This is the conception that pervades the whole of Dostoevski's work.

Now Kretschmer has remarked that it is no accident that an inclination to religion is particularly encountered in those who suffer from bizarre experiences and peculiar alterations in consciousness. In particular, this is seen frequently in epileptics and schizophrenics. He explains this by arguing that the threat to the integrity of the whole personality felt by the patient in his inward experience of the disease process is projected outwards into the cosmos. "There arises a compelling sense of great metaphysical connections, a profound oneness with the universe and with Godliness, everything is brilliantly lit up, clear as the edge of a precipice, strangely threatening." Hence arises the feeling of divine inspiration and the consequent mystical or religious outlook.

What is extremely interesting, as Gide points out, is that Dostoevski himself seems to have seen this connection between the states of exaltation which formed the aura of the fits and his religious ethic. We frequently find in his novels an epileptic expressing in one form or another this religious outlook and relating it to his epileptic attacks. Thus in *The Idiot* we find Prince Myshkin saying to Rogozhin, "At that moment—at that moment I seem somehow to understand the extraordinary saying that there shall be no more time." "You've begun to believe in future eternal life?" "No, not in a future eternal life, but in eternal life here. There are moments, you reach moments, and time suddenly stands still and it will become eternal."

The moments he is referring to are those just prior to the fits. Again, in the passage quoted earlier from *The Possessed*, we find the same view expressed.

Thus it seems reasonable to argue that the religious mysticism which dominates Dostoevski's life originates in very much the same way as the religiosity of the average epileptic. That is, it springs out of the particular character of his emotional experiences. That the one should have a rich content and great depth and the other should be superficial, arises presumably from the fact that the one takes shape in a great intellect and the other in a comparatively dull one.

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JAKOB-CREUTZFELDT DISEASE.

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THE presenile psychoses have been the subject of intensive study in recent years. Both Alzheimer's and Pick's disease can now be regarded as well-defined clinico-pathological conditions. However, there occur cases with dementia developing in middle age or in early senium which do not fit into any of the established clinical types. A small group of cases characterized by dementia, extra-pyramidal symptoms and involvement of the spinal cord has been described by Jakob (1920) and Creutzfeldt (1920) independently. Similar cases have since been reported by Meyer (1929), Davison (1932), Jansen and Monrad-Krohn (1938), Davison and Rabiner (1940), and most recently by Jervis, Burdum and O'Neill (1942). McMenemy (1940), in a review of dementia in middle age, stated that the number of cases of that type reported in the literature did not exceed 14. Though all of them had the syndrome mentioned above in common, they varied considerably in respect of the leading symptoms. While in some the clinical picture was dominated by dementia associated with a variety of psychotic features, in others the extrapyramidal and in a few the spinal symptoms were predominant. Nothing definite is known about the etiology of that condition, though the hypothesis has been expressed that it may represent an atypical form of encephalitis. Josephy (1936) suggested that it might be a deficiency disease. No agreement has been reached on a suitable terminology. Jakob's original description of the condition as spastic pseudosclerosis has been found to be misleading. K. Wilson (1940) proposed to call it "cortico-striato-spinal degeneration." Davison and Rabiner (1940) speak of "diffuse encephalomyelopathy." Other authors advocated the provisional term Jakob-Creutzfeldt disease. In view of the scanty knowledge of the symptomatology and pathology of the disease, this term seems at present to be the most acceptable.

We have observed a patient of this type over some months, and it has been possible to carry out a full pathological investigation in this case. A second case will be reported briefly which one of us (E. S.) observed some years ago.

CASE I.—Thomas Y—, aged 49, hotel manager, was admitted on 26.ii.44. Family history negative. The patient was a healthy child, and at school he was of average intelligence. He served in the Great War for four years and was discharged physically fit. He entered his father's business and was very efficient at his work. He was described as a solitary, timid and somewhat

suspicious man. There had never been any woman in his life except his mother, to whom he was greatly attached. He was healthy until 1941, when he complained about tiredness and lack of energy. His condition became gradually worse. In July, 1942, a hypochromic anaemia was diagnosed: blood examination revealed 60 per cent. Hb, R.B.C. 3,700,000. No other signs of disease were found. He received iron therapy, and after three months he was free from symptoms and remained well until the onset of the present illness. Eighteen months prior to admission it was noticed that he tended to fall asleep during the day, and that he was becoming progressively slow in speech and action. Nine months later his business accounts were found to be inaccurate. He showed impairment of memory, which gradually became worse. He was depressed, and said that people were against him because he had let his family down and was unclean. He thought that he was suffering from venereal disease and that other people knew about it. He feared that something terrible was going to happen to his mother and himself. He could not concentrate, and lost interest in everything. He used to sit for hours motionless and seldom spoke. His gait was stiff and uncertain. On one occasion he was incontinent of urine. On the day prior to admission he was very agitated and tried to kill himself.

Physical examination on admission.—A well-built man of good colour and moderate nutrition. Apart from slight oedema of the hands and feet there were no symptoms of circulatory disease. B.P. 142/106. Respiratory system: N.A.D. Alimentary system: Tongue clean, bowels constipated, liver normal in size. Blood count: R.B.C. 4,200,000; Hb. 90 per cent. Urine analysis completely negative. Renal function: Water excretion and concentration tests gave normal results. Blood W.R. and Kahn negative.

Central nervous system.—Motor system: The patient sits with hands on knees, head bent, eyes downcast, mouth slightly open and with the lower lip rimmed with saliva. He stands with knees slightly bent and shoulders drooping. Facies wooden and stolid, eyes with a far-away look. Gait: Unsteady and clumsy, with occasional stumbling. He walks slowly and takes short steps. When the hands are held forward coarse tremors occur, right more marked than left. During tests for Rombergism, head-nodding sometimes occurs. No intention tremor. There are fine fibrillary twitchings in the pectoral muscles and in the glutei and hamstrings on both sides. Motor power normal except in the lower limbs, where power is generally reduced, especially in the extensors. Both speech and movements are slow. No paralysis is present. The patient has difficulty in carrying out fine movements with the fingers, e.g. picking up a coin. Muscle tone normal in the upper extremities. Rigidity in lower limbs, but not of a cog-wheel character. Position of legs when at rest in bed is one of 10° flexion. Dysdiadochokinesis in both hands. Muscle volume: distinct symmetrical atrophy of a moderate degree is present in the muscles of the thighs and calves, and atrophy of a slight degree in the shoulder girdle and the pectoralis muscles.

The sensory system.—Hypaesthesia for touch and pain on hands and feet. Sharp was returned as blunt in 40 per cent. of cases. Temperature appreciation is impaired. Cold is well recognized on all parts of the body; but warm

is poorly appreciated in the hands and feet. Tactile discrimination is impaired on all extremities. Deep sensibility normal, except for the vibration sense which is grossly impaired on the lower limbs. There is increased tenderness on pressure of the muscles and nerves of the lower extremities. Tactile discrimination impaired on all extremities. Stereognosis: correct replies given only after delays of one and two minutes. He is unable to distinguish between milled and unmilled coins. Ataxia: patient has difficulty in walking along a straight line. "Heel to knee" test performed poorly, especially with the left leg. Rombergism is present.

The reflexes.—Corneal, pharyngeal, abdominal reflexes and plantar extensor response normal on both sides. Oppenheim and Rossolimo negative; biceps, triceps, radial reflexes normal; knee and ankle jerks absent both sides.

Cranial nerves.—Smell normal. Visual fields, acuity and fundi normal. Eyelids slightly drooping. The movements of the external ocular muscles are normal, except that there is a limited upward movement of both eyes. Convergence incomplete. Horizontal nystagmus to the right. Otherwise no abnormality of the cranial nerves.

Cerebrospinal fluid.—W.R. negative. Kahn negative. Cells, 2 per c.mm. Globulin normal. Colloidal gold test normal.

Mental condition on admission.—The patient is content to sit in his room motionless. His expression is impassive, but he is obviously very depressed. He seldom speaks of his own accord. He replies to questions slowly in a dejected and monotonous voice and often does not answer for some time. His answers are brief and always relevant. He says that he is a broken man and that there is no hope for him. He believes that his private parts are diseased and that he has syphilis. He fears that he may have infected his mother. He blames himself for having disgraced his family. He implores the doctor to shoot him. He avoids other patients, whom he is ashamed to face. He believes that people avoid him because of a smell that comes from him. At times he becomes frightened and agitated when left by himself.

Orientation for person and space correct. Orientation in time usually good, but there have been occasions when the patient got out of bed at 5 a.m. and dressed in the belief that it was time to do so. Memory and retention are poor. The patient regularly forgets that he has been examined the day before. He forgot the lumbar puncture after 24 hours. He realizes that his memory is failing. General knowledge is fair, knowledge of current events very poor.

Progress notes.—For the first three weeks after admission the patient's condition showed no material change. In spite of his ataxia he was able to go out for short walks. Sometimes on a cold winter day he would refuse to have a fire in his room and say that he wanted to expiate his sins. Memory and retention deteriorated and he confabulated. Orientation in time became grossly defective. In the middle of March his physical condition showed signs of rapid deterioration. He was incontinent of urine. The ataxia became worse and he was unable to walk without help. He looked extremely ill. His consciousness was less clear. He could perform only the simplest tests of intelligence, and had difficulty in comprehending what he was required to do.

He reiterated that he was a sick man and that he would never leave the hospital alive. During April he went downhill rapidly. He lost a great deal of weight. He took very little food. His complexion was sallow. (The blood picture remained normal.) He was confined to bed all the time. Mood and thought contents remained unchanged. During the last four weeks before his death his consciousness became progressively clouded and he could hardly answer questions. A dysarthria of the bulbar type developed and he had difficulty in swallowing. He died with signs of bronchopneumonia. The diagnosis was Jakob-Creutzfeldt disease.

Post-mortem examination (Dr. W. Blackwood).—Bronchopneumonia in both lungs. The heart showed a moderate degree of brown atrophy, with slight arteriosclerotic changes of the coronary vessels. Otherwise the organs appeared healthy on macroscopic examination. Central nervous system, see below. The microscopic investigation showed the typical changes of early bronchopneumonia. There were some foci of old interstitial fibrosis in the heart muscle. The spleen showed acute engorgement, with hyaline thickening of the corpuscular arterioles. In the kidneys there were some fibrosed glomeruli. Suprarenals were healthy. The pituitary was of normal size, and there were no abnormalities in the glandular tissue. The posterior lobe showed some cells containing haemosiderin. Portions of the muscle which had appeared atrophic clinically were examined. The muscle bundles of the deltoid were slightly atrophic microscopically, and so were the bundles of the glutei which showed variability in calibre and hypernucleation suggestive of partial denervation.

Central nervous system.—*Brain*: Weight 2 lb. 4 oz. The meninges appeared normal. There was generalized symmetrical gyral atrophy, more marked in the frontal regions than in other lobes. The basal vessels were healthy. On section there was no particular abnormality, apart from slight enlargement of the lateral ventricles. Ependyma healthy.

Microscopic examination (E. Stengel).—Cerebral cortex. Sections were examined from all cortical areas and stained by HE and Nissl, for microglia and oligodendroglia and astrocytes, myelin, fat, and by silver impregnation (v. Braunmühl's method). The Nissl stain showed numerous fairly distinct foci of loss of nerve cells, chiefly in the third layer of the frontal (including pre-Rolandic), parietal and occipital areas, less numerous in the temporal lobes. The sensory areas of the cortex showed only very few of those foci. Many nerve cells showed on Nissl stain colliquation of the cytoplasm and shrinking of the nuclei. Those nerve cells were in many places surrounded by an excessive number of microglia cells and phagocytes. These changes were particularly marked in the cornu ammonis of either side. Fat stain revealed excessive lipoidosis of nerve cells in the same areas and phagocytes full of lipochrome. There was lipoid material in the glial elements and in the adventitial spaces of the small blood vessels as well as in the endothelial cells of the capillaries.

Those signs of fatty degeneration of nervous tissue were most pronounced in the third layer of the cortex, which also showed disorientation of the pyramidal cells.

There was a general increase of microglia and oligodendroglia. The glia proliferation in the cortex corresponded in degree to the loss of nerve cells. The

oligodendroglia cells showed signs of "acute swelling." The microglia was also increased in the white matter of the gyri, especially of the frontal lobes, and so were the astrocytes. Myelin stain showed numerous small areas of demyelination up to about 1 mm. in diameter. Swollen myelinated fibres in various stages of degeneration were seen to enter some of these circular areas, which were most numerous in the external three layers of the cortex. Those foci were very scanty in the parietal and occipital sensory areas. Silver impregnation revealed the presence of moderately numerous senile plaques, especially in the depth of the sulci. Those plaques were distributed over all layers. They were small, and were not related to the much bigger areas of demyelination. The centres of many plaques showed an amorphous substance, with a light brownish tinge on silver impregnation. No intracellular neurofibrillary tangles of the type of Alzheimer's neurofibrillary changes were seen, nor were there intracellular argentophile bodies, such as those described in Pick's disease. The blood vessels of the cortex and the leptomeninges did not show pathological changes, apart from the fatty deposits in the adventitial spaces above. No iron deposits were seen.

Centrum semiovale.—While in the white matter of the gyri the microglial elements were increased in many areas, no abnormalities were found in the centrum semiovale.

Caudate nucleus, putamen and globus pallidus.—Cell changes similar in nature to those found in the cortex were present. The large nerve cells were more severely affected than the small ones. Myelin stain showed no focal demyelination, but there was abnormal swelling of fibres in many places. There were no pathological changes in the *optic thalamus*, but there were signs of cell degeneration in the *substantia nigra*. A considerable amount of the dark cell pigment was found in the adventitial cells and spaces of the blood vessels, indicating destruction of pigmented nerve cells. There was also a certain amount of that pigment in the glial elements of those areas.

Midbrain and medulla.—In the posterior colliculi there were some small foci with satellitosis and neuronophagia suggestive of cell degeneration. In the medulla there were foci of nerve-cell destruction, and acute microglial activity in the nucleus of the spinal tracts of the fifth nerve on either side. The large motor cells of the cranial nerves showed signs of degeneration (chromolysis, increased lipochrome content) with proliferation of the surrounding glial cells, but there was no indication of pathological cell loss. There were no signs of demyelination.

Cerebellum.—There were small foci of glia proliferation in the white matter surrounding the dentate nuclei on both sides, and there were foci of demyelination similar to those found in the cerebral cortex in the same areas. The cerebellar cortex was free from pathological changes, apart from abnormal swelling of some Purkinje cells.

Spinal cord.—The meninges were healthy macroscopically. Size and consistency of the cord were normal. Even with the naked eye areas of degeneration could be seen in the white matter. They were quite distinct in the posterior, less distinct in the lateral columns of all segments. Myelin stain showed large areas of demyelination. The myelin sheaths in parts of the

posterior and lateral columns were either completely lacking, or showed all degrees of degeneration from swelling to extreme ballooning and the formation of large myelin balls. Fat stain showed fatty deposits in phagocytes and in all layers of the walls of the blood vessels within or adjoining the areas of demyelination. The axis cylinders also showed various degrees of disintegration. There were areas of *status spongiosus* in the posterior and lateral columns. The reaction of the glia was obviously inadequate to fill the gaps, though there was considerable astrocytic proliferation. On the whole the picture was similar to that found in subacute degeneration of the cord. Like in the latter disease, the areas of demyelination were, in cross section; wedge-shaped with peripheral bases. The changes were more marked in the cervical and thoracic than in the lumbar and sacral segments.

The large motor cells of the anterior horns showed very marked signs of degeneration. Many of them were completely filled with lipochrome. In others a few Nissl granula were left and only a minority of cells were normal. The damaged cells were surrounded by satellites. The number of the motor elements appeared reduced in the cervical and lumbar segments.

Peripheral nerves.—Portions of the sciatic nerves were examined microscopically. Cross sections showed a moderate degree of swelling and loss of myelin in many bundles, but there was no marked loss of fibres. Longitudinal sections confirmed those findings, and also showed granular change of the myelin substance. The mesodermal sheaths of the nerves were not affected, and there was no sign of inflammation.

Summary.—This is a case in which the first symptoms of cerebral disease appeared at the age of 46. They were lethargy and slowness of action. Progressive dementia followed, associated with severe depression. The patient died two years after the onset of symptoms. Neurologically he showed the Parkinsonian syndrome, ataxia, absence of the deep reflexes and disturbance of vibration sense in the lower extremities. There was muscular wasting in the shoulder girdle and in the large muscles of the lower limbs. Towards the end bulbar motor symptoms developed. The pathological investigation revealed degenerative nerve-cell changes in the cortex, especially in the third layer, in the corpora striata affecting mainly the large cells, in the substantia nigra and among the large motor neurons of the spinal cord and, to a lesser extent, of the medulla. The glia proliferation was moderate in degree and mostly of a secondary character. There were, in addition, small foci of glia proliferation in the midbrain and the medulla, independent of nerve-cell degeneration. Argentophile plaques were found in the cortex. There were small patches of demyelination in all layers of the cortex as well as in the white matter of the cerebellum, and there were large areas of destruction of white matter in the spinal cord. Early myelin changes were found in the sciatic nerves. Inflammatory changes were absent throughout the nervous system.

COMMENT.

The clinical symptoms can be related to the degenerative changes in the nervous tissue which, though widespread, did not affect all parts of the brain

to an equal degree. Certain areas and cell types showed a higher susceptibility to the damaging agent than others. Glial reaction was poor, and there was no tendency to proliferation of fibrous astrocytes as in disseminated sclerosis. The lack of vigorous glial reaction was most clearly seen in the spinal cord. In this and other respects the spinal lesions were very similar to those of the subacute combined degeneration of the cord, though in the latter condition degeneration in the motor cells of the anterior horns is not usually seen.

The pathological findings in our case differed in some respects from those reported hitherto. No previous investigator has found senile plaques. Their presence in our case was possibly incidental. In a few cases, however, Alzheimer's neurofibrillary changes were seen, which were absent in this case. Another new feature was the involvement of the substantia nigra, which was reminiscent of that found in post-encephalitic Parkinsonism. The distribution of the cell degenerations in the cortex was somewhat different from that found by others, as in our case certain layers and areas were not markedly affected. The involvement of the peripheral nerves, as shown by examination of the sciatics, is also an unusual feature.

The pathological changes found in Jakob-Creutzfeldt disease, as compared with those of Alzheimer's and Pick's disease, are characterized by their subacute nature and by involvement of medulla, spinal cord and peripheral nerves. It can easily be understood that variations in distribution and degree of the widespread lesions may result in different clinical pictures, in which certain components of the syndrome which were less pronounced in our case may be very prominent. A good example of such a variation is the following case, which one of us (E. S.) observed together with Dr. R. N. Craig some years ago.

CASE 2.—A. S. C.—, business man, aged 66, was admitted to the Arthington Nursing Home for Nervous Diseases, Torquay, on February 12, 1941. He had been mentally and physically healthy until the early months of 1939. There was no history of alcoholism. Family history negative. The first symptoms of his illness were forgetfulness and increased fatigability. In autumn, 1939, the patient had to give up work. Some months later wasting of the hand muscles was noticed. This was progressive, and from August, 1940, the patient was unable to write. At that time he first showed difficulties of articulation and swallowing. A few weeks prior to admission he became restless and depressed, and complained about being watched. On admission the patient presented the picture of an advanced organic dementia with confabulation. He was apprehensive, but did not express delusional ideas. The mood was one of depression of a moderate degree. On physical examination the cardiovascular, respiratory and urinary systems were found to be healthy. B.P. 158/80. There were no signs of a deficiency disease. The blood picture was normal. W.R. blood negative. C.S.F. completely negative. Nervous system: Pronounced Parkinsonian posture. Tremor in both hands. Marked rigidity in all extremities. Severe dysarthria of the bulbar type. Impairment of swallowing. Pharyngeal reflexes absent. Otherwise cranial nerves intact. Abdominal reflexes absent. Cremaster reflex present on the left, absent on the right side. Moderate muscular wasting with fibrillations in the shoulder

girdle and upper arms; advanced atrophy of all muscles of both forearms and hands. Biceps and triceps reflexes exaggerated both sides. Wasting of moderate degree, and fibrillations in the muscles of the calves. The atrophic muscle groups were paretic. Examination for disturbance of sensation was difficult owing to the mental state of the patient, but there seemed to be no gross disorder, apart from increased tenderness of the nerve stems in the lower extremities. No cloni. P.E.R. both sides, right more than left; Oppenheim positive both sides. Gait was paretic. During the last few weeks before his death on May 5, 1941, the patient had difficulties in breathing, suggestive of paresis of the intercostal muscles. The diagnosis was Jakob-Creutzfeldt disease.

No full post-mortem examination could be carried out. It was possible to examine the brain and spinal cord, but only macroscopically. They showed no signs of vascular disease. The meninges appeared healthy. There was diffuse cortical atrophy of moderate degree, more pronounced in the frontal and temporal lobes. Naked-eye examination of cross-sections of the spinal cord was suggestive of foci of degeneration of white matter in the lateral and to a lesser degree in the posterior columns.

In this case the lower motor neurons as well as the pyramidal tracts were more seriously involved than in Case 1, thus producing the clinical picture of amyotrophic lateral sclerosis. Similar cases have been described by Meyer (1929, 1938).

It is noteworthy that in both cases and in a number of patients described by other authors depression was an outstanding feature among the mental symptoms. The same has been found to be the case in a considerable proportion of patients with Alzheimer's disease (Stengel, 1942), from which otherwise this condition differs considerably. Jakob-Creutzfeldt disease as a rule runs a course not extending over two years.

The two cases reported in this article fail to give any direct clue to the etiology of the peculiar condition. Jakob (1921) has discussed the possibility of its being an atypical encephalitis. It has been argued that it is difficult to conceive of an encephalitic process of relatively acute course without involvement of mesodermic elements. That argument is not quite convincing in view of the fact that the progressive pathological changes seen in post-encephalitic Parkinsonism are also of a degenerative nature. The strongest argument against an encephalitic or myelo-encephalitic character of the disease is the nature of the spinal changes, which are similar to those found in deficiency anaemia. We therefore tend towards the view, first expressed by Josephy (1936), that the condition might be a deficiency disease. In Case 1 there was a history of anaemia, though not of the deficiency type. That finding is difficult to interpret, since by the time the patient was admitted to hospital the blood picture had improved. However, it can be safely assumed that there are types of deficiency disease still undefined biochemically. Certain pathological changes in Case 1, such as the degeneration of the motor nerve-cells and the foci of glia proliferation, are reminiscent of those seen in pellagra. Possibly some cases of obscure origin which have certain features in common with our two patients belong to

that group. Hemphill and Stengel (1941) described a middle-aged woman with a depressive psychosis and various cerebro-spinal symptoms running a subacute course. The pathological changes were not unlike those in Case 1, but there was, in addition, a recent subarachnoid haemorrhage. In view of the nature of the pathological findings, the authors expressed the opinion that the condition may have been due to a deficiency disease.

In recent years considerable attention has been paid to certain features in the symptomatology and pathology of involuntal, presenile and senile psychoses, which suggest a relationship to avitaminoses. The findings reported in this paper are of interest in connection with those hypotheses.

CONCLUSIONS.

Two cases of Jakob-Creutzfeldt disease have been described. In both a depressive state was associated with a variety of neurological symptoms. Both patients died within two years after the onset of the disease. In the first case a full pathological investigation was carried out which added new features to the pathology of the disease. The diagnosis and etiology of the condition has been discussed, and the view has been expressed that it might be a deficiency disease.

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UNAWARENESS OF PHYSICAL DISABILITY (ANOSOGNOSIA).

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PSYCHIATRISTS constantly observe pathological attitudes towards mental and physical illness among their cases. At one end of the scale there are the hypochondriacal patients, with their increased awareness and over-emphasis of discomfort and deficiency; at the other end there are those who make light of, or even ignore, their disabilities. The psychiatrist is often faced with the task of modifying such abnormal attitudes. This aim can, in many cases, be achieved by psychotherapy, while in others physical treatment such as shock therapy or prefrontal leucotomy may prove successful. Both the abnormal attitudes towards illness and the success of treatment are as yet little understood. Possibly observations such as those on which we are going to report in this article may contribute to that problem. We refer to the symptoms of imperception and unawareness of gross physical disabilities in certain cases with lesions of the nervous system.

CASE I.—*Imperception of peripheral blindness in a case of frontal lobe lesion.*

James J—, aged 62, was admitted on August 1, 1944. No outside history was available. The patient said that he had been working as a carter until five years before admission, when he gave this up owing to a bad leg. His wife had died 20 years previously. During the past five years he had been doing odd jobs. He was picked up by the police as homeless and destitute, and was placed in a municipal hospital. There he proved difficult to manage owing to irritability and aggressive outbursts. He was certified after a few days and transferred to this hospital. On admission the patient was, on the whole, co-operative and friendly. Occasionally he would become irritable if he did not get his food when he wanted it, or for some other trivial reason. He remained in bed all the time, often lying for many hours motionless with the blanket over his head. He was completely lacking in initiative, and wet and soiled his bed. He took his food and slept well, and he did not express any physical complaints spontaneously. When spoken to he answered readily and in a natural manner. His mood was one of cheerful contentment, and when asked whether there was anything wrong with him he gave the stereotyped answer that he was "pretty well all right." Questioned as to his whereabouts he said that he was in hospital for a rest because of a sore foot. (He had a varicose ulcer on the left lower limb.) He spoke about his bad leg only in a very casual manner, and obviously regarded it as a trivial affair. He denied any other disability, and when asked expressly about his eyesight he said that he could see quite well though in fact he was almost completely blind. When tested soon after admission all that was left of his vision was a small area in the centre of the left visual fields, within which he was able to see the light of a torch, and sometimes to make out the number of fingers shown to him or even to recognize a familiar object. Owing to the fact that he never mentioned his visual impairment to anybody the nursing staff was quite unaware that he could not see. He was able to state correctly whether it was night or day. When asked to describe what he could see round him he started without hesitation describing his surroundings in a confabulatory manner. He also often confabulated when shown objects, while on

other occasions he would admit that he could not see them, sometimes making trivial excuses. When told that he was practically blind he denied this, even when he had just failed to see objects shown to him. When pressed he would admit that his left eye was bad. If allowed to handle objects he could name them quite easily. He seemed to avail himself little or not at all of his auditory perceptions for the purpose of recognizing an object. His visual imaginary was not impaired. The perception of the position of his eyelids was undisturbed.

The patient showed a memory defect of the organic type whereby recollection was more severely impaired than retention. There was no disorder of speech, no apraxia, no finger agnosia. Right-left orientation and orientation on his own body were unimpaired. There was no agraphia, but his performance suffered as the result of perseveration. The patient was able to draw simple figures as well as could be expected. He could spell extremely well. Calculation was fairly good.

Physical examination on admission.—The patient was a well-built man of good physique. Cardio-vascular and respiratory systems were healthy. X-ray of chest was negative. B.P. 140/100. There was an unhealed varicose ulcer in the lower third of the left leg. No tenderness of the skull.

Central nervous system: No papilloedema or haemorrhage in the fundi. The diagnosis of the Eye Department of the Royal Infirmary, Edinburgh, was optic atrophy due to pressure. Visual fields, see above. Pupils average in size and equal, reacting very sluggishly, but only if the light fell in from the left side, otherwise no reaction. The patient did not converge. The other cranial nerves were intact. No impairment of motor power, tonus, deep and superficial sensation on all extremities. Deep reflexes brisk. No pyramidal signs. No disturbance of co-ordination. Gait: The patient made small steps and the feet tended to stick to the ground. The posture was normal.

X-ray of skull (Royal Infirmary, Edinburgh) showed a considerable amount of new bone growth on the medial part of the left lesser wing of the sphenoid and to a smaller degree on the right lesser wing. The left large wing showed moderate diffuse thickening. Pituitary fossa normal. The lateral wall of the left ethmoid cells was deficient. Optic foramina normal. The appearances were suggestive of a tumour arising from the base of the anterior cranial fossa.

The examination of the nose (Mr. Simson Hall) revealed a broken and displaced septum, which made inspection of the sinuses impossible. Resection of the septum was carried out and the nasal cavities were found to be normal.

Mr. Norman Dott, who kindly discussed the case with us, expressed the opinion that the clinical symptoms and the X-ray findings were typical of a meningioma arising from the base of the left frontal lobe with pressure towards the middle line, thus probably involving secondarily the right frontal lobe and the corpus callosum. In view of the advanced clinical condition surgical intervention was not indicated.

Extracts from some examination records:—I.I.x. 44: The patient was euphoric; He gave his name correctly. He said that he was 53 and was born in 1891. He thought that he was in Crewe Hospital. He gave the date as November 15, 1915, and the name of the Prime Minister as Mr. Baldwin. 'How are you?' 'I am pretty well all right.' 'Anything wrong with you?' 'I have a sore leg.' 'Anything wrong otherwise?' 'I am quite all right, the only thing that is the matter is the left foot.' 'Can you see and hear well?' 'I can see and hear all right.' 'Why are you in hospital?' 'For trench foot.' 'How long have you been here?' 'For a fortnight.' 'Have you seen me before?' 'No' (incorrect). 'Have you seen this gentleman?' (the examiner pointed to a lady doctor). 'Yes, he had a bad ankle. He is lame and a bit grey haired.' 'Are there other patients in the room?' 'Yes' (incorrect). 'What is wrong with them?' 'One is a bad walker and the one next to me could not see. He cannot see if you give him a match.' A few minutes previously the patient had been given a cigarette, but was unable to light it owing to his blindness. 'Can you see everything in this room?' 'I can see pretty well.' 'Are there pictures on the wall?' 'No' (incorrect). When shown objects he recognized them only when allowed to handle them. Otherwise he confabulated, e.g. he called a pair of scissors "a small bottle," a brown purse a "white box," etc. 'I think you are blind?' 'The left eye is not good; the right is all right. I have been idle for a year.' When tested for visual memory he described Princes Street fairly correctly and was able to give the shapes and colours of familiar objects. When asked about his memory he described it as very good, but he could recall a date only partially after two minutes and forgot it completely

after four minutes. When told short stories he was able to give a short summary with the correct meaning, but after five minutes he had forgotten everything.

Calculation : $5 \times 7 = 35$, $35 \times 2 = 70$, $70 - 25 = 25$, $9 \times 7 = 63$, etc.

Writing.—The patient wrote his name correctly, but otherwise he showed severe perseveration, e.g. he wrote "food" as "foooodd," 63 as 6666333, etc. He also was inclined to repeat parts of letters and tended to scribbling playfully. When shown a piece of paper and asked to read, he sometimes, if encouraged, confabulated ; on other occasions he said that there was nothing to be seen.

When asked to enumerate objects belonging to the same category his performance was poor, e.g. when requested to name birds he succeeded in naming only two, while on another occasion he said "swallow, greyhound." He was equally at a loss about other categories except for dogs, in which he appeared to take a particular interest. He was able to enumerate four of them, although with considerable delay.

3.xi.44 : The patient was shown a comb : "This is a chair." The examiner's hand was held in front of his face : "This is a table." Keys : "Can't see anything. My sight comes back to me all at once." "What is wrong with the other patients round you ?" "I cannot see anything the matter with them." When told that he was blind he said, "The left eye is bad." When told that he could not see on the right side he protested, "I can see with the right eye all right." When asked about his eyesight two minutes later he said, "Pretty good, pretty decent now ; no bother with it." To-day he was unable to see the light of the torch, or to state the number of fingers held in front of his face in any part of his visual field.

4.xii.44 : The patient was unable to see anything. Otherwise his condition was unchanged. Asked about his incontinence he admitted it, and said that he sometimes could not walk when waking in the morning.

Throughout the year 1945 the patient's mental condition showed no material change. He developed a severe ataxia, and during the second half of the year he was unable to walk, even if supported. When asked how he was, he would consistently complain about his bad leg, but he remained unaware of his blindness. When asked explicitly about his eyesight his answers varied. Sometimes he would completely deny any impairment. "There is one good thing I have got ; my eyes never bothered me" (April, 1945). At other times he would mention casually that one eye, usually the left, was beginning to get bad. He never gave any indication that he was taking notice of and adapting himself to his blindness.

Comment.—The chief symptoms were lack of spontaneity, euphoria, organic amnesic syndrome and impairment of "categorical thinking" (Goldstein). There was also incontinence for urine and faeces, which is often seen in cases of frontal lobe tumours pressing on the corpus callosum. There was a pressure atrophy of both optic nerves. At first the patient could still see something in a small area of both left visual fields, which may have been a residue of vision simulating a left-sided hemianopia in optic atrophy, but it is also possible that a real hemianopia resulting from destruction of the left optic tract temporarily coincided with progressive pressure atrophy. The X-ray findings suggested that the tumour was growing from the left side, and it may have established an early right-sided hemianopia and only gradually destroyed the fibres supplying the right halves of the retinae, while at the same time causing pressure atrophy. Such a mechanism could account for loss of vision in the left visual field becoming complete much later than in the right.

The patient was quite unaware of the loss of vision, but there was, at first, a difference in the degree of the unawareness concerning both visual fields. While he denied any visual impairment on the right side, where he was completely blind, even when it was demonstrated to him, he was sometimes prepared, though grudgingly, to admit impairment of vision on the left side, where some function was still preserved. That reaction was in keeping with Gold-

stein's (1942) observation that unawareness of blindness, which he regards as the expression of an atypical readjustment of the organism to the defect, is more complete the more severe the disability.

There was no reason for assuming that other but the prefrontal areas were grossly affected in this patient. This is remarkable in view of the fact that in nearly all the cases in which unawareness (imperception) of blindness has been described the loss of vision had been due to lesions of the occipital lobes involving the visual cortex. Monakow (1885) seems to have been the first to describe unawareness of blindness in a case of bilateral occipital lesions. Anton's (1899) cases showed the same type of lesions, and so did two cases described by Redlich and Bonvicini (1911). Those and similar observations led to the opinion that unawareness of blindness was due to the destruction of fibre systems connecting the visual areas with other parts of the brain. This view was first questioned by Redlich and Bonvicini, who found the symptom in two cases with tumours not affecting the occipital lobes; in one of those cases the tumour was situated in the frontal lobe. The authors expressed the opinion that the symptom was not due to localized lesions of the visual areas, but was the result of the coincidence of blindness with a generalized impairment of cerebral activities. There are two more observations of unawareness of blindness not due to occipital lesions. The one was a case of tabo-paralysis with optic atrophy (Stertz, 1920), and the other a case of frontal lobe tumour (D. Campbell, 1920) not unlike the patient presented above. Campbell suggested that the localized frontal lesion was responsible for the symptom. The memory disturbance and the euphoria observed in our case were also noted in the patients reported by other writers. Lack of visual attention has generally been regarded to be responsible for the symptom. The validity of that view will be discussed later on. Our patient and those of the other authors not only ignored their blindness, but they often actively denied it even if they were proved to be unable to see. This feature induced Schilder (1934) to assume that there existed a mechanism which he called "organic repression." He understood by this term psychic attitudes similar to the psychic repression, but caused by organic lesions. Our patient showed, in addition, a mechanism well known in psychopathology, namely, the tendency to project his disabilities on to others. Goldstein's theory that unawareness of blindness is the expression of the struggle of the organism towards adjustment is not incompatible with Schilder's conception. It is noteworthy that our case was unaware of his blindness only, while he was fully aware of another more trivial complaint.

CASE 2.—Imperception of paraplegia in a case of syringomyelia and syringobulbia during the course of a psychotic state.

Allan G—, aged 41, draughtsman, was admitted to this hospital on 11.ii.44. The family history was negative for mental and nervous diseases. The patient had a normal childhood development. He was a sturdy child, comparing favourably with other children of his own age. He went to school at the age of 5 and was described as a bright and studious pupil. He left school at 14 years, and was at that time rather above the average physically and intellectually. At the age of 16 he had diphtheria. Some months later the patient was noticed to stoop and to be round shouldered. He slowly developed a severe kyphoscoliosis. When he was 18 he started to drag his left leg. Later the left arm became weak and later still the other extremities. In 1931 he had a painless fracture of his elbow, and

shortly after he sustained a refracture of this part. Five years later he sustained a fractured femur, again without pain. In the intervals between hospital treatment the patient worked very well. He was a quiet man, very attached to his family, without other interests but his work. Following the fracture of his leg at the age of 28 there was a short period during which the patient was mentally disturbed. He was elated, somewhat grandiose, bought all sorts of things and gave them away. He was in a mental hospital for a month, and on discharge he was quite well mentally. From that date until the end of 1943 there was no evidence of mental disorder. On account of his physical condition he had been unable to work for many years. The last three years he spent in hospitals for incurables, where he was very popular, read a great deal, kept up to date with current events, and was described as a silent sufferer who had adjusted himself well to his invalidism and had never given up hope of getting better. For the last ten years he had been a chair case. At the end of 1943 he suddenly developed symptoms of mental illness. He became pompous and elated, expressed big ideas and regarded himself as an important personality. His memory became impaired for recent events, but seemed well retained for the more remote past. According to his father his condition was much worse than when he was in a mental hospital first, during which time his memory was unaffected.

Physical condition on admission.—There was a gross kyphoscoliosis, with associated displacement and malposition of ribs and sternum. The head was large, and gave the impression of some degree of hydrocephalus. There was marked wasting of the muscles of the shoulder girdle and of the hand muscles. The appreciation of temperature and pain on the left side of the face and bilaterally on neck, arms and legs was grossly impaired. The sensation of touch was also impaired, but to a lesser degree than that of temperature. Deep sensation moderately disturbed on all extremities. Muscular wasting of the hand muscles. Spastic flexion contracture on both legs. Knee and ankle jerks absent on the right, exaggerated on the left. Bilateral plantar extensor response. There was nystagmus to the right. Corneal reflex absent on the left. Otherwise cranial nerves intact. There was a painless ulcer on the left cheek, due to scratching. Blood Wassermann negative, C.S.F. negative except for marked xanthochromia. Cardiovascular, respiratory, urinary systems healthy.

Mental condition on admission.—The patient conducted himself with an air of self-importance, ordered the nurses about, and if his demands were not immediately complied with he abused them. He continually reprimanded his fellow patients. When engaged in conversation he answered promptly and coherently. He tended to be over-talkative. At first he expressed vague ideas of reference, but later his thought content was confined to delusions of grandeur. He stated that his father left him many millions and that he wanted to perfect the world with that money. He was king and his wife queen of Scotland. He had been used sexually by thousands of nurses and doctors. His affect was in harmony with those ideas. His memory was moderately impaired. He was unable to give the date correctly. He thought the war was completely over. His knowledge of more remote events was unimpaired. Retention was only moderately disturbed. He was able to carry out calculations quickly and correctly.

When the patient was asked why he was in hospital he usually said that he needed a rest, but denied that there was anything wrong with him. Although constantly confined to bed and unable to move, he said that his legs were all right and that he could walk as much as he liked. When it was pointed out to him that he was paralysed and when it was demonstrated to him that he was unable to move his legs, he persisted in denying his invalidism and would make trivial excuses, such as that he just wanted to stay in bed for a rest, that he had no desire to walk just at the moment, etc.

Progress notes.—The patient's condition remained unaltered, though at times he behaved quite reasonably, but even when he was calm his mood was one of euphoria. At all times he was unaware of his paralysis, and when told and shown that he was paralysed he resorted to trivial rationalizations. In April he developed large bed-sores and bronchitis. He died on May 19, 1944.

Post-mortem examination (Dr. W. Blackwood, Scottish Mental Hospitals Laboratory).—There was a distortion of the left elbow, due to complete dislocation of the radius. There were healed fractures of the lower ribs and an old fracture of the neck of the left femur. Marked thoracic kyphoscoliosis to the left. The heart

was somewhat atrophic, otherwise healthy. The lungs showed acute purulent bronchiolitis. Liver, spleen, kidney healthy. The brain showed, on section, marked internal hydrocephalus", with atrophy of the white matter and of the corpus callosum. On the left there was a cavity filled with old blood-clot occupying half the white matter of the temporal lobe, infero-laterally to the inferior horn of the lateral ventricle. That cavity had a well-defined yellowish, gelatinous wall. The basal vessels were healthy. The floor of the third ventricle was expanded and thin. The surface of the brain, which weighed $3\frac{1}{2}$ lb., was neither flattened nor atrophic. The microscopic examination of the haemorrhagic cyst suggested that it was several months old. Its origin was not obvious, but it was probably caused by pressure due to an exacerbation of the hydrocephalus. There were signs of leakage of blood from the haemorrhage into the subarachnoid spaces. The secondary subarachnoid haemorrhage accounted for the xanthochromia of the C.S.F.

Spinal cord.—There was an advanced syringomyelia. The cavity was very large in the cervical and dorsal region, and moderately extensive in the lumbar parts. It extended into the medulla, where it caused a cavity on the left side, opening into the ventricle (syringobulbia). This cavity accounted for the disturbance of sensation in the left face.

Comment.—In this case unawareness and denial of paraplegia formed part of a psychotic reaction characterized by elation, expansive ideas and memory impairment. This mental condition had developed in a patient with advanced syringomyelia who had been aware of, and had been fully adjusted to, his disability for many years. From the purely psychopathological point of view the psychotic state can be regarded as a complete denial of the distressing reality, and as an attempt at creating a new world of wish fulfilment. The thought contents were similar to those which are sometimes expressed in fever deliria by patients who instinctively feel the approach of death. In those cases the failing power of the organism results in a breakdown of adjustment to reality and in release of fantasies. In our case the mental reaction set in suddenly five months before death, but was unassociated with marked physical deterioration. As far as could be ascertained the psychotic reaction was not precipitated by a psychic trauma. There was, however, reason to assume that pathological changes took place in the brain of the patient at the time when the symptoms of mental illness set in. The cerebral haemorrhage could well have been five months old, and was responsible for a subarachnoid haemorrhage. It was probably due to an acute or subacute increase of the hydrocephalus, resulting in damage to a blood vessel near the wall of the ventricle. K. Wilson (1938) has pointed out that sudden exacerbations of hydrocephalus occur in some cases of syringomyelia for unknown reasons. The assumption that this happened in our case is supported by the clinical development. The patient had until five months before his death been in possession of normal intellectual capacities of a good level. This is compatible with a moderate hydrocephalus often found in syringomyelia, but not with the degree of hydrocephalus found in this case on post-mortem examination. We feel justified in assuming that the psychotic reaction resulting in unawareness of paraplegia was precipitated by acute or subacute cerebral changes affecting diffusely the whole cerebrum and resulting in a local haemorrhage. The question arises why unawareness of paralysis is not seen more often in cases in which progressive changes take place in the brain, and why paralysed patients with euphoria and expansive delusions are not as a rule unaware of their disabilities.

In fact, the case described here is in our knowledge the first in which unawareness of paraplegia has been observed, while unawareness of hemiplegia, though far from common, has been seen on several occasions. There clearly must be a certain constellation of symptoms, both physical and mental, which give rise to this phenomenon. To arrive at an understanding of our case it is necessary to consider first the symptom of unawareness (imperception) of hemiplegia with disturbance of sensation. Babinski (1914, 1918) described this symptom in a case of hemiplegia with disturbance of sensation on the paralysed side. He called the phenomenon "anosognosia," and drew attention to the fact that it occurred in association with lesions of the right hemisphere only. Babinski's observations were corroborated by other authors. They also noted that a certain degree of euphoria and memory disturbance could be found in most of those patients who otherwise were not necessarily disordered mentally. The most recent case in point is that of Klein and Mallie (1945), in which anosognosia was observed within an even more comprehensive syndrome. In our patient we find in principle the same constellation of symptoms described in cases with unawareness of hemiplegia, i.e. paralysis, disturbance of deep and superficial sensation and euphoria. Our case differed from the classical cases of anosognosia in various respects: The paralysis associated with disturbance of sensation was not of hemiplegic but of paraplegic type; it was not of cerebral, but of spinal origin; lastly, the euphoria was excessive, and amounted to an expansive megalomaniac psychosis reminiscent of a classical general paralysis. In our case it was impossible to relate the symptoms to a localized cerebral lesion. The haemorrhage can hardly be regarded as being of localizing significance, though it may have contributed to aggravating a general lowering of psychic activities, which, as in Case 1, formed one of the conditions for the development of the symptoms.

DISCUSSION.

Unawareness of physical disability has been discussed by Schilder (1934) in psychological terms. It is clear that it cannot be regarded as a purely psychogenic phenomenon in the same sense as neurotic manifestations. Schilder's conception of organic repression is valuable, as it points to the fundamental kinship between psychological mechanisms arising on the physiological and on the psychological level. That conception has been criticized by others who prefer to describe the phenomenon in purely physiological or biological terms. Such objections are based on the still common conception that a mental phenomenon cannot be studied from the psychological, physiological and biological angle with equal benefit if it develops on the basis of organic disease. Unawareness of disability can be understood as the expression of a psychological mechanism on an organic level; of a physiological mechanism that causes a certain group of experiences to be blocked off from general consciousness; and lastly as an attempt of the organism to adjust itself to mutilation. The regular finding of localized lesions in certain parts of the brain in cases of unawareness of blindness and of hemiplegia has stimulated localizatory tendencies in the interpretation of the symptom. It cannot

be denied that the cases with localized lesions are far more numerous than those in which the symptom occurs in association with diffuse brain damage. However, most of the patients in whom the symptom has been observed were either arteriosclerotic or had brain tumours, and in such cases the pathological and mental changes are hardly ever confined to isolated areas and functions. The fact that unawareness of blindness or hemiplegia is as a rule associated with euphoria and memory defect argues against a strictly localizing interpretation. At any rate, our cases demonstrate the occurrence of unawareness of blindness due to optic atrophy and that of unawareness of paraplegia due to spinal lesion. We are inclined to believe that imperception of physical disability can arise in cases with generalized brain lesions under a specific constellation of symptoms outlined above, and that the development of the symptom is favoured by localized lesions in certain areas of the brain such as defined by other authors.

It has been held that lack of attention resulting from the cerebral disease is responsible for unawareness of disability. It seems doubtful, however, whether lack of attention is the correct description of the attitude of those patients towards their perceptions, if we understand by attention the volitional act of concentrating psychic activity in the direction of objects. Those patients are not really inattentive in the exact psychological sense. In fact, they are anxious to satisfy themselves and others about their perceptions, but they are unwilling or unable to consider their disabilities and to fit them into their scheme of things. The symptom of imperception of gross physical disabilities can be regarded as a specific disturbance in the relationship of the self to its own body.

Case 2 is an instance of disturbance of the postural model of the body. Head and Holmes (1912) have shown that by means of perceptions and motor activities the individual builds up a "plastic schema" of his body. Schilder (1934) has elaborated and extended this conception. He understands by the "body image" the picture that everybody has of his own body. The body image proves highly resistant if the actual shape of the body undergoes changes as a result of illness or mutilation. The phenomenon of the phantom limb demonstrates the tendency to maintain the integrity of the body image in the form in which it had been built up in the person's development. Loss of movement, if associated with loss of sensation, may under certain conditions, as in Babinski's cases and in our patient, result in disturbance of the body image. In cases of unawareness of hemiplegia there is usually at first an estrangement of the paralysed half. Such a patient will say that the paralysed half of his body does not belong to him, thus, as it were, amputating it from his body image and establishing a new one. Our patient went even further. He replaced the paralysed limbs by two healthy ones. This mechanism is reminiscent of the phantom phenomenon, and can be described as a phantom illusion, with the help of which the patient in his psychosis recreated his normal body image. It is interesting in this connection that phantom limbs occur not only in cases of amputation, but sometimes also in cases with lesions of the peripheral and central nervous systems, resulting in complete paralysis and loss of sensation without actual loss of the limb (Mayer-

Gross, 1929; Riddoch, 1941). The constellation of the neurological symptoms in which the phantom illusion developed in Case 2 did not differ from that underlying the phantom phenomenon in certain cases without psychosis.

The peculiar features of the psychosis in Case 2 are worthy of interest. The probable precipitating factors have been discussed above. It is difficult to fit the clinical picture into any of the known types of psychotic reactions. There certainly were manic features, but the thought content was not typical of the affective manic reaction. In the megalomaniac general paralysis of which the patient's condition was reminiscent in some respects, the psychosis does not develop suddenly. It is noteworthy that the patient had many years previously had a similar though less severe mental reaction following a painless fracture. Whether he was unaware of his physical deficiency during that period could not be ascertained. We are inclined to regard the recent psychosis as a recurrent mania which might have been precipitated by the patient's life situation. The delusions of grandeur and the phantom illusion can be interpreted as the expression of an endeavour to overcome the physical disability and to rebuild the body image. Possibly the idea of our patient that he was omnipotent and could perfect the world sprang from the desire to perfect his own body. This he achieved in the phantom illusion. Loretta Bender (1934) made a study of abnormal mental reactions to somatic disease that distort the body structure and cause an insult to the physical personality. She examined cases of Paget's disease and dwarfism, and found that in those patients the discrepancy between the actual body structure and the body image constitutionally and sociably acceptable tended to produce abnormal mental reactions. They were characterized by imperception of the body defect, by emotional upsets due to accumulative thwarting of the libido, and by paranoid delusions related to the mysteriousness of the pathological process, which was enhanced by its painlessness and chronicity. These latter features are very typical of syringomyelia, in which even fractures of the bones are painless. Bender's study seems to show that diseases resulting in distortion of the physical body structure prove more pathogenic mentally than other physical illnesses.

In the introduction to this presentation reference has been made to the task of the psychiatrist to modify abnormal attitudes to physical and mental distress. Unawareness of physical deficiency is the extreme of an attitude which, though abnormal, nobody would wish to modify in cases with incurable disease. It is a matter for regret that this symptom is not more common in this type of patient. In recent years brain damage has been procured therapeutically in cases with excessive awareness of mental distress, and in some the results achieved by prefrontal leucotomy have been not unlike, though not as extreme as, the syndrome caused by the brain lesions in our cases. A mood of contentment and euphoria and a reduced consciousness of the self were observed after frontal leucotomy or lobectomy (Freeman and Watts, 1940). Unawareness of physical disability could very well be regarded as the expression of a change in the consciousness of the self. We venture the opinion that the syndrome which has been observed after frontal leucotomy may be basically akin to that of which unawareness of physical deficiency forms a

part. That phenomenon occurs only under certain constellations of disorders which we have endeavoured to define. Perhaps the fact that frontal leucotomy or lobectomy has a more beneficial effect in some cases, with increased awareness of distressing mental experiences than in others, is also due to the presence or absence of certain constellations of symptoms and personality traits. The study of the results of those operations on these lines may yield some information about this problem.

CONCLUSIONS.

Two atypical cases with unawareness of gross physical disability have been described. The first was a patient with involvement of the prefrontal areas due to tumour, who was unaware of his blindness. He showed ataxia, loss of spontaneity, euphoria and memory defect. The question of the localization of cerebral lesions giving rise to unawareness of blindness has been discussed, and the view has been expressed that the phenomenon forms part of a wider syndrome, and cannot be satisfactorily explained on the basis of isolated and strictly localized lesions. The second case was a patient with syringomyelia and hydrocephalus, who was unaware of his paraplegia during a psychotic state, which was probably precipitated by acute cerebral changes. The peculiar nature of the psychotic reaction and its connection with the physical disability has been discussed. The relationship of unawareness of paraplegia to anosognosia (Babinski) and the phantom phenomenon has been examined, and the symptom has been interpreted as a reaction to the distortion of the body image. The constellation of disorders under which unawareness of physical disability arises has been discussed, and the significance of that symptom for a better understanding of abnormal psychic attitudes towards illness in general and distressing mental experiences in particular has been pointed out.

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PERSONALITY DEFECTS AND PSYCHIATRIC SYMPTOMS AFTER
CEREBROSPINAL FEVER IN CHILDHOOD: MENINGOCOCCAL
ENCEPHALOPATHY.

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UNTIL quite recently the mortality from cerebrospinal spinal fever was considerable, and those who survived the illness were considered lucky to be alive at all. As a result of chemotherapy, which has already reduced the case mortality to less than 9 per cent., more and more persons are likely to recover and present new problems. That some of these survivors may continue to complain of symptoms which incapacitate them for work for prolonged periods has been borne out by some recent contributions (Pai, 1944; Degen *et al.*, 1945; MacKieth, 1945; Ballard and Miller, 1945). In a previous paper (Pai, 1945) it was pointed out that some of these symptoms were psychogenic in origin, and others probably physiogenic, due to organic changes in the brain. Among the latter symptoms were changes in personality, intellectual deterioration, mild but persistent depression, occasional disorders of conduct and pronounced tendencies to invalidism. As personality consists to a great extent of several patterns of behaviour acquired in infancy and childhood, it was decided to study a group of patients who had cerebrospinal spinal fever in early life, in order to determine to what extent this illness had contributed to the development or the warping of the personality in each patient.

MATERIAL.

This paper is based on a study of patients of both sexes admitted to this hospital for investigation of neuro-psychiatric symptoms. Prior to coming here all had been under investigation or observation in other hospitals, and had been examined by psychiatrists who had referred them to us. Soon after admission each patient was given an intelligence test, and as part of the hospital routine, the Wassermann test and the blood sedimentation rate were determined. The history of cerebrospinal fever was verified by obtaining information from hospitals where they had been treated and from general practitioners who had kept notes, but owing to the abnormal situation created by the war and other practical difficulties, it was not possible to obtain or to have access to the original case-sheets. Where the above-mentioned sources were not available, and especially in the case of the older patients, documentary evidence, such as certificates of admission to hospital or letters sent by the hospitals to relatives or to school authorities, or correspondence in which the diagnosis was referred to as "cerebrospinal fever" or "cerebrospinal meningitis," was accepted.

Some general practitioners, three school teachers and a clergyman gave useful information. Patients whose history of cerebrospinal fever could not be verified or whose "meningitis" turned out to be due to organisms other than the meningococcus were excluded from this series. In all cases psychiatric social workers visited the relatives and friends of these patients and obtained information about their families, the developmental histories, early neurotic symptoms, school and work records and details concerning illnesses. In the case of service personnel additional information was obtained from officers commanding units, who sent personality reports which took the form of replies to a questionnaire (prepared by the author), and therefore contained information not usually given in Army Form B 183 (Revised). During the patient's stay here psychiatrists, specially trained nurses, officers in charge of occupational therapy and instructors at a technical school reported separately on different aspects of the personality of each patient. All these reports, which could be compared to the pieces of a jigsaw puzzle, were integrated, and the picture which emerged from it formed the basis of assessment of the personality. The information obtained from various sources has been summarized in Table I.

FAMILY HISTORY.

Relevant information about the illnesses in the family was obtained in the case of parents and siblings only. Seven patients gave a history of either neurosis, or psychosis or epilepsy in one or other parent or siblings. Both parents and one sister (NNN) of one patient and both parents (NN) of another patient had suffered from neurosis. The mother of another patient had been admitted to a mental hospital for treatment of senile psychosis, and his brother had been invalided out of the army on account of neurosis (PN). The father of one patient had been discharged from the army during the last war, and had suffered from fits, which were probably epileptic.

NEUROTIC TRAITS.

It is often stated that children with neurotic traits, e.g. enuresis, stutter, undue fear of the dark and persistent nail-biting show a greater liability to neurotic illness throughout life than children without such traits. While nearly all children may have these traits at some time or other, the majority no doubt become free from them before the age of three is reached. Older children who continue to be afraid of the dark can hardly be considered abnormal unless they require someone to lie down with them, or unless they insist on having a light throughout the night. Among the important neurotic traits enuresis was present in 5, undue fear of the dark in 6, stutter in 2 and phobias in 1.

PHYSICAL SEQUELAE.

Of five patients who had visual defects, 2 had strabismus, 2 had unilateral amblyopia and 1 had bilateral optic atrophy. There was marked facial asymmetry in one patient.

NEURO-PSYCHIATRIC RESIDUALS.

Nearly all patients complained of neuro-psychiatric symptoms during and since convalescence. Those who had neurotic traits before the illness complained of fresh symptoms in addition. It is, however, not proposed to describe these symptoms in detail, as Table I summarizes the important features, but a few symptoms deserve some notice.

DEPRESSION.

One of the chief and predominant symptoms was "depression," and this term has been used here for want of a better one, and because the patients used it to describe one of their symptoms. It is not intended to convey the impression of a primary endogenous depressive illness, with its features of self-reproach, retardation, loss of appetite, loss of weight, ideas of reference and suicidal tendencies. This symptomatic depression was characterized by a certain amount of depressive affect, disinclination to indulge in any sustained mental or physical activities, whether gainful or not, and tendencies to avoid other fellow beings. It was mild because there was good insight and some activities of a simple repetitive nature could still be carried on, although the depression was bad enough to interfere with the capacity to earn a living. Each attack lasted anything from four to eight or ten months. Unlike the reactive or so-called "neurotic depression," it did not appear to be precipitated by any discoverable external factors, and the removal of any apparent, real or fancied concomitant stress was not followed by dramatic relief or even speedy improvement. The blood sedimentation rate was within normal limits and did not show any fluctuations. It was, however, not possible to undertake any biochemical investigations.

CASE 29.—Aged 30, single female. Admitted on 19.i.43 for investigation of shortness of breath and depression.

Family history.—Mother, aged 73, described as a cheerful and active person. A brother is an army officer, and two sisters are N.C.Os. in the A.T.S. Good family history and satisfactory upbringing.

Personal history.—Patient had C.S.F. in infancy, which left her with amblyopia in left eye. As a child she was extremely nervous, frightened of "almost everything," always had a night-light, sometimes walked in her sleep, occasionally wet her bed and bit her nails for several years. She hated school, was accused of being lazy, did not mix with the other children and did not play any games. She left school at the age of 15, having reached only standard 5, and stayed at home for two years. Next she started work as a housemaid, but was inclined to worry excessively over trifles and appeared consistently depressed. She had neither friends nor hobbies, and spent all her leisure at home sewing or knitting. When aged 20 she sustained a severe head injury, and suffered from concussion and damage to the right eye. Towards the beginning of 1940 she had a nervous breakdown, which lasted until about May, when she joined the A.T.S. as she hoped the army might do her good. After three weeks' training at Brighton she was posted to Chatham, where, following some air-raids, she became unduly apprehensive, anxious and depressed, and was therefore sent to St. John's Hostel at Denmark Hill. After eight months this hostel was bombed and she was sent to Hounslow, where she was on duty for about four months. She then complained of pain in the chest and was over a month in a hospital, followed by four weeks' sick leave. After another short spell of duty she was transferred to Luton, where she again

Case.	Family history.*	Neurotic symptoms before C.S.F.	Age at C.S.F.	Sequelae.		School record.		
				Physical.	Psychiatric.	Mixer.	Games.	Standard reached.
1	—	—	5	—	Nervousness; headaches; stomach trouble; depression on and off; solitariness; fainting attacks	Poor	No	4
2	—	—	2	—	Timid; lonely; constantly ill	"	"	X7
3	—	—	5	—	Unduly frightened of the dark; dizziness; fainting attacks; depression on and off; delinquency	Fair	Games	6
4	N	—	4	—	Easily tired; solitary; self-conscious; easily depressed; headaches	Poor	No	5
5	—	—	4	—	Nervousness; stutter; enuresis; fainting	Fair	Games	6
6	NNN	—	3	—	Fear of the dark; fear of water; fear of heights; headaches	Poor	No	4
7	—	—	10	—	No details	Fair	Games	X7
8	—	—	2	Facial asymmetry	Nervous, timid; enuresis until 8; fainting attacks	"	No	X7
9	—	—	6	—	Enuresis; stammer; frightened of the dark	Good	Games	5
10	—	—	4	Poor vision	Timidity; phobias; fainting attacks	Poor	No	3
11	N	Nervous	6	—	Ditto	"	"	6
12	—	Enuresis; undue fear of the dark	7	—	Enuresis until 12; stutter; headaches; depression	"	Games	X7
13	—	Enuresis	7	—	Enuresis until 14; headaches on one side	Good	"	6
14	NP	Phobias, nervousness; nail-biting	6	—	Nervousness; dizziness; depression; delinquency	Poor	No	5
15	—	Nervousness; frightened of the dark	4	Bilateral optic atrophy	Nervousness; enuresis until 13; fear of the dark; persistent nail-biting; timidity	"	"	5

* N, neurosis; P, psychosis; E, epilepsy.

I.

Illnesses.			Work history.			Personality.	Marital state. ‡	Age at admission.
Con- vulsion.	Disease of C.N.S.	Neurosis 3 weeks or longer.	Skilled; semi- skilled; unskilled. †	Unem- ployment.	Record.			
—	—	—	US	Much	Poor	Unstable, ill-adjusted, seclusive, dependent and without initiative; somewhat consistently depressed; no hobbies or interests; spends most of his leisure at home.	W	34
At 17	—	—	SS	Fair	Fair	Average go, but dependent; touchy and seclusive	M	33
—	—	—	US	"	Poor	Unstable, ill-adjusted, delinquent, somewhat seclusive, but hysterical and inclined to exaggeration	S	28
—	—	—	US	Much	"	Unstable, timorous, dependent; without initiative, and asocial; consistently depressed; interested in gardening and hiking	S	26
—	—	—	SS	Fair	Fair	Fairly well adjusted; interested in games, pictures and dancing	S	23
—	—	—	US	Much	Poor	Seclusive, ill-adjusted; occasional periods of depression, alternating with periods of listlessness and energy; cinema gives him headaches	S	24
—	—	—	S	Little	Good	Highly strung and quick tempered; though ambitious, only average go; interested in mechanics and radio	S	36
—	—	—	SS	Fair	Fair	Inert, seclusive, dependent, but methodical and conscientious; rather timid; interested in reading fiction	S	25
—	—	—	US	Little	"	Adaptable, but quiet and timid; some hobbies and interests; usually cheerful	S	27
—	—	—	US	Nil	Good	Unstable, poor mixer; over-dependent; inclined to exaggerate and liable to hysterical reactions; no hobbies or interests	M	33
—	—	—	US	Much	Poor	Unstable and dependent; no friends or interests	S	19
—	Chorea at 12	—	US	"	"	Unstable, dependent, timorous, inert; no hobbies, interests or friends; spells of depression	S	19
—	—	—	SS	"	"	Fairly good mixer, but moody and introspective; depressive spells; interested in fishing and repairing wireless sets; very jealous of wife	M	27
At 14	—	—	US	"	"	Unstable, shy, solitary, worrier; consistently depressed; no friends or hobbies	M	37
—	—	—	SS	Nil	Good	Shy, solitary, dependent, over-emotional; suggestible; easily influenced; spells of depression	M	40

† S, skilled; SS, semi-skilled; US, unskilled.

‡ S, single; M, married; W, widower; D, divorced.

TABLE I-

Case.	Family history.*	Neurotic symptoms before C.S.F.	Age at C.S.F.	Sequelae.		School record.		
				Physical.	Psychiatric.	Mixer.	Games.	Standard reached.
16	E	—	7	—	Headaches; undue fear of the dark; delinquency; depression	Good	Games	6
17	—	Nervous; enuresis; frightened of the dark	15	—	Headaches; nervousness; undue fear of the dark; delinquent; asocial	Poor	"	X7
18	—	—	12	—	Nervousness; timidity; depression	Fair	"	5
19	—	Stutter; enuresis until 4	8	—	Stutter; enuresis until 12; fear of the dark	"	"	4
20	—	—	6	—	Headaches; occasional enuresis until 12; fear of the dark until 14	Good	"	7
21	—	Nervous; stutter; enuresis	6	Defective vision	Nervousness; stutter; enuresis until 12; head noises; poor sleep; always ailing	Poor	No	4 illiterate
22	—	—	5	—	Sleepwalking; headaches	Good	Good	7
23	NN	Timidity; unduly frightened of the dark	5	Poor physique; palpitation; precordial pain	Phobias; fainting attacks; timidity; fear of the dark until 13	Poor	No	Form V
24	—	Fear of the dark	6	Lisping	Nervousness; stutter; fear of the dark until 9; timidity	"	"	Form IV
25 ♀	E	—	3	—	Enuresis until 10; nail-biting; fits since 13	Fair	—	St. 5
26 ♀	—	Frightened of water; nail-biting	7	—	Unable to speak for 6 months	Poor	Games	No fixed schooling
27 ♀	—	—	10	—	Enuresis until 16; over-emotional; delinquent; depressive spells	Good	No	Form V
28 ♀	—	—	3	—	Nervous; spends too much time at home	"	"	"
29 ♀	—	—	2	—	Frightened of everything; always a nightlight; occasional enuresis and sleepwalking; nail-biting	Poor	—	St. 5

* N, neurosis; P, psychosis; E, epilepsy.

continued.

Illnesses.			Work history.			Personality.	Marital state.‡	Age at admission.
Concussion.	Disease of C.N.S.	Neurosis 3 weeks or longer.	Skilled ; semi-skilled ; unskilled.†	Unemployment.	Record.			
—	—	—	US	Much	Poor	Good mixer, but unstable ; sentimental, irresponsible and unreliable ; spells of depression ; no interests except pictures and listening to music	S	22
—	—	—	S	Little	Good	Poor mixer ; unstable ; depressive ; no initiative ; delinquent	M	21
25	—	—	SS	"	"	Inert ; seclusive ; dependent ; homebird ; no outside interests	S	40
—	—	—	US	"	Fair	Good mixer, but hysterical ; seeking the limelight ; interested in games and dancing	S	28
—	—	—	SS	"	"	Fairly adaptable, but quiet ; no hobbies except breeding fowls	S	26
—	—	—	US	"	Poor	Schizoid, unreliable, delinquent	S	19
—	—	—	S	"	Good	Good mixer ; plenty of initiative and drive, but emotionally unstable	D	29
—	—	—	Clerical	Nil	"	Unduly dependent on parents ; excessively timid ; no friends or hobbies ; only desire is to sit by fireside at home ; mildly hypochondriacal	S	23
—	—	—	"	Much	Poor	Unstable ; ill-adjusted, timorous, dependent, inert, depressed easily ; typical "ne'er-do-well"	S	23
—	—	—	"	"	"	Prefers company of older people ; unstable, ill-adjusted, depressed easily, restless	D	29
—	Chorea at 13	—	US	"	"	Moody, obstinate, quick tempered ; poor mixer	S	21
—	—	—	US	Little	"	Irresponsible and unreliable ; no real sense of money or honesty ; frequently in debt ; on probation for delinquency twice ; in love with an invalid suffering from an incurable illness	S	20
—	—	—	US	"	Good	Fairly adaptable, but no hobbies or interests outside home ; very devoted to mother.	S	25
Concussion, aged 20	—	—	US	"	Poor	Extremely shy and self-conscious ; worrier ; moody and solitary ; feels unwanted ; easily frightened	S	30

† S, skilled ; SS, semi-skilled ; US, unskilled.

‡ S, single ; M, married ; W, widower ; D, divorced.

complained of chest trouble and spent five weeks in hospital. On discharge from hospital she was employed in the cook-house, but found the work difficult and could not get on with the other girls. She felt depressed again and complained of pain in the chest. Just before Christmas she was again admitted to hospital, where she complained also of headaches and nightmares. As she was again obviously depressed she was transferred to this hospital.

On admission she spoke almost in a whisper with frequent pauses and signs, and appeared retarded and depressed. The physical findings were: Amblyopia left eye; anterior synechia right eye; right pupil smaller than left, but reacting to light and accommodation. Visual acuity Standard IV. X-ray of chest: N.A.D. EEG abnormal. There is a dominant rhythm of 8 p.s. and voltage 40 mv. and abnormal rhythm of 4-6 p.s. Unstable on hyperventilation. Diffuse abnormality, but no specific epileptic features.

During her stay her condition improved, but it was noticed that on "pass days" she did not go out of the hospital. She was invalided out of the army on 9.iii.43 and treated as a civilian patient. A few days later she complained of a severe pain in the region of the left sacro-iliac joint, but the X-ray was negative and the pain subsided rapidly without treatment. She got on fairly well with the other patients and for several days worked satisfactorily in the kitchen, but had another attack of depression for no obvious reasons. There was no history of depressive illness in her family, and her attacks of depression were not precipitated by any discoverable stress.

Those who knew her family appear to have remarked that she was entirely different from the other members, and there is no doubt that the early meningitis had been responsible for her defective personality. Her preoccupation with somatic complaints and tendencies to invalidism are characteristic of this syndrome.

HEADACHE.

The incidence of headache after recovery from C.S.F. has varied from *nil* (Todesco, 1940) to 10 per cent. (Borovsky, 1933; Hague, 1940). Slesinger found only a few complaining of headache, which was not severe. Though it has been shown (Northfield, 1938) that raised intracranial pressure may not cause headache, it is not unusual to subject these patients to needless and repeated lumbar punctures. The mechanism of this headache is obscure. It may be due to temporary dilatation and abnormal state of tension in the walls of cerebral vessels similar to histamine headache (Pickering, 1933), or the result of increased amplitude of pulsation of cerebral arteries similar to the mechanism in migraine (Graham and Wolff, 1938). Dilated blood vessels, by stimulating sensitive structures in their neighbourhood, may also cause headache (Pickering, 1939), or it may be due to traction on the dural sinuses and the arteries at the base of the brain (Ray and Wolff, 1940). In two cases reported by Baker (1934) the headache appears to have been due to internal hydrocephalus, which lends support to the view that post-meningitic headache may be due to traction on the dural sinuses by the cerebral veins as a result of temporary dilatation of lateral ventricles. The symptoms of the acute phase are regarded as due to the presence of endotoxic substances contained in the meningococci, and which are liberated when the cocci undergo autolysis (W. W. C. Topley and G. S. Wilson, 1936). It is possible that some toxin, by periodically reaching a certain concentration, may stimulate the walls of cerebral vessels, giving rise to headache. That the endotoxin may have a selective action on the blood vessels is suggested by the case-history of a London bus conductor, aged 50, in whom a severe attack of C.S.F. in 1942 was followed

by rapid arteriosclerosis, progressive increase in blood-pressure, confusional attacks and dementia, which preceded his death in August, 1945.

A psychogenic explanation of post-meningitic headache is less satisfactory. In the process of disintegration of personality patterns the threshold for pain may be lowered, whereby harmless stimuli which ordinarily do not cause headache are misinterpreted by a crumbling personality as potential threats to itself.

Many of our patients complained of frontal headache, but the majority described it as a dull pressure or constant heaviness extending from above the eyebrows as far as the top of the forehead. In addition to this heaviness, five patients also complained of attacks of brief but severe unilateral headaches which seem to have responded to sedatives like aspirin.

CASE 12.—This patient, who had an attack of C.S.F. at the age of 7, complained of neurotic symptoms during convalescence and had considerable difficulty in controlling his bladder. He was unduly frightened of the dark, and for the next four years his mother had to lie down with him until he fell asleep. He frequently complained of headaches, blackouts, forgetfulness, fainting attacks and depression. His lack of bladder control and personal hygiene was a source of annoyance to his teachers who used to blame his mother for his condition. He did not make friends or play games, was often away on account of headaches, and at the age of 12 was off school for over two years on account of an attack of chorea. After leaving school he had several unskilled jobs, but "could never complete a full week's work." At the age of 16, while sitting on the branch of a tree, he had a blackout and apparently fell down, as he was picked up unconscious, with fractures of the right wrist and right ankle. After a year at home he started work as a waiter, but was sacked after three months. The manager told his mother that he could not be trusted to carry anything, and that he had blackouts, when he would let go of whatever was in his hands. Next he was apprenticed to cabinet-making, but was continually leaving his work to go to a chemist to buy tablets to relieve his headache. On account of the large number of "aspro" tablets bought by him over a number of years the chemist appears to have questioned him and also warned his mother. He had neither friends nor interests, and would not take the trouble to dress and go out after his work was over in the evenings. Any sustained activity was beyond him; he could not concentrate on reading, and watching films gave him headache. He would sometimes light a cigarette and throw it away before he had finished smoking it.

He was called up on 10.viii.42 and was very keen on soldiering. Six weeks after joining up, while being trained as a driver, he wrote to his mother that he was afraid of driving or even having to sit in a motor lorry. He reported sick several times, and early in 1943, while home on leave, he appeared depressed and would shut himself up in a room. Towards the end of May he went to see some soldiers off at a railway station, felt as if the stairs came up and hit him in the face, had a blackout and fell down. He was taken to the Prince of Wales's Hospital, Tottenham, where he was detained for the night and allowed to go home next day, but a few hours later he had an attack of vomiting and yelled with pain in his stomach. He was therefore readmitted to hospital, and remained there until seen by a psychiatrist and transferred here.

BLACKOUTS, FAINTING ATTACKS AND FITS.

Seizures at onset of illness and before the meningeal involvement are regarded as toxic in origin (H. Rolleston, 1919) and those occurring during convalescence or subsequently may be the result of involvement of the cerebral cortex (Grinker, 1937), but Dopter (1921) thinks epilepsy may be caused by small areas of thickened meninges, which act as irritants to the cortex. Baker

(1934) reports the case of a girl who, after an attack of C.S.F. at the age of 18 months, was free from symptoms until the age of 17, when suddenly she had several attacks of screaming with convulsions, during which she was unconscious for nearly 30 minutes. Her panel doctor diagnosed her condition as hysteria and sent her to Guy's Hospital, where Dr. Conybeare confirmed this diagnosis and sent her home. Three days later she was taken to St. Thomas's Hospital, where the same diagnosis was made. Next she was sent to Lambeth Hospital, where a diagnosis of hysteria was made for the fourth time and she was sent home. Three days later she died in a fit. On doing an autopsy the brain was found distended and the convolutions flattened from internal hydrocephalus. Baker quotes the case of another girl, aged 18, who complained of headache, pain in the back and fits. One day she suddenly became unconscious, but on account of several features, her condition was considered hysterical until her death, when a post-mortem revealed internal hydrocephalus. In these two patients the convulsions appear to have been due to internal hydrocephalus. Blackouts, fainting attacks or even sudden dizziness in persons who have recovered from C.S.F. may be part of an epileptic phenomenon and should be viewed with suspicion. While a positive EEG may help to clinch the diagnosis, a single negative finding does not necessarily exclude the epileptic nature of these symptoms.

CASE 25.—Admitted on 21.1.43 complaining of fainting attacks, ? hysteria.

Family history.—Parents healthy (father an ex-P.T. instructor) and three brothers in the Army.

Personal history.—After recovering from a severe attack of C.S.F. in infancy, for which she was 13 months in hospital, she was abnormally frightened of the dark, suffered from enuresis until the age of 10 and bit her nails until 16. At the age of 13 she started having fits, and two years later left school on account of a nervous breakdown, and stayed at home for over a year. She then started work, but gave it up after ten months and again stayed at home for about 14 months until she got married. Three years later she had another nervous breakdown. At the age of 24 she became divorced from her husband.

In February, 1944, she joined the Service, having been free from fits for over four months. While in the army she was obtaining luminal from her civilian doctor, and during June and July was also attending him for insomnia, loss of weight and fainting attacks. On October 20, when on duty, she received a severe electric shock down the left side, and though not unconscious, was taken to hospital, and after four weeks was sent home on sick leave. There she had more frequent fits, and though these were in no way different from previous ones, the aura was shorter. Occasionally she was incontinent, and once or twice injured herself while falling. As her condition was considered apparently functional in origin she was referred to this hospital.

On admission there was some weakness in left arm, and slight impairment of sensation to pinprick over left arm and left leg. Lumbar puncture, cells 2 per c.mm. Protein, 30 mgm. per 100 c.c. W.R. negative. The EEG: "Diffuse fast frequencies with sudden changes of frequency in D.R. in paroxysmal manner. Occasional spike and wave complex seen. Very strong evidence that this patient is suffering from epilepsy."

SCHOOL CAREER.

Information under this heading gives some idea of the child's social adaptability and his scholastic achievement. Seven were described as good mixers, 8 had difficulty in making friends, but nevertheless managed to have one or

two, and the remaining 14 had practically no friends because either they were too timid or too unstable to mix freely with their mates. It is also quite possible that on account of their intellectual backwardness they were ignored by the more intelligent children. Several of the male patients admitted that they were nicknamed "Cissy," which sums up briefly their personality as assessed by their mates.

Another facet of the personality is revealed by the nature and type of games played. Football, for instance, may appeal to the aggressive and hyperkinetic as well as to the lonely type of individual, who has no patience for the slow tempo of cricket. A boy who has many friends may prefer cricket more for the sake of the company of his friends than for the sake of exercise. Fourteen of our patients were stated to have taken part in some games, but the rest did not.

The scholastic achievement, i.e. the standard reached by a child, gives some indication of its intelligence and its grasp of information. Low or defective intelligence may reveal itself in lack of progress. Some writers, among whom are Netter (1911), Foster and Gaskell (1916), maintain that after recovery from C.S.F. no mental enfeeblement occurs. Of 36 patients sent to Hitchen Convalescent Home only one had mental changes and palsy of right arm, suggesting a cortical lesion (Foster and Gaskell). Rundle (1929), however, says a patient is often mentally weak and childish until he has regained his full strength. Fagge found many imbeciles among the survivors of an epidemic in Rhineland. Previously intelligent children may become incapable of benefiting from schooling on account of disturbed attention and forgetfulness (Pette, Pfeiffer). Advanced mental defect or permanent mental sequelae may result from involvement of the cortex (Grinker, 1937). Goepfert mentions that 20 (3.7 per cent.) of 539 survivors of an epidemic in Norway showed severe mental enfeeblement, but Borovsky (1933), who followed up 60 patients, found mental dullness in only one child. In his follow-up of 42 patients, besides other sequelae Slesinger (1933) found idiocy in 2, mental retardation in 2, hydrocephalus in 1 and chronic meningitis in 2. Mental sequelae have also been reported by Abril (1938). It is, however, not clear precisely how the above-mentioned workers arrived at their conclusions, and whether they depended solely on their clinical judgment or on a group of well-recognized tests for assessing intelligence. The degree of mental deterioration may vary in different patients. Rosanoff (1938) estimated that 2 or 3 per cent. of the institutional cases of mental deficiency have resulted from meningitis. Dementia following C.S.F. has been reported by Sainton and Voisin (1906), Marchand and Petit (1910), Pette and Pfeiffer.

In this series 17 (58 per cent.) were considered backward and included those who had not reached a higher standard than 5 and also those who had been placed in standard 6 despite lack of progress and solely for reasons of age. The alleged reason for the backwardness of these children was often given as "frequent absence on account of illness" or "constantly ailing." It has already been pointed out (Pai, 1945) that in adults intellectual deterioration may show itself in forgetfulness, poverty of association of ideas, difficulty in learning new material or in planning ahead quickly. It is therefore not

difficult to understand how a child who is suffering from intellectual deterioration may not make any progress at all, even without being frequently "absent on account of illness." Weygandt (1905) has pointed out how different types of mental activity cause different degrees of mental fatigue. He found the fatigue caused by a task involving simple addition could be relieved by about half an hour's sleep, while the fatigue induced by work requiring memorization needed five or more hours of sleep. When a child cannot cope with a task owing to difficulty in memorizing he may complain of headaches or of not feeling well, in which case he is likely to be sent home. Should a doctor be called in he may, in view of the history of meningitis, order a few days' rest in bed. When the patient returns to school he may be already behind the class, and may not be able to keep pace with his mates.

Some children who recover from C.S.F. may suffer from lack of adequate sleep at night and may feel drowsy during the day. Unless special provision is made for such children they may have considerable difficulty in benefiting from instruction given in ordinary schools. It is significant that the maximum incidence of absence on account of alleged ill-health occurred between the ages of 9 and 12. Perhaps a possible explanation lies in the fact that after the age of 9 children are expected to spend more time in memorizing than in simple addition and multiplication and, as mentioned already, memorization is a greater strain than other forms of mental activity.

In this series 12 patients had made satisfactory progress, 4 having attended high schools, where 3 reached the Fifth Form and one the Fourth Form. But a higher standard of scholastic achievement does not imply greater stability.

CASE 23.—Had C.S.F. about the age of 5, and was three months in bed. During convalescence he was excessively nervous, unduly frightened of the dark, and until the age of 13 would not go to bed without his mother. He had no friends at school, where he was so teased and bullied by his mates that his mother was compelled to complain to his teachers. On account of his fainting attacks his teacher told him to sit near the door so that he could be removed quietly. He did not make a proper social adjustment, played truant several times, and his only wish appeared to be to sit by the fireside at his home. After leaving school, where he reached the Fifth Form, he was employed as a clerk, but began to complain of precordial pain and attacks of palpitation. He had no hobbies, but occasionally went to the cinema with his parents, on whom he continued to be excessively dependent. Just before being called up he had a fainting attack while cycling home and, in falling down, injured his thighs, necessitating some stitches. Although he did not expect to be passed fit for the Army he was accepted, but on the very first day collapsed on the drill square. He was therefore mustered as a clerk and transferred to a station near his home, where he appeared to have done satisfactory work for some months until transferred to a new station, where on arrival he broke down, complaining of depression.

On admission he appeared to be an immature, timid and depressed person, who had always regarded himself as an invalid and who was over-dependent on his parents, especially his mother. No "organic" cause was discovered for his symptoms, and according to the psychological tests, he was above the average in intelligence and in his grasp of information.

OTHER ILLNESSES.

In any assessment of symptoms alleged to be due to meningitis one should be careful to exclude the effects of damage to the brain by other infections,

injury or concussion. Five of our patients had severe concussion, but in three this does not seem to have contributed appreciably to their symptoms. The condition of two patients seems to have got worse after their head injuries, but they did not complain of any fresh symptoms except irritability.

The personality defects may be conspicuous, and the psychiatric symptoms severe in patients with a family history of mental instability.

CASE 14.—Referred on account of nervousness, feeling tired, lack of interest in his work, loss of energy, impairment of memory, dizziness and depression.

Family history.—Father died at the age of 70; mother, aged 78, suffering from senile dementia. One brother was discharged from the army during the last war, another was invalidated out during this war, and a third one was described as nervous.

Personal history.—As a child he was nervous, and after an attack of C.S.F. at the age of 7 his condition appears to have become worse. At school he kept to himself, did not play any games, was away a good deal, apparently on account of illness, and at the age of 14 reached only standard 4. After two years at home he started unskilled work, doing mostly odd jobs for short periods, and was reported to have worked probably less than six months in a year. He had no friends, hobbies or interests, did not play or even witness games, and was constantly going to the doctor complaining of "nerves" and "depression." A few years ago he joined the T.A. as a bandsman, was mobilized in August, 1939, and went to France with the B.E.F. After working as a stretcher-bearer he returned *via* Dunkirk without complaining of any fresh symptoms or showing new signs as a result of exposure to intense enemy action during the retreat. A few months later, while home on leave, finding that his mother had been admitted to hospital, he married a girl three years his senior, hoping (as he said) to overcome his depression. In his unit he attended sick parades frequently, and the N.C.Os. reported that he was forgetful, limped after heavy work, and that he was frequently wandering away from his job. A transfer to the Pioneer Corps did not improve his condition, and his mates remarked that he was consistently depressed without being able to explain why. His O.C. stated, "Although he is well behaved, very clean and of smart appearance, he is very neurotic, and I suggest his discharge as *mentally unfit*." (The italics are mine.)

On admission the psychological tests revealed that he was a borderline mental defective. He was hesitant in speech, slow in movements, apathetic and depressed. His EEG was abnormal. After some improvement he was invalidated out of the Service on 10. xii. 43, but continued to complain of symptoms. About a year later a letter was received from his wife in which she complained that he was frequently out of work and that she regretted having married him.

Sixteen patients had suffered from neurosis requiring in-patient treatment for three weeks or longer. This limit was arbitrarily chosen because in general hospitals a diagnosis of functional illness is ordinarily made by a process of exclusion of organic conditions, and only when all the investigations, which take about three weeks for completion, have been found negative. No notice was taken of instances where a patient had stayed less than three weeks. Each of three patients had been admitted thrice and four patients twice. Unfortunately the information obtained under this heading was not as complete as one could have wished, nor was it possible to have access to the original case-sheets in order to find out the details of each illness, but from the statements made by the patients the predominant symptoms appear to have been depression and headache.

WORK HISTORY.

The type of work done and the ability to hold down a job reflect some aspects of the personality, especially intelligence and social adaptability.

TABLE II.

Type of work.			Unemployment.			Record.		
Skilled.	Semi-skilled.	Unskilled.	Much.	Fair.	Little or none.	Good.	Fair.	Poor.
6	7	16	4	4	13	8	6	15

Some explanation of this table is necessary. For the purpose of this study four clerks and one regular soldier with over five years' service have been included among the skilled workers, while regular labourers have been shown as semi-skilled workers. Others, such as errand boys and casual labourers, have been included among the unskilled. It may be remarked that although 13 had little or no unemployment, only 8 have been shown as having good work record. Where a person had frequent changes and numerous different jobs for short periods, his work history has been considered poor, although he may not have had any unemployment at all. By these criteria the work record of 15 (55.5 per cent.) persons was considered unsatisfactory.

CASE 16.—Admitted 22.xi.43 complaining of "inward nervousness," constant heaviness in the head, frequent frontal headaches, forgetfulness, inability to concentrate, a feeling as if someone is forcing his brain to work and spells of depression.

Family history.—His father was invalided out of the Army during the last war, and was in receipt of a disability pension until his death from "fits." Mother and only sister healthy and stable.

Personal history.—Since the age of 7, when patient had an attack of C.S.F., he appears to have complained of frequent headaches and depression. After leaving school, where he was placed in the top class on account of his age, he did odd jobs for short periods in different firms, but was sacked each time for inefficiency. Following a long spell of unemployment he joined the Regular Army in August, 1939, but was frequently on the sick parade and was discharged as unlikely to become an efficient soldier. After trying unsuccessfully to obtain civil employment he re-enlisted, giving a false name, and without mentioning his previous Army service, but found it difficult to stay away from the medical inspection room. As he was in trouble several times for minor offences and was also found unreliable in his statements and untrainable, he was transferred to the Pioneer Corps, where he began to complain of stomach trouble. He was admitted to three hospitals on different occasions, but investigations for gastro-duodenal functions did not reveal any abnormality. He was then seen by an Army psychiatrist and sent here.

On admission he was a well-built youth, of Hackney, who seemed to have neither ambition nor any sense of civic responsibilities. Intelligence tests placed him in Grade IV, and psychological tests revealed impairment of attention, retention and recall. The EEG was abnormal. He stated that he did not wish to be discharged from the Army and that he was not frightened of air-raids—a statement confirmed by social investigations, which revealed that though he was exposed to intense enemy action during the period of the London "blitz" he did not manifest any of the usual signs of neurosis, such as tremor, stutter or frequency of micturition. His mother and sister were stated to be intelligent and well organized, while the patient was described by the neighbours as a "typical ne'er-do-well."

A person with a "good" work history, i.e. a steady job for a number of years, may not have done anything except simple routine and repetitive work requiring neither much intelligence nor initiative and skill.

CASE 10.—Aged 33. Following an attack of C.S.F. at the age of 3, he complained of blurred vision and seemed to have lost all desire to play with other children. On account of his timidity he did not make any friends or play games at school, where he was a continual butt for his mates and was backward in his studies. It was

stated that he had worked steadily for 18 years as a "tailor's assistant," but independent inquiries revealed that his work consisted in merely laying out patterns on material ready for cutting by machine. (Elderly pensioners with failing eyesight and impaired memory are often employed for doing similar work.) He never went out alone and was taken to and from work each day by a neighbour. He was stated to be very nervous, jumpy at the slightest noise or if anyone came up behind him. He was a poor mixer, who was very dependent at first on his parents and then on his wife, whom he met in the factory where he was employed. He spent all his leisure at home doing practically nothing useful.

He was conscripted on 7. i. 43, but was observed to stumble about the barracks, falling and tripping over chairs, forms, tables, etc., and his platoon sergeant noticed that he was behaving in this manner even when he had no reason to suppose that he was being observed. As it was found quite impossible to train him he was sent to the M.O., who referred him to an ophthalmic specialist, but the latter could not find anything wrong with his eyes. He very rarely left his quarters of his own accord, and in order that he might get some exercise he was often sent out with other men proceeding out of barracks on such things as medical appointments. On one such occasion the man he was with went into a public convenience in the town, leaving J—standing at the top of the steps. A few moments later J—fell down the steps into the urinal, having apparently moved from where he was left. His O.C., after pointing out that he was quite useless, concluded, "He was used as a room orderly during his stay, some 34 days. He sat in the room, and if anyone entered he would call out, 'Who is there?' Beyond that he could do nothing at all. He had to be taken to meals, and in fact anywhere away from his room." On admission here on 12. ii. 43 he was found to be almost illiterate, and according to the psychological tests he was a borderline mental defective. He seemed incapable of distinguishing a private from an officer, and whenever a soldier in uniform went to speak to him he would try to salute him and address him as "Sir." His eccentricities and oddities of behaviour were sources of amusement to the other patients. He had lived in the East End of London all his life, and despite prolonged exposure to air-raids, did not develop any of the usual signs, such as stutter or tremor of limbs. Incidentally his intelligent parents seem to have selected the right type of job for him.

MARITAL STATE.

Twenty were single, two had been divorced and one was a widower. Many of these stated that they were not interested in the opposite sex, and the data did not allow of any conclusions. Those who were married did not appear more stable than the rest, and the circumstances which led to the marriage of some of them are interesting. One patient remarked that when he went home on leave there was no one in the house to cook his meals, as his elderly mother had been admitted to a mental hospital. He therefore proposed to a spinster whom he had known for a few hours only and subsequently married her. Two men gave as their reason for entering matrimony (on the deaths of their respective mothers) the fact that they wanted someone to look after them as their mothers had done.

CASE 15.—Following C.S.F. in early childhood he appears to have become very timid and also complained of defective vision, which handicapped him at school. He was a poor mixer, who did not play games because he was afraid of hurting himself. On leaving school he lived with his parents and worked with his father as a linotyper for nearly 26 years. He was described as shy, solitary, dependent, easily influenced by others and liable to spells of depression. After the death of his mother when he was aged 34 he married a 48-year-old widow, and appeared to be excessively dependent on and to some extent frightened of her.

He had gross refractive defects at enlistment, less than $\frac{1}{8}$ in each eye, improving to $\frac{1}{4}$ each side on correction. On account of his limited range of usefulness he was sent to a personnel selection officer, who reported "little mechanical aptitude,

trainability limited, becomes very nervous at work; no imagination." A few months later he complained of sudden loss of vision in right eye and inability to carry out his duties. An ophthalmic specialist who examined him found bilateral optic atrophy possibly due to old meningitis, and elliptical scotoma on right side with inferior peripheral field defect, but he could not account for the recent alteration.

On admission there was bilateral secondary optic atrophy, and on analysing his visual fields by means of Bjerrum Charts there was central scotoma and lower quadrant defect on the right side. X-ray of skull: N.A.D. Lumbar puncture fluid: Cells 1 per c.mm. Lange, 00000000. Total protein 20 mgm. per cent.

During his stay his vision improved sufficiently to carry out the hospital routine, but in the workshops it was found that he was capable of doing only simple repetitive work of an unskilled nature.

PERSONALITY.

To a great extent personality consists of numerous patterns of behaviour, each pattern being a response to the demands of society. For a rational response there should be a correct synthesis of past experience, present requirements and future goal, and such an integration is possible only when the cognitive, emotional and volitional functions are unimpaired. In the development of a child at first by a process of trial and error, and then by the integration of its intelligence, its past experiences and acquired knowledge, the early patterns undergo constant modification to suit the changes in the environment. If, as a result of disease or injury to the brain, intelligence is impaired, or if there is inability to utilize past experience or difficulty in acquiring new knowledge, there may be a failure of proper synthesis, causing the personality to be defective.

Several writers have mentioned briefly that some children who recover from C.S.F. may show changes in personality, but no detailed case-histories have been published.

Rolleston and Ronaldson (1940) say that children of a placid and cheerful disposition may become morose after the illness, while Pfeiffer thinks they may become emotionally more labile. Increased irritability, emotional disturbances and change of character have been mentioned by Redlich. A profound change of the total personality may result from hydrocephalus (Pette, 1936). Some of the survivors of the Paris epidemic of 1910 showed disorders of conduct similar to those seen in children after recovery from acute encephalitis lethargica. A change in character and temper characterized by faulty habits, mendaciousness and cruelty was found by Kinnier Wilson (1940) in a little boy convalescent from C.S.F., and although his condition improved after several months the recovery was not "quite complete."

In the case of our patients the assessment of personality was based on information collected from various sources, namely, relatives, school-teachers, employers, officers commanding units, psychiatric social workers and medical officers who had known the patients for some time, though all these sources of information were not available in the case of every patient. The majority appeared unstable, ill-adjusted, lacking in initiative and drive, over-dependent on relatives and very restricted in their interests—a finding similar to that found in some persons who had C.S.F. in adult life. It has been said (Rolleston and Ronaldson, 1940) that some of those with a hereditary or personal history

of nervous instability may become more irritable and quick-tempered. Loss of temper merely indicates a person's inability to cope with an immediate situation, and may be expected from any person suffering from frustration and anxiety. With a solitary exception irritability, outbursts of passion, aggressive and paranoid tendencies were not present in any of these patients, who appeared to be generally passive and content to jog along.

CRITERIA.

Are the defects of personality and other symptoms seen in these patients the result of damage by the *meningococcus* or are they due to other causes? This question can be answered only if the criteria which one proposes are clear and definite. If there is definite evidence of involvement of the brain during the acute phase and if symptoms persist without any interval of complete freedom, and if no psychological factors can be discovered to account for such symptoms, then they are probably the result of the initial illness (C.S.F.). This probability becomes almost a certainty if there is no history of neuropathy or psychopathy in the family or personal history of mental instability and if the brain has not been damaged by any other infection or injury.

Application of these criteria.—In all except one patient the symptoms dated since the meningitis, but seven gave a family history of mental instability and eight more had some neurotic traits in childhood. These 15 may be considered by some psychiatrists as potential neurotics, specially liable to break down under conditions of stress. Five had suffered from head injuries, but from a study of individual patients the effects of concussion in these patients could be safely ignored. If, however, on account of the difficulties of disentangling the effects of concussion one excludes the head injury patients, there still remain 11 patients whose symptoms have been more or less continuous since the C.S.F. and who satisfy all the criteria. It would be interesting to compare the 15 potential neurotics with the rest who, on account of their stable family and personal histories, were not predisposed to neurosis.

TABLE III.

Disposition to neurosis (family history plus neurotic traits).	Number.	Backward at school.	Poor work history.	Neurotic illnesses since C.S.F.
With	15	10 (66.6%)	12 (80%)	9 (60%)
Without	14	7 (50%)	9 (64%)	7 (50%)

In the following table these 29 patients have been compared with a group of another 29 patients of the same average age, who had been admitted for neurotic illness, but who did not suffer from C.S.F. in childhood.

TABLE IV.

Number.	History of C.S.F.	Backward at school.	Poor work history.	Neurotic illness.
29	With	17 (60%)	21 (72%)	16 (55%)
29	Without	6 (20%)	15 (51%)	11 (37%)

It is therefore obvious that the C.S.F. has played a significant role in the subsequent life-histories of these patients. Even so, one has to be extremely

cautious before attributing the personality changes to the early C.S.F., as it is notoriously difficult to foretell which child is going to develop into a stable personality and which not. However, where there is a good family history and all the children except one are stable and well above the average in intelligence, one may justifiably suspect the meningitis to be responsible for the instability of the backward child. In view of the disconcerting changes in personality observed in previously well-organized persons who had C.S.F. in adult life, the evidence for regarding that C.S.F. in early life may warp permanently or hinder the proper development of personality appears convincing.

MENINGOCOCCAL ENCEPHALOPATHY.

It is becoming increasingly clear that between complete recovery and advanced dementia there may be various grades of residual disability, and though individual symptoms may vary in severity in different patients, a group of symptoms occurs with sufficient frequency to warrant the name of meningococcal encephalopathy. This syndrome consists mainly of changes in personality, intellectual deterioration, mild but prolonged depression, headaches, and a pronounced tendency to invalidism. Persons suffering from this condition are more susceptible to neurotic breakdown and less amenable to psychotherapy than those persons who, on account of a family or personal history of mental instability, are specially predisposed to neurosis. In these case-histories there is also sufficient evidence for postulating an infective cause for the origin of neurosis.

It is pertinent to ask what features in the initial illness (C.S.F) might have contributed to the development of encephalopathy. The virulence of the meningococcus varies from type to type (M. H. Gordon and E. G. Murray, 1915), and strains belonging to the same type may show fluctuations in their invasiveness and virulence. It is not known whether there is a strain of meningococcus which has a mild but prolonged action on the C.N.S. In patients who die during the acute phase of meningitis the cerebrum sometimes appears undamaged, even when there is evidence of inflammation under the ependyma, and occasionally there may be evidence of acute encephalitis (Boyd, 1940), with suppurative foci scattered through the brain. Had such patients survived it is easy to speculate that the healed abscesses would have left permanent cavities, and depending on their size and position might have given rise to signs and symptoms. Damaged areas too minute to produce neurological signs may, nevertheless, cause disturbances of function, and widespread damage may result in dementia.

The possible role of vitamin deficiency during the fever period has also to be borne in mind.

TREATMENT.

One of the surgical lessons of the two wars has been the contribution to the knowledge of gunshot wounds of the head. When a part of the brain has been permanently damaged, the remaining healthy portion may be trained by suitable re-education to carry out the functions previously performed by the

damaged part. This principle may be utilized in the case of persons whose brains have been injured by infection. Every child who survives an attack of meningitis should be examined by a psychiatrist and the residual damage assessed. To judge intellectual deterioration reliable psychological tests are necessary. The battery of tests devised by Halstead (1943) with minor modifications appears suitable, but any other similar group of tests may be equally serviceable. If there is impairment of visual memory, emphasis should be laid on instruction by verbal (auditory) methods, and if auditory memory is at fault visual instruction should be given. By special methods of teaching, a good deal of useful education may be imparted to a child who otherwise might not make any progress in an ordinary school. The child's progress should be watched by repeating the psychological tests at frequent intervals. But repeated investigations, such as X-ray of the head and lumbar puncture, should be avoided, as such tests, without giving any additional information, may actually foster an invalid attitude by impressing on the young patient's mind that his meningitis has left some serious disability.

Soon after leaving school such children should receive vocational guidance to prevent misfits and neurotic reactions in industry. While slight degrees of intellectual deterioration may not make any difference to a labourer, it may handicap a more ambitious person who is keen to become a skilled worker.

Treatment of symptoms should be modified according to the age and intelligence of individual patients.

Although depression may not respond to any of the usual methods of treatment, these patients may benefit by small doses of insulin, about 10 units daily, given half an hour before breakfast, combined with occupation not requiring much intellectual effort and of a simple or of a repetitive nature. In the early stages digging, sawing wood and making simple toys, and when there is some improvement, gardening, woodwork, breeding poultry or rabbits, are suitable therapeutic occupations which, by giving a sense of achievement towards the end of each day, may prevent frustration and secondary anxiety. There are no advantages in giving larger doses of insulin, nor in the administration of benzedrine.

Post-meningitic headache requires further study, as there are reasons for believing that it may be physiogenic in origin, and certainly responds better to sedatives than to psychotherapy.

Tendencies to become over-dependent on parents or relatives should be combated early by suitable outlets for increased socialization.

Symptoms due to secondary anxiety and hysterical reactions may subside if the cause is removed by suitable social work, and if appropriate but brief psychotherapy is given, e.g. hypnosis for removing stutter or hysterical amblyopia. Prolonged psychotherapy and hospitalization should be avoided.

These principles of treatment may help many of these patients to become useful members of society.

DISCUSSION.

From a study of these patients it is obvious that the *Neisseria meningitidis* may not only bite the meninges, but also lick the brain, and intellectual

deterioration, defects of personality, changes in character and disorders of conduct observed in some of the survivors may be the result of organic changes in the brain. The EEG was abnormal in the majority of these patients, but no conclusions could be drawn from such a small series of cases. The subject certainly requires further study.

Despite the fact that the majority of the patients had lived in London and all had been exposed to more or less severe air-raids, it is surprising that only one patient showed anxiety symptoms precipitated by bombing, which lends support to the view that their persistent symptoms were probably physiogenic in origin. Such symptoms as irritability, suspicious tendencies and paranoid reactions, frequently observed in some patients during convalescence from head injuries, were not prominent in any of these patients. On account of the personality defects, however, these patients may become specially liable to neurotic breakdown, and may react to trauma (either psychic or somatic) or to economic stress by developing additional but purely psychogenic symptoms, such as stutter, enuresis, tremor of limbs and disorders of gait.

To evaluate such symptoms as headache, blackouts and fits is not easy, as they may appear to be psychogenic in some patients and probably physiogenic in others. A positive EEG may sometimes confirm the epileptic nature of the fits, but a single negative finding does not exclude epilepsy.

Although none of these patients had received chemotherapy for their meningitis, their residual symptoms were similar to those following cerebrospinal fever in adults treated with sulphonamides, and it is worth emphasizing that chemotherapy does obviously not prevent the development of these features. This view, expressed by the author three years ago, has received further confirmation as the result of a recent survey in South-East Wales and Monmouthshire. Degen (1945), in a follow-up study of 986 cases of cerebrospinal fever, found an appreciable incidence of residual symptoms, which persisted for several months. Neuro-psychiatric symptoms, like depression, headache, emotional instability, inability to concentrate and poor memory, were reported by the survivors in nearly all the age-groups; 36 per cent. of the children of school-going age and 42 per cent. of adults in the age-group of 15-24 are reported to have complained of persistent symptoms. All these patients had no doubt been treated with chemotherapy.

It cannot be emphasized too strongly that no statistical conclusions should be drawn from our small series of cases. But these case-histories are sufficiently impressive to be published for the guidance of medical practitioners and psychiatrists.

SUMMARY.

(1) Twenty-nine patients with residual neuropsychiatric symptoms after C.S.F. in early life were studied. The majority of the patients showed personality defects and complained of symptoms suggestive of an encephalopathy. They were backward in their studies, and had difficulties of adaptation at school and later at work. They were unstable, dependent, restricted in their interests, and showed tendencies to invalidism.

- (2) Those with a family history of instability showed severe and persistent reactions after recovery from C.S.F.
- (3) Nearly all showed tendencies to neurotic breakdown under conditions of even moderate stress.

My thanks are due to Dr. A. B. Stokes, the Acting Medical Superintendent, Mill Hill Emergency Hospital, and my colleagues for their valuable co-operation and permission to publish these case-notes. Thanks are also due to the following for their co-operation: Army psychiatrists, officers commanding units for sending personality and efficiency reports, general practitioners and medical officers who supplied information, and Dr. Dennis Hill and Mrs. Arundale for EEG reports.

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THE USE OF CURARE WITH CONVULSIVE THERAPY.

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CONVULSION therapy may now be considered to have established a position for itself in psychiatry, and in particular there is now a consensus of opinion that in states of depression occurring in later life it offers a chance of recovery for the patient unrivalled by any other form of therapy. The treatment is associated with a risk of causing compression fractures of the spinal vertebrae, and especially in the age-groups above 60 one is still concerned with the violence of the muscular spasm produced at the treatment. In July, 1939, at the Woodside Hospital we first commenced to study the problem of vertebral fractures complicating convulsion therapy, and also to investigate the general problems involved in rendering the treatment safe for our involuntional cases. Our first attempt was with curarine, which we were enabled to give to a few of our patients in the psychiatric department of the Middlesex Hospital owing to the facilities placed at our disposal by the research pharmacological department. We then established—

1. That curarine given intravenously was safe in controlled doses.
2. That it cut down the total muscular spasm, thus appearing to render the treatment more safe.
3. That its use in no way interfered with the therapeutic results of convulsion therapy.

This work was briefly referred to in the literature, but no detailed publication was made, owing to the outbreak of war, and meanwhile other duties appeared to require the attention of those engaged on the research. Six months later, in the U.S.A., a preparation of physiologically standardized curare became available; and through the courtesy of Messrs. E. M. Squibbs & Sons a sample was obtained which eventually found its way to the Middle East, where I was enabled to utilize it on a number of my Service patients. The drug has meanwhile caught the attention of anaesthetists, but its value in psychiatric practice still appears to be underrated.

Curare has an interesting history, and is first mentioned in the writings of the Spanish Conquerors of S. America—especially those who accompanied Quesada on his epic march to Bogota (*circa* 1520). Sir Walter Raleigh appears to have been the first Englishman to mention it, and it was an Englishman, Waterton, who, about 1820, collected the first crude samples. In 1844 Claude Bernard demonstrated its site of action on the myoneural junction, and in 1936 Ranyard West gave it its first clinical trial in cases of tetanus. It was first used in psychiatry in England in July, 1939, and in 1940 the Americans took up its study with characteristic clinical enthusiasm, so that we now have a marketable product. Curare is obtained as an infusion of the bark and roots

of *Strychnos toxifera*, and is physiologically assayed by comparing its antagonism to acetylcholine on the gastrocnemius of the frog, and also by the head drop induced when injected into a rabbit's ear.

It acts primarily on the motor end-plate of voluntary muscle, where it inhibits the acetylcholine from acting. It is selective in its action, which shows a regular march first on the muscles of the head and neck, and last of all on the intercostal muscles and diaphragm. It has no effect on the circulation or sensory nerves (i.e. the blood pressure is not affected), and death, when it occurs, is due to respiratory paralysis.

Its action is quick and elimination is rapid, and "curarization" probably requires 65-70 per cent. of the lethal dose. The peak effect is achieved by intravenous injection, and all clinical effects have worn off within 20 minutes. No tolerance is acquired, but some pharmacological change evidently lingers on for some 12 hours, as is shown by the dangerous effect if a second dose is administered within this period. The aqueous solution is very stable and may be autoclaved. Prostigmine is a complete and safe antidote, and adrenaline, leptazol (cardiazol) and atropine all modify its action in some degree. Artificial respiration and intubation are clinical antidotes, the latter for the bronchospasm which sometimes occurs when using crude preparations. Its administration results first in a fuzziness of vision, followed by ptosis and nystagmoid movements of the eyes; later there is relaxation and heaviness of the jaws; tightness felt in the throat and a husky voice; generalized heaviness of the body; inability to lift the head; weakness of all muscles; shallow breathing; and lastly accumulation of saliva in the mouth and fauces and severe dyspnoea, leading to death.

Dosage is estimated according to body-weight and the desired effect, and speed of injection is critical. The maximum clinical effect is achieved when the patient finds difficulty in raising his head. Using the preparation marketed as "Intocostin," this means a dose of 1 c.c. per 40 lb. of body-weight given intravenously over a period of 90 seconds (equivalent to 20 mgm. active material per 40 lb. body-weight).

It has been found that old people require proportionately more of the drug, and it is of the utmost importance never to give more than one dose within 24 hours. Nursing assistance demands that the patient's head be held forward and the jaw supported. The physician must be prepared to perform intubation, artificial respiration and give prostigmine intravenously.

Ideally, one should always place in position a Bragg-Paul respirator, and with this apparatus, together with prostigmine, the treatment becomes 100 per cent. safe in competent hands, seeing that the lethal diaphragmatic effect is the last to appear and the first to disappear; and animal experiments have suggested that even with a lethal dose, artificial respiration maintained for ten minutes tides over the diaphragmatic paralysis, after which the clinical condition becomes one of safety.

Research in America has investigated the use of synthetic substitutes, such as quinine methochloride, and one worker has successfully employed magnesium sulphate intravenously.

It would indeed be a pity if in the present stage of development of the

therapeutics of convulsion therapy, this drug does not become generally available. In practice 50 per cent of the above dosage in all probability gives an adequate softening of muscular effect.

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THE EARLY RESULTS OF PENICILLIN TREATMENT IN G.P.I.

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THE favourable results obtained in the treatment of early and late syphilis by penicillin fostered the hope that it would also be of benefit in cases of G.P.I. Accordingly, this method of treatment was instituted in a psychiatric hospital in M.E.F. (No. 78), and the results obtained in six cases are here recorded.

DESCRIPTION OF CASES.

CASE 1.—A Palestinian Jew, aged 37. Acute maniacal onset. Malarial therapy was commenced, but was stopped after two rigors owing to a collapse of the lung. The patient afterwards coughed up a broken tooth. He showed rapid mental deterioration, loss of weight, and progressive anaemia. He had a fluctuating urinary infection, oedema of the legs, and neurotrophic ulcers of the sacral area and heels. The last started to improve when penicillin was given and, thanks to untiring nursing care, eventually healed. The patient was practically bedridden, and had loss of sphincter control and degraded habits. He was subject to violent outbursts of rage. No mental contact was possible. 154 days after commencement of penicillin treatment he was mentally unchanged, in a state of advanced dementia.

CASE 2.—A British sergeant, aged 44. Civil occupation: master butcher (own business). No history of primary infection elicited. There was a history of depression and failure of efficiency over the previous nine months. On admission he was semi-stuporose and was experiencing visual, auditory, and tactile hallucinations. Speech was slightly blurred and mental deterioration was clearly present. The C.N.S. showed no abnormal physical signs, but he was found to have syphilitic aortitis. After treatment he became euphoric and facile. Behaviour was satisfactory, and he was employed on simple hospital tasks—gardening, running errands, etc. While mentally improved he was still below his former level of intellectual capacity. There were defects of concentration, memory, and judgment which would prevent his return to a successful business life.

Period of observation after commencement of treatment: 86 days.

CASE 3.—A British sergeant, aged 28. Civil occupation: postman. He had a primary sore in 1940, when with the B.E.F. The diagnosis had not been finally established when the German offensive began, and he did not again attend a V.D. centre.

There was a three months' history of inefficiency and lack of confidence prior to admission, when he was noted to be dull, apathetic and retarded. He had a marked dysarthria and tremors of lips and tongue. The clinical diagnosis of general paresis was not supported by the original C.S.F. findings, though they were typical later (see Table I). Similarly there were no abnormal signs in the C.N.S. on admission, but after the first course of penicillin treatment he was found to have Argyll Robertson pupils, and was experiencing auditory hallucinations of derogatory type. There was, however, improvement in his intellectual powers, and he became more alert and efficient, though it was apparent that there was some residual impairment. He was fit to do simple tasks.

Period of observation after commencement of treatment: 86 days.

CASE 4.—A British lance-corporal, aged 44. Civil occupation: gents' outfitter (own business). No exposure to infection admitted. He came under observation for minor injuries (? sustained in a fit). He showed the typical early personality change of loss of the finer distinctions of social conduct, e.g. pilfering sweets and

cigarettes from fellow-patients, sunbathing naked in view of a public highway. There were no abnormal physical signs. On admission he was engaged in writing a novel of the penny novelette, wish-fulfilment variety. It contained many inconsistencies and absurdities. He abandoned this in favour of gardening, which he did with great energy and application, but little knowledge or foresight. With treatment his test results showed improvement, though the effects of practice were noted. The low score on the last testing with the Retreat Scale can be attributed to lack of interest (see Table II). His conduct also improved after treatment, though there were still minor social blemishes. He was careless and selfish. He also showed poor judgment. While he was considered fit for civil life, these defects would handicap him in any complex occupation, such as his own business.

Period of observation after commencement of treatment : 129 days.

CASE 5.—A British lieutenant, aged 34. Civil occupation : schoolmaster. No history of primary infection was obtained. The classical type, with delusions of grandeur, wealth and omnipotence. He was aurally and visually hallucinated from the outset. There was rapid deterioration of the mental and physical condition, though the C.N.S. showed no abnormal physical signs. After treatment he remained weak, but the physical condition did not continue to deteriorate. He had periods of excitement and degraded conduct, with intervals when he was co-operative, clean in habits, and lucid in conversation on simple topics. He was judged likely to remain in an institution.

Period of observation after commencement of treatment : 111 days.

CASE 6.—A Syrian Arab, aged 29. Civil occupation : shoemaker. No previous history obtained. On admission he was diagnosed as hysterical pseudo-dementia, a condition not infrequently seen amongst Arab patients, because of his clowning conduct, Ganser answers, beating his head against the wall—without hurting himself—theatrical demonstrations of weakness. A differentiating feature was the occurrence of noisy outbursts at night, which it was suspected were due to hallucinations of a minatory nature. There were no abnormal physical signs, and the diagnosis was made on the results of blood and C.S.F. examinations. There was no change, for better or worse, discernible after treatment, and his clowning conduct remained unaltered in form and content. It was doubtful if he would be fit to reside outside a hospital even in the tolerant environment of an Arab village.

Period of observation after commencement of treatment : 80 days.

TREATMENT.

On the advice of Lt.-Col. J. M. Bassett, R.A.M.C., Adviser in Venereology M.E.F., penicillin was given in two courses of 2,400,000 units, with a month's interval between them. It was decided to give intramuscular injections at three-hourly intervals. McAdam *et alii* (1944) have shown that administration of penicillin two-hourly is five times, and three-hourly three times as efficient as four-hourly injections in maintaining a required concentration in the blood. A three-hourly interval was chosen as the more convenient and less inefficient. The degree of immobilization of the patient necessary for administration by a continuous intramuscular drip rendered this method impracticable. It was found that the patients soon tolerated the frequent injections. They remained in bed for the first 48–72 hours of the treatment.

To minimize the danger of a flare-up of the syphilitic lesions (Herxheimer reaction), which may produce transverse myelitis, convulsions, or acute exacerbation of mental symptoms, the method of low initial doses advocated by Stokes *et alii* (1944) was adopted. In their series the ultimate effect of the treatment did not appear to be lessened. Accordingly, Cases 1, 2, 3 and 4 were started with doses of 10,000 units for the first two days, 20,000 units for the next two days, and 40,000 units thereafter up to completion. Cases 5

and 6 were started on 20,000 units for the first two days, and then given 40,000 units. All the patients had malaise, headache, and fever in the first 48 hours. The highest temperature recorded was 102° F.

TABLE I.

Days.	Blood.		Cells (lymphs.) per c. mm.	C.S.F. Protein mgm. per 100 c.c.	Increase of globulin.	W.R.	Lange.	Remarks.
	Kahn.	W.R.						
Case 1 . . .	89 . . .	+++	Less than 2 .	70 .	Definite .	+++	5555431000 .	..
	34 . . .	Negative .	" 2 .	50 .	Slight .	A.C.	4322000000 .	..
	77 . . .	" .	" 1 .	20 .	nil .	+	4433210000 .	..
Case 2 . . .	33 . . .	+++	72 .	70 .	Slight .	A.C.	5554430000 .	..
	32 . . .	+++	10 .	70 .	" .	+++	5432100000 .	..
	79 . . .	+++	1 .	20 .	nil .	+++	4333210000 .	..
Case 3 . . .	40 . . .	+++	Less than 2 .	40 .	" .	+++	0024320000 .	..
	3 . . .	..	70 .	50 .	Slight .	+++	5555531000 .	..
	41 . . .	+++	Less than 2 .	60 .	Definite .	++	5542000000 .	..
	47 . . .	+++	" 2 .	40 .	nil .	+++	5555431000 .	..
Case 4 . . .	50 . . .	+++	63 .	80 .	" .	+++	5555431000 .	..
	50 . . .	+++	" .	Slight in- crease	nil .	+++	5555543100 .	..
	30 . . .	+++	22 .	" .	" .	+++	..	..
	62 . . .	Negative .	6 .	..	" .	++	..	..
	98 . . .	+++	8 .	60 .	Slight .	Negative .	..	..
Case 5 . . .	19 . . .	+++	50 .	50 .	" .	+++	5554310000 .	Gross blood contamination
	30 . . .	+++	..	Marked increase	Marked .	+++	..	..
	74 . . .	+++	10 .	50 .	Definite .	++	..	..
	98 . . .	+++	20 .	50 .	Slight .	Negative .	..	..
Case 6 . . .	33 . . .	+++	40 .	50 .	Definite .	+++	5554310000 .	Specimen lost in transit.
	48 . . .	+++	1 .	..	" .	-	..	..
	77 . . .	..	3 .	30 .	nil .	++	..	..

As an additional precaution, Cases 1, 2 and 3 were given desensitizing doses of 0.2 g. bismostab in each of the two weeks preceding the first penicillin treatment. Cases 4, 5 and 6 were given, in addition, liq. hydrarg. perchlor. m. xxx, potass. iodid. gr. x, *t.d.s.*, for fourteen days. 25 per cent. magnesium

sulphate solution was kept in readiness for rectal administration to combat cerebral oedema. The second course for all patients was given in doses of 40,000 units from the beginning. There were no reactions.

TABLE II.

Days.	Matrix (full score = 60).	Shipley-Hartford (full score = 40).			V.I.Q.	Wechsler-Bellevue.		F.S.I.Q.	Deterioration. (Wechsler).	Deterioration index (Reynold).
		Vocab.	Abstract.	C.Q.		P.I.Q.	F.S.I.Q.			
Case 2 .	- 19 .	28 .	14 .	70 .	79 .	88 .	82 .	N.A.	N.A.	
	+ 9 .	30 .	16 .	71 .	.. .	.. .	.. .	.. .	.. .
	+ 31 .	30 .	24 .	84 .	91 .	98 .	93 .	N.A.	N.A.	
	+ 78 .	29 .	30 .	99 .	103 .	90 .	98 .	nil	+	
Case 3 .	- 21 .	31 .	24 .	81 .	.. .	.. .	.. .	.. .	+
	- 3 .	.. .	.. .	.. .	108 .	90 .	99 .	.. .	.. .
	+ 40 .	33 .	38 .	111 .	110 .	100 .	107 .	31%	N.A.	
	+ 78 .	32 .	38 .	111 .	104 .	107 .	107 .	13%	+	
Case 4 .	- 22 .	32 .	10 .	59 .	95 .	95 .	95 .	nil	+	
	+ 31 .	36 .	24 .	80 .	115 .	109 .	113 .	7%	+	
	+ 61 .	35 .	22 .	76 .	120 .	118 .	120 .	nil	-	
Case 5 .	- 9 .	37 .	20 .	73 .	129 .	87 .	115 .	"	+	
								25%	+	

N.A. = relevant subtests not available. U. = scores unreliable.

PATHOLOGICAL EXAMINATIONS.

Table I gives the results of examinations of the blood and C.S.F. (a) at the time the condition was first diagnosed, (b) one month after the beginning of

the first course of treatment, and (c) one month after the second course. Cases 4 and 5 were in hospital long enough to enable further examination to be made. In the "days" column — indicates the number of days before the first course was begun, and + the number of days after. In the later stages of the investigation materials for the colloidal gold reaction were not available in M.E.F.

PSYCHOMETRIC TESTS.

In addition to assessing progress clinically, an attempt was made in the British patients (Cases 2, 3, 4, 5) to obtain a record of the intellectual changes by means of standard tests. The ones used were Raven's Progressive Matrices, the Shipley-Hartford Retreat Scale, and the Wechsler-Bellevue Intelligence Scale. Results are given in Table II.

The Progressive Matrices is the standard intelligence test used in the hospital. It was also included in Bellevue Scale by means of a standardization of scores worked out by Major R. Orton, R.A.M.C.

The Retreat Scale (Shipley, 1940) establishes an index of intellectual deterioration by comparing the score obtained on testing an ability relatively little influenced by deterioration (vocabulary) with the score of a test of an ability (abstract reasoning) that is more influenced. A Conceptual Quotient (C.Q.) is obtained, and values 80–90 are classified as borderline, 70–80 very doubtful, below 70 pathological.

The Bellevue Scale gives an intelligence rating in the form of an Intelligence Quotient. The Scale is made up of ten subtests sounding various mental abilities. Separate I.Qs. are obtained for verbal and performance tests (V.I.Q. and P.I.Q.), and the final rating on all tests is a full scale I.Q. (F.S.I.Q.). The range of the I.Qs. for average intelligence is 91–110. In persons of average intelligence or above, the V.I.Q. is usually higher than the P.I.Q., and by not more than about 10 points. An alteration in either of these relationships is very often significant of mental disease or maladjustment. Scores on the individual subtests have been equated, and thus it is possible to compare the functioning of separate mental abilities with one another and with the mean test score. The diagnostic use of the scale is described by Rapaport (1944). An analysis of the subtest scores would be out of place here, and no general deductions could, in any case, be based on them, as there were only ten testings of four patients. (Case 5 deteriorated too rapidly to test further.) Suffice it to say that the most consistent findings were of significant impairment of abstract reasoning (Verbal Similarities), learning and motor speed (Digit Symbol substitution), and the preservation of vocabulary and general information. In serial testing the effect of practice cannot be ruled out entirely, but it is held that the test scores give an indication of the progress of the patients. The information gained from observing the patients doing the tests and from an analysis of the subtest scores was incorporated in the clinical assessment given in the case notes. The measured mental deterioration does not correlate highly with the clinical picture, but as a matter of interest the percentage Deterioration Loss (Wechsler, 1944) is given in those instances in

which the formula could be applied. This formula was devised originally for estimating deterioration occurring with age in normal subjects. The necessary correction for age has been made here. The deterioration index described for cases of head injury by Reynell (1944) is shown where it was positive. The principle in both these measurements is the same as that underlying the Retreat Scale.

In Cases 2 and 4 the Matrix Scores indicate an improvement of more than accidental magnitude. This improvement is reflected in all cases in the Wechsler F.S.I.Q. The principle underlying the Retreat Scale is well exemplified in this series with an almost constant score on the vocabulary test in each case, contrasting with a rising score on the abstract reasoning test as a concomitant of the mental improvement.

RESULTS.

The short periods of observation can allow of no firm conclusions. General paresis is a disease of remissions and fluctuations, and long-term assessment is necessary.

All cases showed improvement in the C.S.F. with reduction in cell count as the most consistent change following treatment with penicillin. This is similar to the findings of Stokes *et alii* (1944), and Nelson and Duncan (1945), in all forms of neurosyphilis. Dattner (1944) states that improvement rarely occurs in treated G.P.I. without this first happening. In five cases out of six the protein content was lowered, with reduction of the globulin fraction in four cases, and in five cases there was a change for the better in the qualitative Wassermann reaction. In two cases of the three which had full serological examinations the Lange curve showed a movement towards normal. Case 1, which had the most even improvement in the C.S.F., had the greatest mental deterioration. It is recognized that there may be variations in the serological reactions of both C.S.F. and blood in the period immediately following treatment, and therefore, from the prognostic standpoint, the negative reactions obtained in Cases 1, 4 and 5 must be viewed with caution. The persistence of a positive reaction in the blood is of no clinical significance in late neurosyphilis (Nicol, 1944).

Case 1 and 5 can be considered as grossly deteriorated, but probably stationary. Case 6 appeared mentally and physically unchanged. Cases 2, 3 and 4 showed mental improvement. It may therefore be stated that favourable changes, either serological or mental or both, have been observed in these patients after the administration of penicillin.

SUMMARY.

1. Six cases of G.P.I. were treated with penicillin in two courses of 2,400,000 units each. Dosage, administration, and preliminary treatment are described.
2. Results of serial serological and psychometric examinations are tabulated.
3. Serological improvement occurred in all cases. Two cases showed no mental improvement, one case appeared unchanged and three cases showed definite improvement.

4. The early results of penicillin therapy give grounds for optimism, though it should be emphasized that the cases were only observed for periods of 80 to 154 days from the inception of treatment.

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THE TREATMENT OF CEREBRAL PALSY.

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AN interesting field for investigation and experiment is provided by the conditions formerly known as Little's disease or spastic diplegia, or hemiplegia, or spasticity with athetosis.

One hundred years ago Little studied cases of types now grouped under the common term "cerebral palsy." His conclusions justified attempts at rehabilitation rather than surgical intervention.

In 1918 Phelps (U.S.A.) began to investigate the incidence, the percentage of true mental defect, and the utility of peripheral surgery in cerebral palsy cases. He eventually worked out a system of rehabilitation, and re-classified cerebral palsies into five main groups for purposes of treatment.

Data gathered showed a yearly occurrence of 7 cerebral palsy births per 100,000 population; in a city of 100,000, cerebral palsy is represented by 140 persons under 20 years of age. In the U.S.A. this means there are at least 150,000 cases of cerebral palsy.

A study showed that 68·8 per cent. of these are educable to useful citizenship level. These figures are independent of the degree of handicap. The degree of physical handicap is not relevant to treatment by conservative methods in the majority of cases.

Phelps laid down basic principles of treatment, and his results have been excellent. Similar principles are now being successfully applied in cases of head injury of adult patients in America.

Treatment depends first upon a careful diagnosis of the particular kind of cerebral palsy. Once this has been made mental assessment can be attempted.

Phelps' principles have been followed with good results in an experimental unit at Queen Mary's Hospital for Children, Carshalton, Surrey, over a three-year period.

Children undergoing training are removed from ward conditions, and studies are made of the whole child in the new environment. Work was begun with an unselected group of cases, but selection is now made on the basis of suitability of age and of mental ability. Post-operative cases are now excluded.

Assessment of the total handicap is made as follows:

- i. Functional ability.
- ii. Nutrition and appearance.
- iii. Aetiology and final diagnosis.

- iv. Classification into Phelps' five motor groups—spastic, athetoid, ataxic, rigidity, tremor.
- v. Specific disabilities, e.g. muscle imbalance, joint motion difficulty, eye defects, hearing defects.
- vi. Dominant handedness.
- vii. Mentality—having regard to sensori-motor handicap assessment and former environmental factors.

Training is as follows, all measures overlapping to form a whole rehabilitation scheme :

I. Physiotherapy. II. Activities. III. Occupational therapy. IV. Speech therapy. V. School work.

I. Physiotherapy includes the following measures :

“Conditioning.”

Respiratory and deglutition work.

Relaxation.

Disciplined rest.

Removal of faulty habit patterns.

Establishment of correct motor patterns by means of—

Passive motion (with mental co-operation of child).

Active assisted motion.

Active motion.

Resisted motion.

Reciprocal motion.

“Automatic motion.”

Combined motion.

Selected contractions and motions.

Balance—muscle balance and equilibration.

Voluntary postural correction.

Special sense training.

II. Activities consist of “ideal” motion learned in physiotherapy practically applied, e.g. hopping, ball-throwing, rhythm, group work.

III. Occupational therapy consists of motions learned in physiotherapy applied to normal skills, e.g. self-feeding, dressing, typewriting, group work.

IV. Speech therapy consists of motions learned in physiotherapy applied to vocalization (respiratory difficulties, excess salivation, etc., having been eliminated as far as possible in physiotherapy).

V. School work—power of thought and concentration ability stimulated in physiotherapy applied to lessons ; activities applied to school needs ; normal skills applied in school ; vocalization applied in oral work in school.

Mechanical aids to training are introduced, only to be discarded as progress is made. These include “skis” for walking, individually adapted chairs and tables, wooden-handled spoons. Occasionally light splints or small springs are used temporarily.

Records include the following data :

- i. Full history with previous diagnosis or diagnoses.
- ii. Condition on admission, including weight and height.
- iii. Psychological difficulties.
- iv. Concomitant defects, if any, e.g. endocrine disturbance.
- v. Evaluation of total handicap after a probationary period for adjustment and observation.
- vi. Examination results ; examinations are made six-monthly.
- vii. Final diagnosis and classification.
- viii. Running records of progress, including difficulties and retrogressions, if any.
- ix. School records.
- x. Graphs of functional ability progress rates.

Graphs are of value in several ways. They provide a check on progress. They indicate ability to date. They encourage the patient. They show set-backs.

Inevitably these graphs are subjective ; but with good team work they are a fairly accurate method of recording treatment results.

CEREBRAL PALSY UNIT

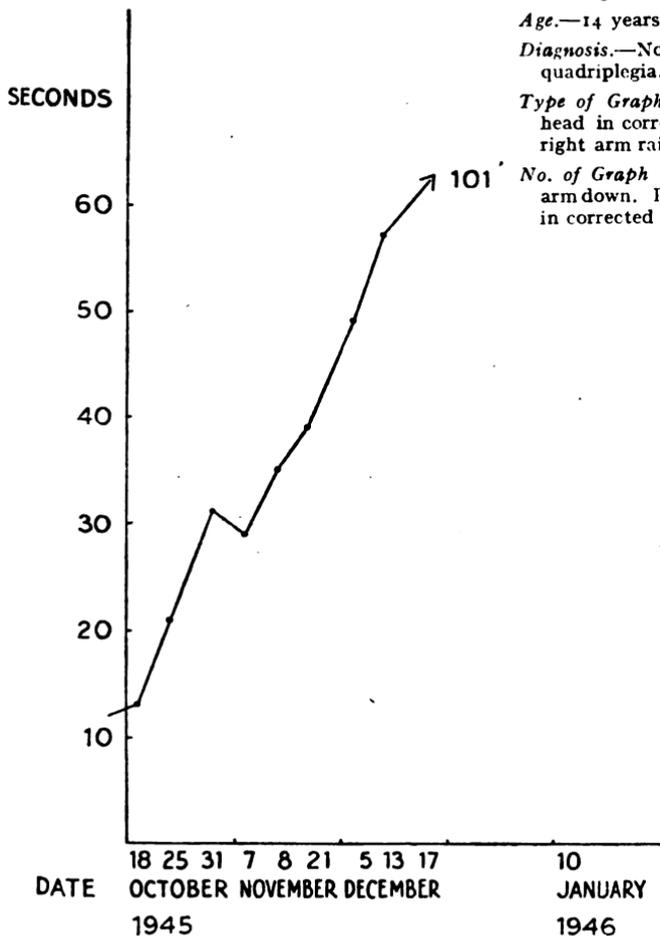
Name.—J. C.—.

Age.—14 years.

Diagnosis.—Non-intention tremor—quadriplegia.

Type of Graph.—Standing, maintaining head in correct position, mouth open, right arm raised—no. of seconds.

No. of Graph II.—Progression on right arm down. Progression to vocalization in corrected position.



A steady upward trend on all graphs of a given child over a year shows satisfactory handling by the staff and intelligent work by the patient. Erratic progress shows a traceable fault somewhere, either in handling by a member of the working team or some undiscovered psychological or physical factor in the child. Static graphs show one of two things— incompetence of staff handling the child or mental deficiency in the child.

Résumés of the graphs provide a table of functional ability at given dates which is found to tally with the running records, functional examination results and school records.

In the three years there has been no failure of any intelligent child to make progress far in excess of that made formerly, even where the former diagnosis was that of mentally defective spastic diplegia (i.e. in 85 per cent. of treated cases).

Case notes are appended of two types of case, (a) non-intention tremor, (b) spastic.

CASE 1.—J. C—, aged 14. Non-intention tremor.

(Former diagnoses made were those of polioencephalitis, rheumatic chorea, spasticity, post-encephalitic Parkinsonianism.) Boy was normal until aged 7, when he had whooping-cough and diphtheria. By 1943 had become a completely helpless cripple; psychologically maladjusted—speech unintelligible—school work impossible for him. Sleeping in plaster bed. Drugs and massage administered.

By January, 1946—after three years' special training—is a practising Scout, roller-skates, gardens, keeps rabbits. No psychological difficulty, is helpful, healthy and active. Does schoolwork, but has missed so much he is behind the average. Chief motor disability is in speech, which is not wholly intelligible, and in awkward use of right arm. Continues to improve in motor ability under supervision.

CASE 2.—A. E—, aged 7. Spastic quadriplegia.

Normal birth. Whooping-cough at 6 months. Motor progress slow. At 6 years unable to lift head; unable to lie prone on either side. No volitional motion whatsoever. Typical position of helpless spastic baby; crossed legs, pronated forearms, etc.; no speech. Child psychologically maladjusted, apathetic, ill, undernourished, doubly incontinent. School impossible. Child tied down in cot all day in hospital ward. Assessed as hopeless mental defective.

After 18 months' treatment is an alert, healthy and responsive little boy. Hair has grown over bald patch where it was rubbed off in bed. Sits in school with others. Not incontinent. Joins in all activities except walking about. No psychological difficulty. Talks well. Chief motor disability lies in slowness of some motor responses, in balance, in inability entirely to dress and feed himself. Is making steady progress.

PSYCHIATRIC DISORDERS AND REACTIONS: DEFINITIONS
AND MANNER OF RECORDING.

NOTE.

The United States Army has adopted for its official use a new method in recording a psychiatric diagnosis and a revised nomenclature as set forth in the *Technical Medical Bulletin*, No. 203, dated October 19, 1945. Brig.-Gen. W. C. Menninger has sent a copy as set out below for publication.

(A) DEFINITIONS.

(1) GENERAL.

In setting up the definitions of psychiatric conditions, the term "disorder" has been used for the designation of the generic group of the specific reactions, while the specific reaction types have been termed "reactions." In classifying psychoneuroses, the dynamics of the psychopathology was chosen as the basis. Of necessity, a few terms remained descriptive (symptomatic). In general, an attempt has been made to retain only such formerly used terms as could be fitted into this general plan and omit categories which are "catch-alls," such as "Simple adult maladjustment," "Constitutional psychopathic state," etc.

In recording a psychiatric condition, the particular type of condition ("reaction") will be specified, and not its generic term ("disorder"). Whenever a reaction is subclassified, only the subcategory will be recorded as the diagnosis. In general, the lowest applicable subclassification of the specific disorder, as given in the list of terms under "Psychiatric conditions," paragraph 20, will be stated as the diagnosis. (For details on recording of diagnoses, see (B), below).

(2) TRANSIENT PERSONALITY REACTIONS TO ACUTE OR SPECIAL STRESS.

(a) *General*.—A normal personality may utilize, under conditions of great or unusual stress, established patterns of reaction to express overwhelming fear or flight reaction. The clinical picture of such reactions differs from that of neuroses or psychoses chiefly in points of direct relationship to external precipitation and reversibility. In a great majority of such reactions, there is an essentially negative historical background.

This general classification should be restricted to conditions which are usually transient in character, though they may be acute and severe, and conditions which cannot be given a more definitive diagnosis, either because of their fluid state or because of limitation in time permitted for their study.

None of the conditions included in the disorder group, transient personality reactions to acute or special stress, is acceptable as the cause of separation from the service for disability.

(b) *Combat exhaustion*.—Combat reaction is often transient in character. When promptly and adequately treated, the condition may either clear rapidly,

or it may progress into one of the established neurotic reactions. The term is to be regarded, therefore, as a temporary diagnosis, and should be used only until a more definitive diagnosis can be established. It will ordinarily be used only in the " Army level," and should never be used back of the communications zone.

This diagnosis is justified only in situations in which the individual has been exposed either to severe physical demands or to extreme emotional stress, such as seen in combat soldiers within the combat area, or to both. In some instances this diagnosis applies to more or less " normal " persons. The stress in such cases is intolerable. The patient may display a marked psychological disorganization akin to certain psychoses.

(c) *Acute situational maladjustment.*—This transient personality reaction is manifested by anxiety, alcoholism, asthenia, poor efficiency, low morale, unconventional behavior, etc. The clinical picture of this reaction is primarily one of a superficial maladjustment to newly experienced environmental factors or to especially trying and difficult situations, but exhibiting no evidence of any serious longstanding or underlying personality defects or chronic neurotic patterns. If untreated or not relieved, such reactions may progress in some instances into a typical psychoneurotic or psychopathic reaction.

The term may be applied to reactions caused by cultural deficiencies and deprivations, when such show no definite neurotic type of reaction. It will also include some cases formerly classified as " Simple adult maladjustment."

(3) PSYCHONEUROTIC DISORDERS.

(a) *General.*—This generic term refers to psychiatric disorders resulting from the exclusion from the consciousness (i.e. repression) of powerful emotional charges, usually attached to certain infantile and childhood developmental experiences. Such repressed emotional charges, which may not be apparent without an extensive and deep investigation of the personality, may or may not be adequately controlled in the absence of external stress. Longitudinal (life-long) studies of individuals with such disorders usually present evidence of periodic or constant maladjustment of varying degree. Special stress may make the symptomatic expressions of such disorders acute.

The chief characteristic of these disorders is anxiety, which may be either " free floating " and unbound (" anxiety reaction "), and directly felt and expressed, or it may be unconsciously and automatically controlled by the utilization of various psychological defence mechanisms (repression, conversion, displacement, etc.). In contrast to psychotics, patients with such disorders do not exhibit gross distortion or falsification of the external reality (delusions, hallucinations, illusions), and there is no gross disorganization of the personality.

Anxiety in psychoneurotic disorders is a danger signal felt and perceived by the conscious portion of the personality (ego). Its origin may be a threat from within the personality—expressed by the supercharged repressed emotions, including particularly such aggressive impulses as hostility and resentment—with or without stimulation from the external situation, as loss of love or of prestige, or threat of injury. The various ways in which the patient may attempt to handle this anxiety result in the various types of reactions.

Diagnoses of psychoneurotic disorders will be recorded as one of the following types of reaction. The term will not be prefaced by any broad group designation, such as "psychoneurotic disorder." The term "traumatic neurosis (or reaction)" will not be used; instead the particular reaction will be recorded (see par. (B) below). The term "mixed reaction" will not be used; instead the predominant type of reaction will be recorded, qualified by references to other types as part of the symptomatology.

(b) *Anxiety reaction*.—In this type of reaction the anxiety is diffuse, and not restricted to definite situations or objects, as in the case of the phobias. Furthermore, it is neither "bound" nor controlled by any psychological defence mechanism, as in the other psychoneurotic disorders. In such reactions, both the psychological and physiological aspects of the anxiety are felt by the patient, but only the physiological aspects are observable by the physician.

This reaction should be distinguished from normal apprehensiveness or fear. This term is synonymous with the former term "anxiety state."

(c) *Dissociative reaction*.—This psychoneurotic disorder represents a type of personality disorganization which proves to be in the majority of instances a neurotic disturbance. (It should be differentiated, however, from a pre-psychotic disturbance.) The diffuse dissociation trends, seen in acute combat exhaustion, may occasionally appear psychotic, but nearly always the reaction becomes neurotic.

In acute cases of such reaction, the personality (*ego*) disorganization appears to permit the anxiety to overwhelm and momentarily govern the total individual, resulting in aimless running or "freezing." This may occur in well-integrated personalities. But even in less acute cases, or in less well-integrated personalities, the repressed impulse, giving rise to the anxiety, may be either discharged or deflected into various symptomatic expressions, such as fugue, amnesia, etc. Often this may occur with little or no participation on the part of the conscious personality.

These reactions should be differentiated from schizoid personality, schizophrenic reactions, and from analogous symptoms in some other type of neurotic reaction. This reaction has been formerly often classified as a type of "conversion hysteria."

The diagnosis should specify the symptomatic manifestations of the reaction, such as depersonalization, dissociated personality, stupor, fugue, amnesia, dream state, somnambulism.

(d) *Phobic reaction*.—By an automatic mental mechanism, the anxiety in these cases becomes detached from some specific idea or situation in the daily life behaviour, and is displaced to some symbolic object or situation in the form of a specific neurotic fear. In civilian life the commonly observed forms of phobic reactions include fear of syphilis, dirt, closed places, high places, open places, some animals, etc.; in military life other specific neurotic fears have been observed, such as fear of specific weapons, combat noise, planes, etc. The patient can control his anxiety if he avoids the phobic object or situation.

In this group of reactions are included the sensitized residual states of combat exhaustion observed after the other acute manifestations have sub-

sided. The term also includes some cases formerly called "anxiety hysteria." In recording such cases, the symptomatic manifestations will be indicated.

(e) *Conversion reaction*.—This term is synonymous with "conversion hysteria." Instead of being experienced consciously (either diffusely, or displaced, as in phobias), the impulse causing the anxiety in conversion reaction is "converted" into functional symptoms in organs or parts of the body, mainly under voluntary control.

In recording such reactions, the symptomatic manifestations will be specified as pain (cephalgia, myalgia, arthralgia, etc.), anesthesia (anosmia, blindness, deafness), paralysis (paresis, aphonia, mono- or hemiplegia), dyskinesia (tic, tremor, postures, catalepsy). However, if the manifestations do not fit the conversion pattern of immediate need, and when they do not represent the result of chronic emotional tension states, the reactions will be properly classified under somatization reactions (see (f) below).

(f) *Somatization reactions*.

1. *General* :

This term is used in preference to "psychosomatic reactions," since the latter term refers to a point of view on the discipline of medicine as a whole rather than to certain specified conditions.

The anxiety is relieved in such reactions by channeling the originating impulses through the autonomic nervous system into visceral organ symptoms and complaints. These reactions represent the visceral expression of the anxiety, which is thereby largely prevented from being conscious. The symptom is due to a chronic and exaggerated state of the normal physiology of the emotion, with the feeling or subjective part repressed. Long continued visceral dysfunction may eventuate in structural changes.

This group includes the so-called organ neuroses. It also includes certain of the cases formerly classified under a wide variety of diagnostic terms, such as "conversion hysteria," "anxiety state," "cardiac neurosis," "gastric neurosis," etc.

It may become necessary to add certain other subgroups of psychogenic reactions. It is not intended that the six listed be interpreted as necessarily including all possible reactions of this sort. If additional subcategories are recorded as diagnoses, they should be clearly identified as psychogenic reactions, and should specify the system involved and the particular symptomatic expressions.

Each type of this reaction should be amplified with the specific symptomatic expressions, as anorexia, loss of weight, dysmenorrhea, hypertension, etc.

2. *Psychogenic gastrointestinal reaction* :

This subcategory may include some instances of such specified types of gastrointestinal disorders as peptic ulcer-like reaction, chronic gastritis, mucous colitis, constipation, "heart burn," hyperacidity, pylorospasm, "irritable colon," etc.

3. *Psychogenic cardiovascular reaction* :

This subcategory includes most cases of such established types of cardiovascular disorders as paroxysmal tachycardia, pseudoangina pectoris, and some types of hypertension.

Neurocirculatory asthenia has been classically defined as an "anxiety reaction"; similar clinical pictures, without subjective anxiety, will be classified as psychogenic cardiovascular reaction.

4. *Psychogenic genitourinary reaction* :

This subcategory includes some types of menstrual disturbances, impotence, frigidity, dysuria, etc.

5. *Psychogenic allergic reaction* :

Occasional instances of apparent allergic responses, including some cases of hives and angioneurotic edema, have a major emotional element in their production. Such cases should be recorded as psychogenic allergic reactions.

6. *Psychogenic skin reaction* :

This subcategory includes the so-called neurodermatoses, dermatographia, and other related disorders, when involving major emotional factors.

7. *Psychogenic asthenic reaction* :

General fatigue is the predominating complaint of such reactions. It may be associated with visceral complaints, but it may also include "mixed" visceral organ symptoms and complaints. Present weakness and fatigue may indicate a physiological neuro-endocrine residue of a previous anxiety, and not necessarily an active psychological conflict. The term includes cases previously termed "neurasthenia."

(g) *Obsessive-compulsive reaction*.—In this reaction the anxiety may be observable in connection with obsessional fear of uncontrollable impulses. On the other hand the anxiety may be under apparent control, through a mental mechanism (isolation), by which the emotional charge becomes automatically separated from the main stream of consciousness and manifests itself in a displaced form through useless or excessive, and often repetitive, activity. In the latter instance the patient is utilizing the mental mechanisms of "undoing"—a symbolic act which temporarily protects the patient against a threat—and "displacement." The patient himself may regard his ideas and behavior as unreasonable and even silly, but nevertheless is compelled to carry out his rituals.

The diagnosis should specify the symptomatic expressions of such reactions, including touching, counting, ceremonials, handwashing, recurring thoughts, accompanied often by compulsion to repetitive action. This category includes many cases formerly classified as "psychasthenia."

(h) *Hypochondriacal reaction*.—This particular psychoneurotic disorder is characterized by obsessive concern of the individual about his state of health or the condition of his organs. It is often accompanied by a multiplicity of complaints about different organs or body systems. Some of such reactions may become excessively and persistently obsessional and develop associated compulsions. Such cases may be classified more accurately as "obsessive-compulsive reactions."

In general, this type of reaction should be carefully differentiated from depression, obsessive-compulsive reaction, symptoms of prepsychotic reactions, and various specific somatization syndromes. This term is synonymous with "hypochondriasis."

(i) *Neurotic depressive reaction*.—The anxiety in this reaction is allayed, and hence partially relieved by self-depreciation through mental mechanism of

introjection. The reaction is often associated with the feeling of guilt for past failures or deeds. This reaction is a non-psychotic response precipitated by a current situation—frequently some loss sustained by the patient—although dynamically the depression is usually related to a repressed (unconscious) aggression. The degree of the reaction in such cases is dependent upon the intensity of the patient's ambivalent feeling towards his loss (love, possessions, etc.), as well as upon the realistic circumstances of the loss.

The term is synonymous with "reactive depression." This reaction must be differentiated from the corresponding psychotic response (see par. 18a (6) (b).)

(4) CHARACTER AND BEHAVIOR DISORDERS.

(a) *General.*

Such disorders are characterized by developmental defects or pathological trends in the personality structure, with minimal subjective anxiety, and little or no sense of distress. In most instances, the disorder is manifested by a lifelong pattern of action or behavior ("acting out"), rather than by mental or emotional symptoms.

None of the conditions included in this disorder group (character and behavior disorders) is acceptable as the cause of separation from the service for disability.

(b) *Pathological Personality Types.*

1. *General.*—The maladjustment of many individuals is evidenced in lifelong behavior patterns. Such individuals are frequently described as personality types. In the evolution of psychoneuroses or psychoses, these types may be likened to abortive stages. They do not usually progress to the stage of a psychosis, nor do they justify a diagnosis of any type of neurosis or psychosis, although they may show some of the characteristics of both. They represent borderline adjustment states. The following types of pathological personality types will be differentiated.

2. *Schizoid personality.*—Such individuals react with unsociability, seclusiveness, serious-mindedness, nomadism, and often with eccentricity.

3. *Paranoid personality.*—Such individuals are characterized by many traits of the schizoid personality, coupled with a conspicuous trend to utilize a projection mechanism, expressed by suspiciousness, envy, extreme jealousy, and stubbornness.

4. *Cyclothymic personality.*—Such individuals are characterized by frequently alternating moods of elation and sadness, stimulated apparently by internal factors rather than by external events. The patient may occasionally be either persistently euphoric or depressed, without falsification or distortion of reality. The diagnosis should specify, if possible, whether hypomanic, depressed, or alternating.

5. *Inadequate personality.*—Such individuals are characterized by inadequate response to intellectual, emotional, social, and physical demands. They are neither physically nor mentally grossly deficient on examination, but they do show inadaptability, ineptness, poor judgment and social incompatibility.

6. *Antisocial personality*.—This term refers to chronically antisocial individuals who, despite a normal moral background, are always in trouble, profiting neither from experience nor punishment, and maintaining no real loyalties to any person, group, or code. Ordinarily an individual of this type is not the calculating criminal, but one who is on the verge of criminal conduct and may eventually become involved in such conduct.

This term includes most cases formerly classed as "constitutional psychopathic state" and "psychopathic personality," but, as defined here, the term is more limited as well as more specific in its application.

7. *Asocial personality*.—This term applies to individuals who manifest their disregard for social codes and often come in conflict with them, by becoming gangsters, vagabonds, racketeers, prostitutes and generally environmental ("normal") criminals. Many such individuals are to be regarded as the normal product of a life-long abnormal environment. This term includes most cases formerly designated as "psychopathic personality, with asocial and amoral trends."

8. *Sexual deviate*.—These conditions are often a symptom complex, seen in more extensive syndromes as schizophrenic and obsessional reactions. The term includes most of the cases formerly classed as "psychopathic personality, with pathologic sexuality."

The diagnosis will state whether overt or latent, and specify the specific type of the pathologic behavior, such as homosexuality, transvestism, pedophilia, fetishism, and sexual sadism (including rape, sexual assault, mutilation).

(c) *Addiction*.

This diagnosis usually implies antisocial behavior, while the individual is under the influence of alcohol or drug, such as pugnaciousness, deception, stealing, sexual assault, etc. It represents a much deeper character disturbance than cases where the usage of alcohol or drug represents a symptom of some more extensive psychiatric illness. This term should not include excessive symptomatic utilization of alcohol, which is a symptom of depression or psychoneurosis; nor should it include acute alcoholic intoxication.

The term includes cases formerly classed merely as "drug addiction" and also some cases which were formerly classified as "constitutional psychopathic state."

The diagnosis should specify whether the addiction is to alcohol or drug.

(d) *Immaturity Reactions*.

1. *General*.—This category applies to physically adult individuals, who are unable to maintain their emotional equilibrium and independence under minor or major stress, because of deficiencies in emotional development. Some individuals are classed in this group because their behavior disturbance is based on fixation of certain character patterns; others, because their behavior is a regressive reaction due to severe stress.

The classification will be applied only to such character and behavior disorders in which the neurotic features (such as anxiety, conversion, phobia, etc.) are not prominent, and only the basic personality development, and not

anxiety, is the crucial distinguishing factor. Evidence of physical immaturity may or may not be present.

The diagnosis should report the specific immaturity reaction as defined below.

2. *Emotional instability reaction.*—In this reaction the individual reacts with excitability and ineffectiveness when confronted with minor stress. His judgment may be undependable under stress, and his relationship to other people is continuously fraught with fluctuating emotional attitudes, because of strong and poorly controlled hostility, guilt, and anxiety which require quick mobilization of defence, usually explosive in nature, for the protection of the ego.

This term is synonymous with the former diagnosis of "psychopathic personality, with emotional instability."

3. *Passive-dependency reaction.*—This reaction is characterized by helplessness, indecisiveness, and a tendency to cling to others. The clinical picture in such cases is often associated with an anxiety reaction which is typically psychoneurotic, but it may be also a type of emotionally immature personality development. There is a predominant child-parent relationship in such reactions.

4. *Passive-aggressive reaction.*—The aggressiveness is expressed in such reactions by passive measures, such as pouting, stubbornness, procrastination, inefficiency and passive obstructionism.

5. *Aggressive reaction.*—A persistent reaction to frustration with irritability, temper tantrums, and destructive behavior is the dominant factor in such cases. A specific variety of this reaction is a morbid or pathological resentment. Below the surface there is usually evident in such cases a deep dependency, with "reaction formation." The term does not apply to cases more accurately described by the term "antisocial personality."

6. *Immaturity with symptomatic "habit" reaction.*—This category is useful in occasional situations where a specific symptom is the single outstanding expression of the psychopathology. These terms should not be used as diagnoses, however, when the symptoms are associated with or are secondary to organic illnesses and defects or to other psychiatric disorders or reactions. Thus, for example, the diagnosis "immaturity with symptomatic habit reaction; speech disorder" would be used for certain disturbances in speech, often developing in childhood, in which there are insufficient other symptoms to justify any other definite diagnosis. It would not be used for a speech impairment that was a temporary symptom of conversion hysteria, or that was the result of any organic disease or defect.

The diagnosis should specify the particular "habit" reaction, as, for instance, enuresis, speech disorder, etc.

(5) DISORDERS OF INTELLIGENCE.

(a) *Mental Deficiency.*

1. *General.*—Mental deterioration associated with chronic psychoses and blocking of intellectual function by emotional conflicts should not be included

in this category. In recording mental deficiency, distinction will be made between primary and secondary types of the disorder as defined below.

None of the conditions included in the group, Disorders of Intelligence, is acceptable as the cause of separation from the service for disability.

2. *Mental deficiency, primary.*—The term will be applied to cases in which the mental retardation has been present since birth or infancy, without known organic brain disease. It includes clearly hereditary cases. In recording such disorder, the mental age should be indicated, along with the psychometric test by which it was determined.

3. *Mental deficiency, secondary.*—The term will be applied to cases of mental retardation which have resulted from an organic disease of the brain, whether congenital or acquired. Frequently, therefore, when the organic disease is also present, the mental deficiency will be recorded only as a manifestation of the originating organic disease, as for instance, with cerebral agenesis, developmental defects of the central nervous system, microcephaly, hydrocephalus, cretinism, etc. In other instances, such as when secondary to encephalitis or birth injury, the originating condition may not be recorded as a diagnosis, because it is not then present. The diagnosis of mental deficiency in such cases will be qualified as secondary to the specific originating condition.

In all cases the condition should be recorded as mental deficiency, secondary, and the mental age of the individual should be specified, along with the psychological test by which it was determined.

(b) *Specific Learning Defects.*

The diagnosis should specify whether the defect is reading, mathematics, strephosymbolia, etc. If known, the type of encephalopathy will be stated. This diagnosis is not acceptable as the cause of separation from the service for disability.

(6) PSYCHOTIC DISORDERS.

(a) *Psychoses without Known Organic Etiology.*

1. *General.*

These disorders are characterized by a varying degree of personality disintegration and failure to test and evaluate correctly external reality in various spheres. In addition, individuals with such disorders fail in their ability to relate themselves effectively or happily to other people or to their own work.

2. *Schizophrenic Disorders.*

(a) *General.*—This term represents a group of psychotic disorders characterized by fundamental disturbances in reality-relationships and concept formations, with consequent affective and intellectual disturbances in varying degrees and mixtures. The disorders are marked by strong tendency to retreat from reality, by emotional disharmony, unpredictable disturbances in stream of thought, and by a tendency to "flattening-out" the emotional and libidinal struggle, which gives the appearance of "deterioration"—not necessarily fulfilled—that may progress to childishness ("dementia").

It is not essential forcibly to classify such patients into a Kraepelinian type. The predominant symptomatology will be the determining factor in classifying such patients.

(b) *Schizophrenic reaction, latent*.—Certain individuals are found on examination to present definite schizophrenic ideation and behavior (e.g. mannerisms, unpredictable acts), beyond that of the schizoid personality, but not of an advanced stage, as in acute or chronic schizophrenic reactions. These individuals may be incipient schizophrenics, and they may maintain their borderline adjustment over long periods. Among their friends these individuals are regarded merely as queer or eccentric; under close examination, however, they show evidence of psychotic symptoms. They represent essentially borderline psychoses.

Important diagnostic evidence of such reactions consists of disordered conceptual (categorical) thinking as manifested in special tests, such as the Rorschach test, the Vigotsky (Hanfmann-Kasanin) category tests, the sorting tests (Goldstein-Sheerer, Rapaport, and Halstead), proverbs and problems (J. Benjamin, N. Cameron), and the Murray Thematic Apperception Test. Hospitalization of such cases is rarely necessary.

(c) *Schizophrenic reaction, simple type*.—This type of reaction is characterized chiefly by reduction in external attachments and interests and impoverishment of human relationships. It often involves adjustment on a lower psychobiologic level of functioning, usually accompanied by apathy and indifference, but rarely by conspicuous delusions or hallucinations. In contrast to the long history—without any, or slight, change in symptomatology—of the schizoid personality, there is characteristically a change in the personality in the simple type of schizophrenic reaction.

(d) *Schizophrenic reaction, hebephrenic type*.—Such reactions are characterized by shallow inappropriate affect, unpredictable giggling, silly behavior and mannerisms, delusions often of a somatic nature, and hallucinations.

(e) *Schizophrenic reaction, catatonic type*.—The reaction is characterized chiefly by conspicuous motor behavior, exhibiting either marked generalized inhibition resulting in stupor, mutism, negativism and waxy flexibility, or excessive motor activity and excitement. The individual may regress to a state of vegetation.

(f) *Schizophrenic reaction, paranoid type*.—This type of reaction is characterized by schizophrenic (derealistic and autistic) thinking and unpredictable behavior, with mental content composed chiefly of delusions of persecution, occasionally of grandeur, hallucinations, a fairly constant attitude of hostility and aggression, and ideas of reference. Excessive religiosity may be present and, rarely, there may be no delusions of persecution, but instead an expansive and productive delusional system of omnipotence, genius, or special ability. The systematized paranoid hypochondriacal states are included in this group. It will be borne in mind that some patients manifest their paranoid ideas only when they are depressed, and others only when they are manic.

(g) *Schizophrenic reaction, unclassified*.—There are two large groups (acute and chronic) of schizophrenic reactions which cannot be appropriately classified under the four Kraepelinian types.

The acute group of this reaction includes a wide variety of schizophrenic symptomatology, such as confusion of thinking and turmoil of emotion, accompanied by secondary elaboration, manifested by perplexity, ideas of reference, fear and dream states, and dissociative phenomena. These symptoms appear precipitously, often without apparent precipitating stress, but exhibiting historical evidence of prodromal symptoms. Very often it is accompanied by a pronounced affective coloring of either excitement or depression. The symptoms often clear in a matter of weeks, although there is a tendency for them to recur.

The chronic schizophrenias exhibit a mixed symptomatology, and when the reaction cannot be classed in any of the four Kraepelinian types it should be placed in this group.

3. *Paranoid Disorders.*

(a) *Paranoia*.—This type of psychotic disorder is extremely rare. It is characterized by an intricate, complex, and slowly developing paranoid system, with the individual usually regarding himself as particularly singled out. The patient often endows himself with superior or unique ability, and even considers himself appointed for a Messianic mission. The paranoid system is particularly isolated from much of the normal stream of consciousness, without hallucinations and with relative intactness and preservation of the remainder of the personality.

(b) *Paranoid state*.—This type of paranoid disorder is characterized by transient paranoid delusions. It lacks the logical nature of systematization seen in paranoia; yet it does not manifest the bizarre fragmentation and deterioration of the schizophrenic. It occurs most frequently in individuals between 35 and 55 years of age, and it is ordinarily of a relatively short duration, though it may be persistent and chronic.

4. *Affective Disorders.*

(a) *Manic-depressive reaction*.—This reaction will be further qualified by the appropriate one of the following terms: Manic, depressive, stuporous, circular, agitated, with schizophrenic coloring, and mixed.

(b) *Psychotic depressive reaction*.—This differs from the neurotic depressive reaction chiefly in degree. If the patient manifests evidence of gross misinterpretation of external reality (e.g. in matters of guilt and unworthiness), it technically becomes a psychosis and should be classified as "psychotic depressive reaction."

(c) *Involution melancholia*.—This reaction is characterized most commonly by depression, with or without agitation, without previous history of either manic or depressive illnesses. It occurs in the individual's middle life and in his later years. It tends to have a prolonged course and may be manifested by worry, guilt, anxiety, agitation, paranoid and other delusional ideas, and somatic concerns. Some cases are characterized chiefly by depression and others chiefly by paranoid ideas. Often there are gastrointestinal or other somatic concerns to a delusional degree.

(b) *Psychoses with Demonstrable Etiology or Associated Structural Changes in the Brain, or Both.*

The mental reactions with a system infection and with brain infection, neoplasm, trauma, degenerative disease, or vascular disease, are to be regarded as symptoms of the physical (non-psychiatric) condition with which they are associated. When the psychotic reaction does not constitute any of the clinical pictures defined above, it will be reported as "psychotic reaction" and amplified by one or more of the following descriptive terms as types: Schizoid, paranoid, depressed, manic, euphoric, deteriorated, confused, anxious, agitated, panic, excited, delirious, apathetic, stuporous, specific behavior disorder.

Included in this category are the psychoses associated with infections (general paresis, meningo-vascular syphilis, epidemic encephalitis, etc.), the psychoses associated with exogenous poisonings, and other associated psychoses, such as ones accompanying pellagra, cerebral embolism, Huntington's chorea, etc.

(B) MANNER OF RECORDING.

(1) INDIVIDUAL MEDICAL RECORDS.

(a) *General.*

The reactions, or specific types of psychiatric conditions (anxiety reaction, emotional instability reaction, schizophrenic reaction, simple type, etc.), are sufficiently well defined to justify their use apart from any generic terms indicating the broad disorder groups (psychoneurotic disorders, character and behavior disorders, immaturity reactions, psychoses without known organic etiology, schizophrenic disorders, etc.). In recording psychiatric conditions only the lowest subclassification of the disorder will be specified, without being prefaced by any term, such as psychoneurosis or psychosis. Even though the list of terms (par. 21) includes the generic terms for the broad disorder groups, these will not be recorded as part of the diagnosis.

In each case the severity of the reaction will be recorded in accordance with paragraph 11d, and the reaction will be qualified as acute or chronic. The severity of a particular reaction should not be determined solely by the degree of ineffectiveness, since other factors, such as underlying defective attitude, other psychiatric or physical condition, etc., may contribute to the total ineffectiveness.

Outstanding or conspicuous symptomatology may be added to any of the psychiatric diagnoses; manifestations must be reported for those reactions indicated in the list of terms (par. 21) as requiring such reporting.

(b) *Multiple Diagnoses: Psychiatric Reactions with Physical Disorders.*

1. *General.*—The general principle governing recording of all diagnoses (par. 3b) will likewise apply to the selection of the first diagnosis in cases which involve psychiatric conditions. The immediate condition which was principally responsible for the initial admission is to be considered as the primary cause of admission and recorded as Dg. 1. In applying this general principle

to cases involving psychiatric conditions, the following combinations may be considered.

2. *Unrelated diagnoses.*—Physical and mental disorders may coexist, but be casually unrelated. In such instances the two or more conditions will be listed as separate diagnoses, with the primary diagnosis being selected on the usual basis. Example: 1. Diabetes mellitus; 2. Mental deficiency, primary, etc.

3. *Related diagnoses.*—Physical and mental disorders may coexist and be causally related. Whether the two conditions are recorded as separate diagnoses or as only one depends on the nature of the conditions.

(a) *Combinations requiring only one diagnosis.*—In some instances the mental reaction, though related, is not sufficiently developed as a clinical psychiatric entity to make a formal psychiatric diagnosis either necessary or indicated. For example, a patient with pneumonia may be apprehensive and tense; the mental status should be described in the clinical history or physical examination along with any other symptom or sign. Minor nonpsychotic mental reactions need be reported only thus: the individual medical record will carry only the nonpsychiatric diagnosis.

Definite pathological mental reactions, other than well-defined clinical syndromes, may often be symptoms of organic disease of the brain, including trauma or intoxication. These include such instances as delirium of febrile reaction, intoxication with uremia, mental reactions with any systemic infection and with brain infection, neoplasm, trauma, degenerative disease or vascular disease. As such, these conditions are to be regarded as symptoms of the physical condition.

Whenever such a mental reaction which does not constitute any of the well defined clinical pictures is sufficiently pronounced to justify mention in the diagnosis, it will be recorded as a manifestation of the primary diagnosis. Since it does not constitute a well-defined clinical type, it will be specified as a non-psychotic or psychotic reaction and amplified by one or more of the following descriptive terms as types: Schizoid, paranoid, depressed, manic, euphoric, deteriorated, confused, anxious, agitated, panic, excited, delirious, apathetic, stuporous, specific behavior disorder. The degree of stress, pre-disposition and incapacity will not be listed.

Examples.—(a) Syphilitic meningo-encephalitis, "old," etc., manifested by psychotic reaction, confused; (b) epidemic encephalitis, acute, etc., manifested by non-psychotic reaction, behavior disorder.

There are other instances where physical and mental disorders coexist, and where the physical disorder is a manifestation of the psychiatric condition rather than a separate condition. Where this is true, only the psychiatric condition should be listed as a diagnosis and the physical condition should be shown as a manifestation thereof. *Example:* Psychogenic gastro-intestinal reaction, chronic, severe, manifested by mucous colitis and hyperacidity.

(b) *Combinations requiring separate diagnoses.*—Physical and mental disorders may coexist and be causally related, with both conditions being sufficiently marked and well defined to justify separate diagnosis. In such cases the causal relationship of the diagnoses should be indicated. The selection

of the order of the diagnoses will depend upon which condition was first in the chain of etiology ; the one which caused or directly led to the other will be selected as first diagnosis (see par. 3b). This order of diagnoses will be followed despite the fact that in most, if not all, cases the psychiatric symptomatology is related to personality factors existing prior to the physical disease or trauma. *Example* : (a) Fracture of skull—simple, depressed, left occipital area, etc. ; (b) paranoid state, precipitated by skull fractures, etc.

(c) *Multiple psychiatric diagnoses.*—If and when two separate psychiatric conditions exist, such as a psychopathic personality and a psychosis, both shall be recorded. If a diagnostic entity (which, if encountered as an isolated personality disturbance, would be recorded as the only diagnosis) is a part of a more extensive process or secondary to it, the primary diagnosis will be given, with the less important condition given as a manifestation of that diagnosis. *Example* : Anxiety reaction manifested by somnambulism, passive-aggressive reaction manifested by enuresis (list other manifestations), asocial reaction type with sexual sadism.

Some psychiatric conditions, if established as the primary diagnosis, are incompatible with certain other psychiatric diagnoses and will not be recorded as existing together. *Example* : Psychoneurotic and psychotic reactions ; acute situational maladjustment with psychoneurotic or psychotic reactions ; combat exhaustion with psychoneurotic or psychotic reactions. Many of these conditions may progress from one to another, but are not simultaneously present ; similarly, only one type of psychoneurotic or psychotic reaction will be used as a diagnosis, even in the presence of symptoms of another type. The diagnosis in such cases will be based on the predominant type, with a statement of manifestations, including symptoms of other types of reaction, thus : " Anxiety reaction, with minor conversion symptoms, etc."

(2) CLINICAL RECORDS.

(a) *General.*

For certain conditions, the diagnosis of merely the type of reaction does not furnish sufficient information to determine disposition. Thus, for example, the term " anxiety reaction " does not convey whether the illness occurred in a previously normal or neurotic personality ; it does not indicate the degree and nature of the external stress, nor does it reveal the extremely important information as to the degree to which the patient's functional capacity has been impaired. Therefore, for certain conditions, as specified below, a complete diagnostic evaluation will be entered in the clinical records, including this information in addition to all of the requirements provided in (1) above for recording diagnoses on the Individual Medical Records. Each case so diagnosed will be evaluated from the following standpoints :

Type and severity of symptoms (diagnostic term, recorded on Individual Medical Records).

External precipitating stress.

Premorbid personality and predisposition.

Degree of resultant incapacity (psychiatric disability).

The complete diagnostic evaluation for such cases will be recorded in the clinical records, and dated in those situations and installations in which the medical officer has sufficient opportunity to evaluate the various points. When he does not have sufficient opportunity or information he should so indicate with the term "unknown" or "not determined." It is extremely important that those medical officers in the field, such as the flight surgeon, the division psychiatrist and the mental hygiene consultation psychiatrist, should indicate the external stress, even though they may not have the opportunity to determine predisposition.

In the utilization of this method of recording a diagnosis it is essential to recognize that the time element is all important; the diagnostic formulation on any particular date may (and in many cases, should) be changed at a subsequent date. A soldier may show marked incapacity upon admission to a hospital, but a few days later can return to duty with minor or no impairment. The disorder diagnosis of any particular type will in no way determine disposition, and the functional incapacity, in cases where these are to be reported. Heretofore the disorder diagnosis was all-important. Under the present system it becomes only one of the four factors to be considered in determining disposition.

(b) *Conditions Requiring Complete Diagnostic Evaluation.*

The four points listed above will apply to the following diagnostic categories: The transient personality reactions to acute or special stress (combat exhaustion and acute situational maladjustment), all types of psychoneurotic disorders, the immaturity reactions, and the various types of schizophrenic, affective and paranoid disorders. The stress, predisposition and degree of incapacity will not be outlined for the character and behaviour disorders, except for immaturity reactions, mental deficiency and psychotic reactions with organic etiology.

(c) *Requirements of Complete Diagnostic Evaluation.*

1. *Type and severity of symptoms (the diagnostic term).*—The provisions of par. B (1) above govern the recording of this first part of the four-part complete diagnostic evaluation. The diagnostic terms to be used are defined in paragraph 21. The severity of reaction will be described by the appropriate word "mild," "moderate," "severe," and qualified as either "acute" or "chronic." Outstanding or conspicuous symptomatology may be listed. *Example:* "Anxiety reaction, mild, chronic, manifested by loss of appetite and insomnia." Obscure, ill-defined, and rarely used technical terms are to be avoided. If a reaction was severe and acute upon admission to a medical installation but improvement or recovery was affected with treatment, it will be recorded as "(type of reaction), acute, severe, improved, or recovered."

2. *Stress.*—Under this heading the external stress is to be evaluated as to type, degree and duration. The stress will generally refer to the environmental situation, Army or otherwise, which is the direct cause of the reaction manifest in the patient. Unconscious internal conflicts will not be considered external stresses. The evaluation of the unconscious internal conflicts is

important both in the understanding of the nature of the clinical picture and in determining a basis for treatment and for estimating prognosis. It is omitted here only because of the difficulty in its uniform formulation and the varying degrees of understanding of psychodynamics by medical officers practising psychiatry in the Army.

The judgment of the military stress can be made most accurately by the medical officer in the patient's own unit, since living in the same environment qualifies him to judge the stress. The opinion of the individual's commanding officer may be of value. It may be more difficult for a hospital psychiatrist to evaluate the stress to which the individual has been subjected, and when the stress cannot be determined it should be recorded as "unknown."

The degree of stress, whether that of combat, regimentation, training, isolation, or other type, must be evaluated in terms of its effect on the "average man" of the group, rather than on the patient. It should not be presumed that a particular environmental stress is severe because one or even several individuals react poorly to it, since these individuals may have had poor resistance to this stress. Stress will be classified as "severe," "moderate," and "minimal." Severe stress is such that the average man could be expected to develop disabling psychiatric symptoms when exposed to it. Minimal stress is such that the average man could be exposed to it without developing psychiatric symptoms. Examples of recording stress :

"Severe stress of 60 days' continuous combat as a rifleman"; "severe stress of 30 hazardous combat missions"; "moderate stress of serious chronic domestic problems"; "stress unknown or not determined."

3. *Predisposition*.—The description of the predisposition will consist of a brief statement of the outstanding personality traits or weaknesses which have resulted from inheritance and development and an evaluation of the degree of predisposition based on past-history and personality traits, recorded as "no predisposition evident," "mild," "moderate," and "severe."

(a) *No predisposition evident*.—This description will be used when there is no evidence of previous personality traits or make-up which appear to be related to the patient's present illness, and when there is no positive history of psychoneurotic or other mental illness in his immediate family.

(b) *Mild predisposition*.—This description will be used when the patient's history reveals mild transient psychological (emotional) upsets and abnormal personality traits, or defect of intelligence which, however, did not require medical care. It will also be used when there is a past history of mental illness in the patient's family.

(c) *Moderate predisposition*.—This description will be used when the patient has a personal history of partially incapacitating psychological (emotional) upsets, or abnormal personality traits or defects in intelligence which resulted in his social maladjustment.

(d) *Severe predisposition*.—This description will be used in the presence of the patient's definite history of previous overt emotional or mental illness or disorder.

4. *Degree of incapacity (psychiatric disability)*.—The psychiatric disability represents the degree to which the individual's total functional capacity has

been impaired by the psychiatric condition. This is not necessarily the same as ineffectiveness, and therefore the degree of incapacity reported should not be determined solely by the degree of ineffectiveness. Effectiveness in any particular job is a resultant of the individual's emotional stability, intellect, physical condition, attitude, training, etc., as well as the degree and type of his psychiatric disability. Depending upon other circumstances, a man with a moderate psychiatric disability may be more effective than another man with a minimal disability. Degree of incapacity as used here refers only to ineffectiveness resulting from the current psychiatric disability.

The degree of disability at the time of original consultation or admission to the hospital will often vary from the degree of impairment after treatment. Disability at the termination of treatment represents the residual or persistent impairment. It will be recorded as *none*, *minimal*, *moderate*, *marked*. The individual's capacity to perform military service will be used as the base-line in estimating the degree of impairment.

(a) *No impairment*.—This term will be used when, in the opinion of the medical officer, there are no medical reasons for changing the patient's current assignment or duty. An individual may have certain symptoms and yet have no medical reason for not performing full duty. For instance, symptoms of anxiety state are present in the majority of troops engaged in combat; a returnee with mild symptoms may fail to function because of his attitude and not because of the severity of his illness.

(b) *Minimal impairment*.—This term will be used to indicate a slight residual degree of impairment in the patient's ability to carry on in his current assignment or duty.

(c) *Moderate impairment*.—This term will be used to indicate a residual degree of incapacity which seriously, but not totally, interferes with the patient's ability to carry on in his current assignment or duty.

(d) *Marked impairment*.—This term will be used to indicate a residual degree of incapacity which totally prevents the patient from satisfactorily functioning in his current assignment. As in all cases of incapacity, the impairment may be temporary; in some cases it may be permanent.

[Extracted from T.B. MED 203, *War Department Technical Bulletin*, dated October 19, 1945. Subject: Nomenclature and Method of Recording Diagnoses.]

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The Horn-Hellersberg Test and Adjustment to Reality.

A performance test is presented which uses a set of given lines and squares for drawing pictures. The individual must adapt his subjective images to objectively given material. This process of using inner impulses in adapting to outer necessities is a fundamental function of our life process. It changes with the inner conditions of the individual, and develops gradually from childhood to adulthood in a fashion typical for the civilization. The test particularly activates perception, motor activity as drawing, and verbalization. The evaluation may utilize various levels of human functioning, and the validity of the obtained results is believed to derive from the fact that these various levels check and control each other. The test has been devised particularly for the practical working psychologist, as a means to control various environmental and therapeutic influences on the client. The obtained material has various implications for the study of personality. Its analysis has proved specifically helpful for screening out individuals who are at the moment unable to cope with their environment or their given job, and this holds true, independent of the type of disturbance shown by their psychiatric diagnosis. The test can be repeated, and, so far as we have been able to follow it up, always registers changes in the individual's relation to reality.

(Author's abstr.)

An Alternative Short Form of the Wechsler-Bellevue Test.

A statistical survey was made to determine which subtests of the Wechsler-Bellevue could best predict the total score. These tests were found to be the Digit Repeating Test and the Picture Arrangement Test. This short form was found to be superior to the Rabin Short Form, providing particularly for discrimination in the IQ range from 40 to 70, and had a correlation of .90 with the full scale in 523 cases from a heterogeneous population.

To use the short form: (1) administer the Digit Repeating Test and obtain a weighted score; (2) administer the Picture Arrangement Test and obtain a weighted score; (3) add the two weighted scores and multiply by five; (4) use the product obtained above to find the IQ in Wechsler's tables. (Author's abstr.)

* A number of extracts in this section are reproduced from *Chemical Abstracts* and *Psychological Abstracts*. To the Editors of these Journals we extend our grateful thanks.

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Prolonged Post-traumatic Syndromes following Head Injury.

1. A series of 125 late post-traumatic syndromes have been compared to 70 cases with acute head injuries, 30 cases with brain disease, and 40 psychoneuroses.

2. The common features of late post-traumatic syndromes were the abnormal high score on the neurotic scales of the Minnesota multiphasic personality inventory and the large number of diffuse complaints. Related to the presence of brain damage in chronic head cases were increase in metabolism and muscular tension, decrease of intelligence, delayed return of sugar values to the base line in insulin and glucose tolerance tests, increase in white blood count, insufficient increase of the pulse rate during stress and after injection of epinephrine. Related to the presence of neurotic tendencies were higher intelligence, greater ventilation volume, irregularity of breathing and decrease of endurance to stress.

3. Comparison of late post-traumatic syndromes with acute head injuries and cases with brain disease on the one hand, and psychoneuroses on the other, revealed that chronic head cases without signs of brain damage resemble the psychoneuroses, and often cannot be distinguished from these. Chronic head cases with neurological signs are in many respects closer to the acute cases, and resemble the psychoneuroses less.

4. In late post-traumatic conditions the importance of organic damage to the brain has been widely over-rated. While cases with severe brain lesions improve as time goes on, post-traumatic conditions without signs of cerebral damage tend to become worse. The longer a post-traumatic syndrome lasts, the less likely it is to be an expression of brain damage, and after one year following the accident most post-traumatic conditions constitute personality problems, convulsive disorders excepted.

5. The post-traumatic personality is a determining factor for delayed or definitely postponed recovery following head injury. While overt and social maladjustment is related to accident-proneness, covert maladjustment, conflicts

and dissatisfaction seem to be associated with prolonged convalescence and post-traumatic physical symptom formation.

6. Abnormal states of mind associated with intoxication, excitement, hatred, fear, guilt or other emotions predispose to accidents. While in some cases the injury may act as a release and solution for an unbearable situation, the environmental conditions and the subject's state of mind after the injury are in many instances the same as before the accident. The same circumstances which may lead to accidents seem therefore to predispose to delayed recovery.

7. While the therapy of convulsive disorders, subdural hematomas, brain abscess, paralysis of cranial nerves and extremities follows traditional lines, the psychiatric treatment of late post-traumatic conditions has to start with the prevention of these syndromes in the acute stage. Attention should be directed at investigation of the state of mind prior to the accident. Pre-traumatic difficulties of adjustment, or immediate post-traumatic signs of anxiety, hysteria, or hypochondriasis should be approached with psychotherapeutic measures. The patient's realization of the presence of pre-traumatic personality difficulties and awareness of the responsibility in the causation of the accident seems to favor recovery. Less successful, but quite amenable to psychotherapy, are cases with post-traumatic syndrome of longer standing, seen weeks or months following the injury.

(Authors' abstr.)

The Memory Function. (1) A Factorial Study of Fifteen Clinical Types.

Fifteen individual memory tests and one intelligence test were given to 60 male neurotic army patients at Mill Hill and Sutton Emergency Hospitals. The scores on these 16 tests were intercorrelated, and the resulting table-factor analyzed. The following results were found :

1. All the memory tests correlated positively with the intelligence test, the correlations varying from +0.63 to +0.96.

2. One general factor accounted for all the correlations in the table within the limits of the probable error ; this general factor accounted for 74 per cent. of the variance.

3. It was shown by two separate methods that the general factor found could be equated with general intelligence, or "g," and that all the correlations in the table could be accounted for without the necessity of postulating a "memory" factor.

4. The conclusion was drawn that the ability involved in the clinical tests of "memory" studied in this research was identical with that involved in the intelligence test used, and that therefore it was misleading to accept scores on these various tests as estimates of a person's "memory" ability. (Authors' abstr.)

Bilateral Internal Jugular Blood. Comparison of A-V Differences, Oxygen-Dextrose Ratios and Respiratory Quotients.

Blood was drawn simultaneously from an artery and the two internal jugular veins in 25 subjects.

The oxygen A-V difference was approximately the same on the two sides, except in four patients with psychosis, and in four epileptics with left-sided cerebral pathology. In the latter the oxygen A-V difference on the affected side was relatively great, suggesting a diminished blood-flow.

In all but three of the 25 cases the respiratory quotient approached unity, the average in these 22 being .995 on the right side and .994 on the left side. Variations in the A-V differences in oxygen, as between both individuals and the two sides, did not cause a shift in the value of the respiratory quotient. The average ratio of the A-V difference of oxygen (in volumes per cent.) to the A-V difference of glucose (in milligrams per cent.) was equal, 1.63 on the right side and 1.62 on the left.

In seven cases hyperpnoea produced the usual increase in the oxygen A-V difference, without consistent differences on the two sides, even in the presence of unilateral brain pathology.

Simultaneous puncture of the jugulars and artery is not necessary if A-V differences in the oxygen content of the blood are being measured, but it is necessary if the carbon dioxide content, the respiratory quotient, or the oxygen-glucose ratios are being measured.

(Authors' abstr.)

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Electroencephalographic Study of Criminals.

Electroencephalographic study of 452 criminals and 1,432 control subjects reveals that when age factors and sampling errors are controlled there are no significant differences between the two groups. Since the EEG is a fairly reliable indicator of epilepsy and organic brain disease, it seems reasonable to conclude that sub-clinical forms of these disorders are not contributing factors in a significant fraction of the "sane" criminal population.

No significant correlation could be found between the EEG and the type of criminal behavior. (Authors' abstr.)

The Correlation of Pre-Electroshock Electroencephalogram and Therapeutic Result in Schizophrenia.

A table is presented showing the relationship of EEG before treatment to outcome of electric shock therapy, in 187 schizophrenics, of whom 95 per cent. were young men. One-fourth of those with a normal pattern left the hospital much improved or "quiescent." None of these with abnormal records was able to leave the hospital. Of 19 patients who had previously had insulin therapy, three left the hospital much improved. (Authors' abstr.)

An Electroencephalographic Study of Cases with Syncope and Related Disorders.

In a study of the EEGs (between attacks) of a selected group of 229 patients subject to "fainting spells" and "dizzy spells" the following observations were made:

1. In patients subject to typical "fainting spells" the incidence of EEG abnormality (11 per cent.) was as low as one finds in normal controls.

Patients subject to "dizzy spells" had an even lower incidence of EEG abnormality (4 per cent.).

Patients subject to "fainting spells accompanied by rigidity" had a considerably higher incidence of EEG abnormality (45 per cent.), suggesting that of the three groups this was the only one in which a significant number of the group might belong to the epileptic category.

2. There was no correlation between EEG abnormality and frequency, duration and number of spells. It appears that repeated syncopal attacks do not produce EEG abnormality.

3. Within the total group of 229 cases there were only two patients whose EEGs showed typical 3 per second spike and wave discharges (*petit mal waves*).
(Authors' abstr.)

The Electroencephalogram in Some Military and Selective Service Convulsive and Non-convulsive Problems.

Electroencephalography was performed in 92 military and selective service convulsive and non-convulsive problems.

Of 20 subjects with a history of convulsion during military service observed by other than medical personnel, the EEG was abnormal in 10 (50 per cent.), doubtful in 2 (10 per cent.), and normal in 8 (40 per cent.).

Of 41 subjects with a self-claimed history of rare convulsions months to years ago, the EEG was abnormal in 18 (43.9 per cent.), doubtful in 1 (2.4 per cent.) and normal in 22 (53.4 per cent.).

Of nine subjects with a history of "fainting attack" in the military service, the EEG was abnormal in five (55.6 per cent.) and normal in four (44.4 per cent.).

Of 12 subjects with episodes of faintness with retention of consciousness, the EEG was abnormal in one (8.3 per cent.), doubtful in one (8.3 per cent.), and normal in ten (83.4 per cent.).

Of ten subjects considered malingerers with vague "nervousness" or vague fainting spells, the EEG was abnormal in none, doubtful in one (10 per cent.), and normal in nine (90 per cent.).

From this study it was concluded that the electroencephalogram was of assisting value in the neuropsychiatric diagnosis of non-convulsive and convulsive problems.
(Author's abstr.)

Ageing and Detoxication. Studies in Hippuric Acid Synthesis during Psychoses of the Involutional and Old Age Group.

The detoxifying capacity of the organism during psychoses of the involutional and old age period was investigated by Quick's intravenous hippuric acid test. Seventy-one patients were studied, 48 of whom were 45 years and older; 30 of these were 60 years and older.

Evidence of faulty detoxication was present in more than three times the number of patients of 60 years and older than had been found by previous investigators in mentally normal people of the same age-group. Moreover, a small group (5) of cases of senile dementia had conspicuously low values, even when compared with patients of the same age suffering from affective disorders or from hypertensive encephalopathy.

A comparison of these cases among themselves shows that gross differences in diet and nutrition, differences in body weight, in blood pressure and in urinary excretion can be neglected as sources of error.

The significance of these findings is discussed.

(Authors' abstr.)

The Central Nervous System in Morphinism.

1. A brief review of the literature concerning the central nervous system involvement in morphinism is presented. Although there are scattered clinical and pathological reports which indicate that acute and chronic residuals may result, no consistent picture of the neurological involvement can be formulated.

2. Histopathological studies are reported in three cases of morphinism in which the illness varied in duration from the very acute to the chronic stage.

3. Definite histological alterations were present within the brains of all cases, and consisted of acute or chronic neuronal alteration and destruction and irregular

perivascular demyelination. The damage was similar in all cases, but was more apparent in the chronic ones. The most severe nerve cell changes were observed in the medulla.

4. There is good experimental evidence to suggest that morphine at certain doses may be a cortical stimulant, and is probably contraindicated in toxic conditions resulting in convulsive phenomena. (Author's abstr.)

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Tremors of Combat Neuroses.

Electromyographic studies were made on the tremors of 23 men of combat personnel. Of these patients, 3 had symptoms of lesions of the extrapyramidal tract, and 20 had a condition diagnosed as combat neurosis.

In addition, studies were made on 10 civilians with paralysis agitans and 10 civilians with tremors associated with psychoneurosis.

Electromyographic data are given on tremor in a case of delirium tremens.

The following electromyographic differences were found between the tremor of paralysis agitans and tremors of psychoneurotic origin.

1. The rate of tremors associated with psychoneurosis is usually faster than that of tremors of paralysis agitans, and is often so fast as to give a completely diffuse electromyogram, with no discernible rhythm.

2. The tremor of psychoneurosis does not have the clearly patterned discharge of smooth increase in the voltage to a maximum followed by a smooth decrease that is typical of tremor of paralysis agitans.

3. Clear interspaces between the individual tremor bursts are rarely found in cases of psychoneurosis.

4. Tremor bursts associated with psychoneurosis do not alternate from agonist to antagonist as in paralysis agitans, but usually appear simultaneously in opposing muscles, and sometimes are even exactly synchronous in the timing of the individual discharge. (Author's abstr.)

Incidence of Advanced Maternal Age in Mothers of One Thousand State Hospital Patients.

1. Of 1,000 patients at a State hospital, 94 (9.4 per cent.) had mothers who were over 40 years of age at the time of the patient's birth.

2. In the same series of patients, 174 (17.4 per cent.) had mothers who died before the patients were 20 years old.

3. Paradoxically there was a high death-rate among the younger mothers, with a relatively low mortality-rate among the mothers over 40 years of age.

4. In a preliminary series of psychoneurotic patients, the percentage of older mothers (3.6) was within normal limits. (Author's abstr.)

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Histopathologic Characteristics of Progressive Muscular Atrophy. <i>Hassin, G. B., and Dublin, W.</i>	317

Disturbances in Sleep Mechanism.

In 25 cases of pathologic sleep there was involvement of the corticodiencephalic structures. The hypothalamus was compressed in 16 cases, and its nerve cells showed pathologic changes in all of these cases. In 4 other cases there was actual invasion of the hypothalamus, while in 1 case there was partial destruction of the hypothalamus. In 2 cases the hypothalamus was compressed without changes in its nerve cells. In 2 other cases there was no compression of the hypothalamus or changes in its nerve cells. In 16 cases, in addition to compression or invasion of the hypothalamus, there was compression or invasion of the basal ganglia with implication of the striohypothalamic pathways. Three cases in which tumors occurred in the suprasellar region were placed in this group because the hypothalamus or its pathways and part of the orbital convolutions and cingular gyri were implicated.

Increased intracranial pressure was present in 18 cases and absent in 7 cases. A high incidence of increased intracranial pressure in this group should be expected, as in most of these cases the neoplasm encroached on the ventricular system.

Ocular manifestations, in the form of diplopia, ptosis, weakness of ocular movements and impairment in conjugate deviation, were present in 4 cases. Slight

endocrine disturbances were present in 3 cases, and in these the tumor was situated either within or in the vicinity of the sella turcica. Slight deviations in temperature in the form of hypothermia were present in 4 cases.

From this series of cases of corticodiencephalic lesions, it may be assumed that some fibers for the control of sleep originate in the cortex, and reach the hypothalamus *via* (1) the median forebrain bundle, (2) the fornix, and (3) the inferior thalamic peduncle.
(Authors' abstr.)

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Abnormal Suppression of Cortical Frequencies.

When abnormally slow rhythms appear in the EEG as a result of cerebral damage, whatever the cause, the normal rhythms are suppressed; the degree of damage, abnormal electrical activity and suppression are usually directly related to each other. This abnormal suppression is quite distinct from the rapidly reversible suppression of the normal "alpha" rhythm which is induced by attention.

In some circumstances normal or abnormal rhythms may be suppressed without slow activity, alone or together, and this suppression may be localized. The phenomenon has been investigated in man, and the factors determining it have been studied.

A large number of abnormal subjects with diverse lesions and an adequate number of normal controls were used. The suppression resulting from focal damage or destruction of brain tissue, caused by penetrating gunshot wounds, was studied, and the results were applied to the interpretation of similar suppression associated with other cerebral lesions.

The following conclusions were reached:

(1) Focal suppression of the "alpha" rhythm is always abnormal, as it was not seen in a large group of normals.

(2) Suppression occurs around penetrating gunshot wounds of the brain, and also in the cortex underlying non-penetrating gunshot wounds, and depressed fractures, and also in other circumstances in which brain is violently percussed.

(3) It is caused by complete destruction of brain tissue, but it also results from temporary suspension of activity as a result of percussion. In the first case it is irreversible, in the second full resolution can occur.

(4) This focal suppression is indistinguishable from the generalized suppression of "alpha" activity which is associated with concussion of the brain.

(5) The suppression results directly from physiological or anatomical interference with the area of cortex initiating or propagating the "alpha" rhythm. Because of this the extent, position, and intensity of the suppression are mainly determined by the proximity of the lesion to that cortex, and they do not necessarily reflect the extent, position or severity of the causal lesion. Thus a small lesion of the parieto-occipital cortex will suppress all "alpha" activity in the affected hemisphere, whereas a frontal, temporal or occipital lesion may have no such effect.

(6) Suppression of the "alpha" rhythm is independent of interruption of visual pathways. There is consequently no support for the view that the optic radiations are a link in a neuronal circuit which sustains the rhythm.

(7) Interruption of physiological continuity of the cortex causes interruption of propagation of the "alpha" rhythm. This supports the view that spread of the potential changes is by neuronal and not simple electrical conduction.

(8) Focal or general suppression of the normal rhythms may occur independently of the appearance of abnormal slow activity.

(9) Suppression of abnormal slow waves, which are the direct effect of cerebral damage, is markedly different from the suppression of normal rhythms. Its position, extent and severity are a direct reflection of the position, extent and severity of the injury. It is usually irreversible.

(10) A "silent area" caused by suppression of normal and/or abnormal waves is determined by these conditions whatever the nature, size or position of the cerebral lesion.

(11) A "silent area" is very common in penetrating head injuries, but uncommon in closed. It is only seen in a closed head injury when there has been severe focal percussion of brain; then the local condition mimics that of a penetrating injury. Removal of damaged brain may abolish abnormal activity and leave an area of suppression.

(12) A "silent area" is not characteristic of subdural or extradural haematomas. It is only found when the haematoma covers the posterior parts of the hemisphere, and short-circuiting through the overlying haematoma is not the main cause.

(13) Cerebral angiomas often cause "silent areas," probably because they commonly lie over the parietal lobe.

(14) "Silent areas" are not commonly associated with other cerebral lesions.

(15) Because factors other than the lesion determine the presence and character of a "silent area," application of the phenomenon to clinical diagnosis is difficult, and requires the integration of all other evidences of the lesion with those recorded in the EEG. (Authors' abstr.)

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Personality: A Symposium. I. The Assessment of Personality.

1. The study of an individual's personality should follow a systematic but elastic scheme, based upon an eclectic interpretation of the current doctrines of academic psychology. The view of personality as a dynamic, integrated, purposive whole, generally accepted in this country since the days of Ward and McDougall, lends itself admirably to practical work. The adoption of such a scheme of study, involving a well-chosen and carefully defined set of scientific terms and headings, and comprising both an analytic and a synthetic approach, may nearly double the accuracy of the investigators' judgments.

2. The final summary of each case should include (a) quantitative ratings for the chief key-qualities or "factors," thus providing an analytic description of the child in terms of a standardized scale or set of diagrammatic profiles, and (b) a qualitative character-sketch, giving a synthetic picture of his total personality in words. The accuracy of the quantitative assessments can be measured by the ordinary product moment correlation; that of the character sketches by a correlation coefficient based on a matching procedure.

3. Both the reliability and the validity of personality judgments are appreciably increased if more than one investigator studied each case. The investigators should work independently, and report their findings before consultation, but join in a case-conference at the close. The dominant partners in the team should be an educational psychologist (the same for all cases) and the child's own teacher.

4. The general procedure should consist in a combination of different methods of approach, and not rely on a single method only. Four main sources of information should be available for all cases, and be given their due and different weights: viz., (i) tests (of a picture, paper, and pencil type rather than instrumental); (ii) interviews (personal examinations, informal but systematic, with at least two sessions for every case); (iii) observations of the child's behaviour in a series of standardized real-life situations (in my view by far the most important feature of the plan); (iv) reports on past behaviour, home circumstances, mental development, etc., from teachers, social workers, parents, etc., including reports of medical inspections. If the psychologist has been adequately trained, reference to an outside specialist—e.g., a psychiatrist—should be necessary only in a comparatively small number of cases, i.e., those in which some pathological disorder is suspected.

5. Assessments based on the combined approach have a far higher validity than those based on one type of procedure only. The current notions that a child's personality can be summed up in a half-hour interview in school, or an hour's session in a psychiatrist's consulting room, or even a couple of hours' formal testing, is quite erroneous. To judge temperament and character it is desirable that he should be watched in natural but controlled situations, and for part of the time in the company of other children.

6. In general the interview is at once more informative and more trustworthy than the tests, the reports (when sent in by competent and interested observers) than the interview, and the observations under standardized real-life conditions better still. The final synthetic character sketch gains greatly in accuracy and value when based on a prior analytic study.

7. The value of quantitative assessments derived from formal temperamental tests has been much over-estimated, largely owing to the practice of not publishing adequate validation-data. Broadly speaking, their reliability coefficients are barely two-thirds, and their validity coefficients less than one-half, those usually obtained with standardized tests of cognitive abilities and attainments. Their chief service is to assist (a) in the preliminary screening, (b) in standardizing ratings by different investigators, and (c) above all in eliciting useful starting-points to be followed up in the interview. On the whole, the Questionnaire appears to be the most effective of the written tests, Ranking Pictures of the individual tests. Some of the newer techniques (e.g., those involving free or self-imposed assignments) throw special light on classroom problems, but require further research before they can be recommended for practical use.

8. Interviewing and observing require a knowledge of techniques quite as much as mental testing. The success of the observer depends partly on personal aptitude, partly on practical experience, but most of all on adequate training. The technical points for which training is more especially needed include a knowledge of the chief traits, tendencies, and types to be noted, their technical names and definitions, their symptoms and syndromes, the use of rating-scales, the construction of scientific reports (including character-sketches), in short, a knowledge of what to look for and how to elicit and describe it, and, last but not least, the validation of the different procedures used and of the observer's own judgments.

(Author's abstr.)

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Personality Structure and Measurement. I. The Operational Determination of Trait Unities.

1. Trait unities are established by co-variation of parts, and can be classified first into *common* and *unique* traits and secondly into *surface* traits (correlation clusters) and *source* traits (factors).

2. In studying co-variation by factor analysis the factors corresponding to psychologically meaningful functional unities can be distinguished from others by the method of parallel proportional profiles.

3. There are basically six and secondarily twelve sources of co-variation data, expressible in a *co-variation chart*, which can be used to provide independent correlation matrices for the above method.

4. It is meaningless to say that some factors represent *real* unities and that others are merely imaginary. All are real, but they may be arranged in a hierarchy according to "degrees of efficacy." The task of psychological comprehension and prediction demands the discovery of trait unities of a high degree of efficacy.

(Author's abstr.)

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The Clinical Use of the Thematic Apperception Test with Soldiers.

It has been the purpose of the present paper to indicate the usefulness of the Thematic Apperception Test in a military hospital where speed and efficiency were of the utmost importance, since it was not possible to keep the patients in hospital for any great length of time. The case-histories which have been presented are

intended to indicate the manner in which the strivings underlying behavior are projected into the stories. It is felt that even the few examples given will serve to illustrate the wide variety of thematic material obtainable from different subjects in response to the same picture. These differences are dictated, not by the picture, but by the personality make-up of the subject himself. A rapid method of analyzing the stories has been outlined and illustrated, and it is felt that the consistent manner in which inner strivings and conflicts revealed by the TAT were verified by subsequent analysis and therapy justifies the conclusion that this test is a useful aid in the study of psychopathology in neurotic patients.

In summary, the following uses of the Thematic Apperception Test to the clinical psychiatrist are suggested :

1. Eliciting further biographical material.
2. Uncovering unconscious needs, sentiments and conflicts not easily obtainable in interview.
3. Elaboration of parental, sibling, and general social relationships.
4. Economy of time in arriving at a picture of psychodynamics at a relatively deep level of personality.
5. As a psychotherapeutic agent, both in the uncovering of dynamics and in the direct use of the stories in helping the development of the patient's insight into his problems. (Author's abstr.)

Comprehension-Defects in the Psychoses.

The present report describes four types of comprehension-defect, made manifest by a tachistoscopic experimental procedure, which were found in a group of 84 psychotic patients. The types of defect did not follow particular diagnostic groupings; rather, they indicate that the process of comprehending undergoes impairment which becomes evident in the change or destruction of the patients' ability to communicate, irrespective of clinical diagnosis. Comprehension and communication, in turn, seem to depend upon association, disturbances of which are reflected in ways typified by the particular comprehension-defects.

(Authors' abstr.)

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Boutons terminaux in the Cerebral Cortex.

An attempt has been made to investigate the problem of terminals within the cerebral cortex in pathological conditions and in biopsy specimens. Structures have been described which are morphologically similar to *boutons terminaux*, recognized to occur in the spinal cord, brain stem and cerebellar cortex. Their identification is difficult, owing to the well-known pathological alterations of nerve fibres, described by Cajal, which lead to similar histological pictures. It is possible, however, that Cajal's phenomena were not wholly degenerative, but represented a reaction of pre-existing, very delicate terminal structures to pathological damage. Likewise, it cannot be excluded that the "artefacts" encountered in biopsy material may have some physiological significance.

While *bouton*-like structures around cortical nerve cells can be demonstrated by our present methods under favourable circumstances, it is obvious that they constitute merely a small portion of terminals. Further investigations, both pathological and experimental, are necessary to ascertain their significance and relation to other forms of terminals.

In the light of our results caution is indicated as regards the qualitative and quantitative assessment of *boutons terminaux* in pathological conditions, particularly as far as the cerebral cortex is concerned. (Authors' abstr.)

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Rorschach Studies on Patients with Paranoid Features.

The case-histories and Rorschach findings of 35 patients with paranoid trends were studied. Most cases (30) show a low threshold for color and shading qualities. The latter are usually perceived as texture. The patients tend to have difficulty in integrating color and texture with form outline.

This feature is easily "lost" within the total possible constellation of factors. Hence cases of schizophrenia with paranoid features show no reliable specific element to distinguish them from schizophrenia as a whole. If, however, one separates from this group cases resembling "true paranoia" an essential difference can be seen. The latter show random abnormalities in their records, especially the tendency described above, but no definitely psychotic features. Therefore, a "normal" Rorschach record does not exclude the presence of true paranoia. The patient's particular pre-occupation is, as a whole, not revealed in the content of the responses; an exception to this was a case with very marked reactive features. The psychopathology and nosology of paranoid reactions is discussed on the basis of the present findings. (Author's abstr.)

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The Nuclear Configuration and Cortical Connections of the Human Thalamus.

In general the human thalamus shows the same differentiation of nuclei as those of higher primates. The differences are: the increase in relative size of the dorsomedial nucleus; the pulvinar and nucleus ventralis lateralis. The anterior group of nuclei, nuclei ventralis posterior and centrum medianum retain their relative proportions. The midline group of nuclei are present, but continuing their gradual diminution in the ascending phylogenetic scale, they are small and may be insignificant in man.

The dorsomedial nucleus possesses a magnocellular part which seems to be intimately connected with nucleus paracentralis and nucleus centralis lateralis. This would appear to evidence a greater richness of intranuclear connections, furthering thalamic integration. That the relative increase in size of the dorsomedial nucleus is related to the increase of the frontal granular cortex in man is indicated by the fact that most of its connections are with this frontal area.

The increase in size of nucleus ventralis lateralis, the recipient of the dento-thalamic and dento-rubro-thalamic fibers, is in accord with the increased development of the cerebellar hemispheres in man, and the growth of the pulvinar appears to be correlated with the inferior parietal and occipital association areas (area O.C. of von Economo).

After degeneration of the cortex or severance of cortical connections the following changes in the thalamus occurred:

1. There was complete degeneration of—

- (a) The nuclei anteroventralis and anteromedialis;
- (b) the internal, small-celled portion of the dorsomedial nucleus;
- (c) nucleus ventralis anterior;
- (d) the pulvinar;
- (e) the nuclei lateralis dorsalis and lateralis posterior.

2. Centrum medianum and the reticular nucleus did not show an appreciable reduction of neurons, but there was a gliosis secondary to the degeneration of the fibers of passage.

3. Nuclei ventralis lateralis and ventralis posterior showed a falling out of the small neurons. The large neurons were preserved. Nucleus submedius showed some reduction of neurons.

The cortical connections of nuclei anteroventralis, anteromedialis, dorsomedialis and the medial portion of nucleus ventralis lateralis run in the anterior limb of the internal capsule.

The preserved large cells in the nuclei ventralis lateralis and ventralis posterior medialis and lateralis may be the anatomical site of "protopathic sensation," and, along with centrum medianum, probably form the thalamo-striate connections.

(Author's abstr.)

Bilateral Neural Integration in Visual Perception after Section of the Corpus Callosum.

A general analysis of visual perception in patients with partial and complete section of the corpus callosum disclosed that the following perceptual functions, depending on some degree of bilateral central interaction, were not materially altered by the operations: (a) binocular depth perception which involved in part fusion and integration of activity set up by stimulation of the heteronymous hemiretinae; (b) ability to maintain and recover fusion in response to diplopia-producing stimuli; and (c) monocular apparent movement vision involving stimulation of points lying on opposite sides of the vertical midline of the eye. However, the data indicate the possibility that the operations produce some deficit in divergence and convergence necessary to maintain and recover single binocular vision. This effect is of questionable significance, and it is clear that these functions are not seriously altered.

It is believed that the present experiments offer suggestive evidence toward the view that the subcortical levels of the central visual system serve a prime role in binocular perception and visual fusion independently of bilateral cortical integration. The exact functions of the subcortical optic system in visual depth perception, binocular fusion and movement vision are not directly disclosed by the

present data. However, it may be suggested tentatively that the subcortical system, which is known to define primary ocular adjustments, may also provide the means for fusion of binocular images and consequent depth effects in seeing, the pattern and detail of which are refined at the level of the geniculo-striate system.

The above point of view is not proposed as a necessary interpretation of the data obtained. It may be that the anterior commissure, either originally or vicariously, provides a bilateral pathway for interhemispherical integration in these patients. The anatomical disposition of the fibers of this pathway and its evolutionary development, however, make this description of the functions of the anterior commissure improbable. Finally, one may not yet dismiss the possibility that a few residual fibers in the splenium, which may have remained intact even in cases with alleged "complete" lesions, provided a sufficient neural connection between the occipital lobes for the observed integrations. Evidence for or against this interpretation depends upon ultimate histological study of the lesions.

(Authors' abstr.) •

The Functional Significance of the Inferior Olive in the Cat.

Cats in which one or both inferior olives were removed through a parapharyngeal approach were observed into the chronic state. Terminally the midbrain tegmentum or bulbar reticular formation were electrically stimulated or the animal was decerebrated.

Following loss of one olive (with inevitable partial retrograde degeneration of the other), the animals exhibited abnormal movements of the vocal cord, predominantly on the side of the lesion. An intention tremor of the neck muscles was present, and some head and body sway occurred on standing. Decomposition of movement, together with hypermetria in the use of the contralateral legs, contributed to ataxia in gait. When tested free, the contralateral legs exhibited an extensor hypertonus, occasionally associated with an overactive patellar reflex. As a result of these symptoms, the animals frequently fell to the side of the lesion when standing or walking. With bilateral lesions, laryngeal myoclonus and hypermetria and extensor hypertonus of the extremities were bilaterally present.

The characteristic tegmental response to midbrain stimulation was not altered by loss of one or both olives, nor were inhibitory effects from stimulating the bulbar reticular formation impaired by olivectomy. The absence of one or both olives did not prevent the development of marked decerebrate rigidity.

The results emphasize the apparently exclusive relation of the olive to cerebellar function—its loss is followed by cerebellar signs, and in its absence the function of other brain stem motor mechanisms is not impaired.

(Authors' abstr.)

Pallidal Isolation in the Monkey: Chronic Physiological and Anatomical Results.

There would no longer seem to be any good reason for speaking of a commissure of Gudden; at least there is, in the monkey, no bundle of such a nature which is clearly separable from that of Meynert. This has already been pointed out by Magoun and Ranson and others, and it is difficult to perceive that the adoption of a simple terminology (i.e., dorsal supraoptic decussation for Ganser's and ventral supraoptic for Meynert's) and abandoning the older connotations of the non-eponymic designations could have any but a clarifying effect upon the terminology of cognate systems.

Riley states the composition of the transverse peduncular tract to be of optico-tectomammillary fibers, pallio-pontile elements and fibers of the tecto-pontine tract. From present circumstances it is apparent that the bundle must also contain elements which either begin or end in the substantia nigra, and pass dorsally into the lateral part of the more caudal, mesencephalic tegmentum.

It may be concluded, further, that permanent changes do not necessarily occur in brain stem nuclei which are quite deprived of either their afferent or efferent routes of conduction, and that neither large nor small, myelinated nor unmyelinated fibers of the pyramids proper arise from an infrapallial locus.

(Author's abstr.)

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Primary and Secondary Suggestibility.

Sixty neurotic male army patients at Mill Hill Emergency Hospital, all with I.Q.'s between 90 and 110, were given 10 tests of suggestibility, and an attempt was made to hypnotize them, and to make them carry out post-hypnotic suggestions.

Also investigated in two subsidiary experiments were (1) the correlation between autosuggestion and hetero-suggestion, and (2) the effect of the length of time during which suggestion was given on the success of the suggestion. A factorial analysis was carried out on the inter-correlations between the suggestibility tests and the hypnotic and post-hypnotic scores. The following conclusions were arrived at:

(1) There are two independent types of "suggestibility," which may be called "primary suggestibility" and "secondary suggestibility."

(2) Primary suggestibility is of the *ideo-motor* kind, and correlates highly with hypnotizability. The best single test of this type of suggestibility is the Body-Sway test.

(3) Secondary suggestibility is of the *indirection* kind, and does not correlate with hypnotizability. It can best be measured by the Odour Suggestion and the Ink-blot Suggestion tests.

(4) A weighted point scale was constructed for the trial "hypnotizability," which showed this trait to be distributed continuously, and not dichotomously.

(5) This trait of hypnotizability could be forecast with considerable accuracy from knowledge of a person's scores on two or more of the suggestibility tests; a multiple correlation of .96 indicated that the tests of suggestibility involved account for 92 per cent. of the factors active in hypnotizability.

(6) It was shown that post-hypnotic amnesia is a natural consequence of hypnosis, and is not dependent on suggestion, either direct or indirect, to that effect.

(7) The distribution of the raw scores on tests of primary suggestibility (and to some extent on tests of secondary suggestibility also) was usually of the U-shaped type found also by earlier investigators. By application of two psycho-physical laws it was possible to convert these distributions into more nearly normal ones, and to show that the U-shaped distribution of raw scores was due to statistical and experimental artefacts.

(8) Hetero-suggestion on the Body-Sway test was shown to be so highly correlated with autosuggestion that the two could not be differentiated experimentally.

(9) It was shown that the length of time during which suggestion was continued affected profoundly the effect of the suggestion.

(10) Results of the Press and Release tests of primary suggestibility suggested a subdivision of this type of suggestibility into "active" and "passive." This finding was only suggestive, however. (Authors' abstr.)

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The Behavioral Sequelae of Neurosurgical Therapy (Bilateral Prefrontal Lobotomy).

The author has attempted to present some of the more important behavioral modifications which follow the neurosurgical transection of the prefrontal tracts in the intact psychotic brain. The case-material has been drawn largely from a series of 20 patients who underwent bilateral prefrontal lobotomy at the Columbus State Hospital, between September, 1941, and September, 1942. Pre-operative and post-operative observations were made at daily intervals for periods ranging up to one year. The program of incidental observation was supplemented through the use of motion pictures, sound recordings, and standardized psychological testing procedures. The examination of the protocols seems to

indicate that the psychological and behavioral picture in the post-operative period is a function of the following six factors: (a) emotional re-patterning; (b) attitudinal modifications; (c) dysfunction of the orientative mechanisms; (d) reorganization of the dynamic equilibrium of the organic substrate; (e) essential lack of neuro-motorial and psychoneurological symptomatology; (f) lack of intellectual change. These six factors, the first four of which are positive, and the last two of which are negative, constitute a core around which the post-lobotomy picture arranges itself. Whenever post-operative changes are present, the probabilities are very great that one of the most notable features will be a shift in emphasis in the emotional sphere. The critical point here is that it is relatively unimportant whether there is an increase or decrease in emotional responsiveness. The essential thing is that there is a rechanneling of emotion, permitting the patient to see his problems in a different light than was possible in the pre-operative period. Related to this shift in emotional emphasis are the modifications in the attitude of the post-lobotomy patient toward himself and toward others. The author prefers to speak of attitudinal modifications, rather than the concept of the consciousness of self which Freeman and Watts have emphasized, for the reason that the level of abstraction of the former is less involved than that of the latter. Attitudinal changes are closer to reality—to the physical nature of the individual—than is the concept of the consciousness of self. We are concerned, however, with the same general aspects of behavior, namely, the more subtle adjustments by means of which the individual is able to maintain his interpersonal and intra-personal balance. Changes of behavior in this area are frequently observed following lobotomy, although it has been impossible, thus far, to find a common thread which binds these changes together. Indeed, such changes in the attitudinal complex of the individuals are characterized by a lack of consistency that is most disturbing. It is here that the pre-operative and the pre-psychotic personality picture is reflected most clearly. Less complex, though equally pronounced, is the dysfunction of the orientative mechanisms. Following lobotomy, one observes a more or less transitory disturbance in the time-schema, the space-schema, and, less frequently, in personal orientation and the body-image. The disturbance of the time-schema appears to be, at once, the most frequent and persistent, although the manner in which the dysfunction is brought about is not clear.

From a therapeutic point of view, the most significant factor in giving an identifying tone to the post-operative picture is the reorganization of the dynamic equilibrium of the organic substrate. This factor, which in one sense includes the three preceding positive factors, is here limited to mean the loss of organic tension and agitation which is reflected, at the psychological level, in the diminution or disappearance of worry, apprehension and anxiety. Basically it is this loss which gives value to lobotomy as an instrument of therapy. If lobotomy did no more than to lower the threshold of resistance to other forms of therapy, and, in so doing, gave the patient a greater hope for recovery, it would thereby be justified. But lobotomy meets more than this minimal essential—it goes farther, in that it allows a spontaneous reorganization of processes which, in itself, appears to aid in the adjustment of the organism. This reorganization, fundamentally organic, alters, in some manner, the complex structuro-functional relationships which together constitute the human organism. These four factors—emotional repatterning, modification of attitudes, disorientation, and the reorganization of the organic substrate—constitute the major positive factors in the post-lobotomy picture. We must not overlook, however, the negative factors which serve to high-light that picture. The first of these negative factors is the lack of significant intellectual change. While it is true that, upon occasion, pre-operative delusional systems have dissolved, or have become attenuated, following the operation, and that we frequently find minor disturbances of the memory-function and of categorical and abstract behavior, it is also true that the over-all intellectual picture remains substantially unaffected. Similarly, there is an essential lack of post-operative neurological symptomatology. Other than the rather common findings of somnolence, restlessness, automatic acts, and increased appetite, there is a noticeable absence of neurological signs. In scattered cases a large number of central, peripheral and autonomic phenomena have been reported, but the analysis of this material indicates that lobotomy does not interfere, in an important way, with the explicit patterns of neurological organization.

(Author's abstr.)

A Study of Types of Word-association in Dementia Praecox and Manic-depressives.

1. The present study of 63 dementia praecox and 37 manic-depressive cases, which repeated the Gardner Murphy method of classifying associations according to logical relationship between stimulus and response, reveals no startling, outstanding, or reliably significant differences in central tendencies except possibly in responses of Type 8, in which there seems to be a strong tendency on the part of manic-depressives to "link" nouns to adjectives.

2. The tendency to give responses of more than one word, which violated the directions given to the subject, viz.: to respond with only one word, was found to be more prevalent in manic-depressive cases. This consisted largely in using definitions, or in explaining the usefulness of noun stimuli.

3. The personality of the investigator is likely a factor influencing the whole procedure.

4. There may be geographical difference.

5. The use of "worth predicates" appears to be characteristic of neither group, but is characteristic of individuals.

6. The tendency to give responses in the form of proper names was more noticeable in the Murphy study than in the present study.

7. The tendency to give purely sound associations was not confined to either psychosis but to individuals.

8. There was a slightly greater tendency on the part of dementia praecox to repeat the stimulus word.

9. The tendency to change the word-form of the stimulus word was peculiar to dementia praecox. This is contrary to the findings of the Murphy study.

10. Responses which consisted of neologisms were not found to be associated with dementia praecox in this study.

11. Stereotypy is not characteristic of either psychotic group, but is characteristic of individuals.

12. Responses containing a personal reference are associated with individuals and not with groups.

13. The use of rhymes was more characteristic of the manic-depressive group than of the dementia praecox group.

14. This study further confirms the conclusions of Kent and Rosanoff that there is a "gradual and not an abrupt transition from the normal state to the pathological state."
(Author's abstr.)

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Electroconvulsive Therapy.

The findings of this study indicate the desirability of utilizing a time factor in the evaluation of the results of electro-convulsive therapy. Analyzing the results in 100 unselected cases, a social recovery was obtained in 87 per cent. When, however, successful application of the therapy was made dependent upon the patient's ability to attain social recovery within 30 days' post-treatment, the therapeutic efficacy was reduced to 51 per cent.

S. M. COLEMAN.

Electroshock Therapy.

In a series of 300 consecutive cases treated with electric shock it was found that 50 per cent. of the recovered patients relapsed. The writer stresses the value of extramural maintenance shock therapy.

S. M. COLEMAN.

Chronic Delirium.

Patients with organic dementia who become delirious fall into two groups—toxic or senile delirium. The former has an acute onset and clears up after the patient has got rid of the toxæmia, for instance bromide. Senile delirium is unrelated to toxæmia, and comes on gradually after the dementia has reached a certain degree of severity. In both the psychiatric picture is the same.

S. M. COLEMAN.

Cultural Influences in Alcoholism.

Considering drinking as a social neurosis it is shown that society has made the practice so attractive and even insidious that the total resistance has been lessened. To combat or counteract this it is necessary to minimize the cultural aspects, avoiding, however, total repression. The appeal of drinking as a glorified function can only be nullified by scientific truth.

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Hallucinations and Mental Imagery.

An investigation was carried out to see whether there was any quantitative or qualitative relationship between mental imagery and hallucinatory experience in 20 schizophrenic patients. It was found that these patients separate the experiences of imagery from those of hallucination. Evidence from different methods of analysis used indicated that the two processes are psychologically distinct. The hypothesis that auditory hallucinations are exaggerations of mental imagery was not confirmed.

S. M. COLEMAN.

Some Aspects of Shock Therapy.

This paper presents observations collected as a result of the psycho-analytical approach to patients treated by shock therapy. It is concluded that the hypoglycemia eliminates the pathological ego and its counter-cathexis. Therefore, the repressed ego and its repressed reality can enter their rights. They were latent, but by no means annihilated by the pathological process. However, neither are the pathological formations destroyed by the shock, since they reappear with automatic certitude and can be observed at work, even during a lucid interval.

S. M. COLEMAN.

Comparative Value of Electroencephalogram.

A heterogeneous group of cases, with and without clinical brain damage, received both abstraction tests and electroencephalograms. It is found that there was a definite but not a pronounced correlation between impairment of abstract ability and abnormality of the electroencephalogram. Abstraction tests are more reliable in diagnosis of brain damage than are the encephalograms. This does not apply to cases of epilepsy in which the EEG is more reliable. In cases with chronic non-progressive or slowly progressive brain lesions the EEG is often negative, despite well-marked lesion pathology.

S. M. COLEMAN.

Mental Examination in State Hospitals.

It is computed that over 300,000 hours annually are devoted to the mental reports of new admissions in State Hospitals. This "rut of verbiage" is of little value to anybody and does not reflect a *living* picture of the patient's personality, though it may tell something of the physician's free associations. Only in conversation where the patient gives his own story in his own words can anything of real value be learnt. Stereotyped methods of case-taking, preconceived theories, which inhibit the free flow of conversation, and the fear that "all has not been told," are alike condemned.

S. M. COLEMAN.

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Character and the Psychopath.

It is concluded that the psychopathic personality is found among a mixed group of individuals whose problems are complex and who often fail to adjust in their normal strata of society. They present a heterogeneous group of symptoms, but they have in common what is popularly known as a "bad character." This personality type is regarded as a reaction which certain individuals demonstrate because they have failed, or have been unable to take full advantage of the potential mechanism for character development incidental to normal life and growth.

S. M. COLEMAN.

Acute Disseminate Lupus Erythematosus.

Disseminate lupus erythematosus is a systemic disease which may produce diffuse damage to the C.N.S. Clinical manifestations include toxic delirium, frank psychosis, coma and convulsions. Neurological examinations show scattered findings which may shift rapidly on successive examinations. The pathological picture is one of diffuse non-specific encephalitis with extensive vascular changes and thrombosis. The nervous parenchyma shows acute and chronic degenerative changes secondary to disturbances in the vascular supply.

S. M. COLEMAN.

Studies Regarding Glutamine and Ammonia.

A group of 50 patients with nervous and mental diseases were investigated as to the level of free ammonia and glutamine in the spinal fluid.

S. M. COLEMAN.

Electroconvulsive Therapy in Acute Hysteria.

Two cases of hysteria, one displaying paralysis and the other amnesia, were treated by means of electric shock as one phase of therapy with relief of presenting symptoms.

S. M. COLEMAN.

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The Diagnosis and Classification of Neurotic States.

The identification of the neuroticism factors with those in the normal personality confirmed by a longer history of psychological research does not immediately provide a key to their inner nature. Much research remains to be done before the deeper, intrinsic character of these source traits becomes known. And since the main purpose of this article is to advance techniques at the descriptive level, we shall not digress into the considerable speculation which is already possible concerning what these factors basically are.

The main conclusion must be that the factors in neuroticism are recognizably the same as those in the normal personality—the same tendencies carried to greater extremes. There are, however, interesting differences, as follows.

(1) The correlations between the factors themselves do not seem to be the same as in the normal population. Of the six possible correlations only two are tolerably similar and three are decidedly different—opposite in sign and of appreciable magnitude. These are all relationships of one factor, III, or (B+K), which, among normals correlates positively with the emotional stability factor (C+G), negatively with the hypochondria factor (D+I), and negatively with surgency, F, but here behaves oppositely. There are adequate reasons for these correlations in the normal population; they express social trends which tend to throw certain "good" qualities—notably intelligence B and emotional stability C—together. The neurotic is evidently a misfit in regard to these social and biologic trends.

(2) The relative magnitude (variance: contribution toward making individuals differ) of the factors appears to be different. (The absolute magnitude is not considered; for Eysenck's correlation device would make the neurotic factors systematically bigger). If we consider two of the neuroticism factors to be compounded, co-operative factors (e.g. III equals (B+K)), the "normal" order would be I, III, II, IV. If III were B alone it would still retain this position, and if it were K alone it would fall to last place. In short, though the range of intelligence may be greater among neurotics than among normals, it is less important in accounting for personality differences. It is noteworthy that the above order agrees better with the "normals" than does the order from the unrotated neuroticism factors.

However, the most noteworthy difference is that some of the "normal" factors do not appear in the neuroticism data at all. Probably this is still a matter of magnitude—the missing factors might well have appeared as fainter factors if the analysis had been carried further. If we suppose that K, G and D are involved as co-operative factors in the above, the still unrepresented normal factors are (1) the cyclothyme schizothyme-factors A, H and L, which either as A or as a compound factor (A+H+L) are the *largest* factor differentiating normal personalities, and (2) the dominance-submission factor E, which is of middling magnitude. Unless the variables chosen were unsuitable for these factors to show themselves, their absence is a mystery. At least variables 15 and 16 might be expected to show big opposite loadings in some factor! A possible explanation lies in the fact that psychotics were excluded from the population. If we assume that when individuals with rather extreme cycloid or schizoid endowment become as extreme also in other factors as were these neurotics they become psychotic rather than neurotics, then no appreciable schizoid-cycloid variation would remain in the group studied here.

The psychiatrist may raise the objection to the present factorial analysis that half a dozen distinct factors are not enough to account for the full variety of neurotic syndromes. Yet the fact is that a few factors can account for a relatively large number of clusters. For example, if we suppose that what we recognize as a truly neurotic syndrome occurs only when some factor is present in extreme amount, then *two* factors could theoretically produce at least *eight* syndromes (four "pure" and four mixed); three factors, sixteen, four, thirty-two and so on. An extreme high or an extreme low endowment in either factor will stand out as a syndrome. Then a cluster can be produced also by each instance of combined action, where two factors are each present in extreme degree (both extreme high or one extreme high and one extreme low), and so on, producing eight major possibilities of cluster origin.

Actually not all of these possibilities would necessarily be realized. There might not exist any manifest, observable symptoms corresponding to some factor combinations, i.e., no variables can be observed in that potential "area of behavior."

The manifestations might, for instance, be purely somatic or purely introspectible, only, i.e., non-behavioral. Consequently, for all that we know at present, fully half a dozen distinct *factors* might be required to account for the observed gamut of psychoneurotic *syndromes*, i.e., the manifest clusters. To sum up the whole situation systematically, the smallest number of factors required by mathematical theory (of combinations and permutations) might not in fact suffice because: (1) Probably in most factors only the extreme endowment in one direction is "neurotic," while the opposite extreme endowment describes superior powers with regard to manifestations of stability, integration, etc. (2) Variables (behavior manifestations) may not actually occur in the quadrant concerned. This is a subtle but real issue, best described briefly as above, by saying that certain combinations of factors may be unproductive of overt symptoms. (3) When a factor has small variance and no variables which it loads very highly, even an extreme endowment in that factor will not suffice to produce high correlation among variables, i.e., a visible syndrome. The more factors there are at work in a given realm of behavior, the less is a correlation cluster from a single factor likely to appear (compared with the incidence of the combined factor cluster).

Illustrations of the relations of clusters (syndromes) to factors are not so easy to give at this early stage of factor research. Among other things we do not know what degree of average correlation within a cluster corresponds to the commonly accepted overt syndrome. (The writer estimates that it is a minimum of about 0.5.) If we examine Eysenck's original correlations for clusters of about this closeness of texture, we find the following clear instances—variables (2, 3, 4, 14), (8, 9, 14), (5, 6, 16), (9, 13, 14), (11, 12, 13), (12, 13, 14), (5, 6, 36), (18, 26, 31, 32), (2, 9, 38), (19, 25, 28, 34)—and many clusters in which the internal intercorrelations are rather less consistently maintained. Unfortunately, only a few of these are the equivalents of common psychiatric syndromes, because some of the individual variables used are themselves syndromes, while in other instances the clusters prove to be clusters of environmental conditions.

However, we may take three of these as illustrative of the three chief possibilities. Cluster 2, 9, 38—unskilled work, narrow interests and low intelligence—is roughly the syndrome of mental defect. The intercorrelations between these variables are due only to one factor (III), in which they all have positive loadings. This is the factor we have interpreted as general intelligence (in reverse). Cluster 18, 26, 31, 32—obsessional, meticulous, irritable, anxious, depressed—is a cluster which seems to belie the clinical separation of neurasthenia and obsessional neurosis. Whichever label is given to it, it provides an instance of a cluster due to two factors. Inspection will show that these variables all have high negative loadings in III, moderate positive loadings in I, and nothing giving a significant correlation in any other. It is a product, therefore, simply of marked "desurgency" and moderate "dynamic disintegration." Cluster 19, 25, 28, 34—hysterical symptoms and attitude, freedom from overt anxiety, sexual anomalies—seems the nearest approximation among these clusters to the syndrome of conversion hysteria. It is an instance of a cluster in the formation of which all four factors have some role. The writer has already pointed out in more normal personality data how a cluster of similar variables, constituting what might be called a mild conversion hysteria syndrome, can be accounted for in part by two factors—low intelligence and dynamic disintegration. The same two factors, III and I, are found to have a role in the present cluster, the former slightly, the latter more markedly. But, in addition, these variables are found to have consistent loadings in II and, especially, IV. (The loadings on II and III are supplementary, affecting different pairs of variables.) The analysis suggests that low intelligence and unintegrated character form the background conditions of conversion hysteria, but that in addition a subaverage (negative) endowment is required in the I Factor of Sensitive, Anxious Emotionality with its *real* somatic upsets, and a decidedly high endowment in the temperamental factor of Surgency.

Although the roughness of the exploratory factorizations, and our present ignorance of the true, underlying nature of the factors discovered, prevent immediate clinical usefulness, the present paper may suffice to show that the consideration of symptoms in terms of correlation clusters and factors—surface traits and source traits—can clarify diagnosis, and in time lead to a psychometric calculus which may revolutionize clinical practice.

(Author's abstr.)

Aminoacetic Acid (Glycine) in the Treatment of Depression.

Nineteen cases of depression of various kinds and degree have been treated with oral administration of amino-acetic acid in the past two years. Most of the cases of mild depression recovered, some showed improvement, whereas the two cases of involuntal melancholia did not benefit by the treatment.

In the opinion of the author, these results justify an extensive trial with this treatment in cases of depression, especially in milder cases which can be cared for in their own homes. Should this treatment prove to be as beneficial in other cases, it would obviate the necessity of placing such patients in institutions, and avoid the use of shock treatment—a very strenuous form of therapy.

(Author's abstr.)

Is the Epileptic a Safe Motor Vehicle Driver?

(1) Epilepsy is a definite motor vehicle danger, and patients so afflicted should not be permitted to drive, unless seizure-free for three years.

(2) Lapses of unconsciousness from secondary epilepsy or other syndromes should be treated in a similar manner, except that the licence can be restored at an earlier period when the spells are under medical control.

(3) State Legislation should be passed to deny these patients so afflicted the right to receive a motor vehicle-driving licence.

(4) In order to render the enforcement of the laws, epilepsy or other conditions causing a lapse of consciousness with loss of motor or sensory control should be made reportable. The passage of such a law should be publicized so that both physicians and patients are aware of its existence.

(5) Nocturnal seizures or an aura are not safety factors.

(6) The diagnosis of epilepsy should be made on clinical grounds; the EEG should only be used to supplement the clinical diagnosis.

(7) In California an epileptic is reinstated on a highly selective basis.

(Authors' abstr.)

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Degeneration of the Basal Ganglia from Carbon Disulphide Poisoning in Monkeys.

1. Four monkeys (*Macaca mulatta*) were chronically poisoned with carbon disulphide by exposing them to inhalation of the vapor for periods of from 12 to 21 months, when marked symptoms of intoxication appeared.

2. In all of the animals the essential and constant pathological changes consisted in extensive, bilateral and symmetrical necrosis of the globus pallidus and the zona reticulata of the substantia nigra.

3. The monkeys presented in common profound motor disturbances characterized by reduction and slowness of all types of movement without paralysis, inco-ordination of locomotion and climbing, plastic cog-wheel rigidity of the skeletal muscles, flexor postural attitudes of the trunk and extremities and severe action and tension tremor.

4. It is believed that the data justifies the conclusion that the motor syndrome observed in the animals is attributable to the destruction of the globus pallidus and substantia nigra, and that there are close similarities pathologically and physiologically to the Parkinsonian syndrome of man.

(Author's abstr.)

Cerebellar Atrophy. I. An Analysis of the Various Forms and an Analytical Scheme for their Study.

Cerebellar atrophy may be the anatomical expression of a number of clinical disease entities and histopathologic states.

One variety of chronic progressive cortical cerebellar degeneration which is termed "Marie's late cerebellar ataxia" is clinically indistinguishable from olivoponto-cerebellar atrophy, and one should be cognizant of the fact that an exact anatomical diagnosis cannot be made during life.

The terms "familial cerebellar ataxia" and "hereditary cerebellar ataxia" are not the designations of specific disease entities or histopathologic states. Under such a designation one may place the pure cases of olivoponto-cerebellar atrophy with familial and hereditary features of Hassin and Harris; the pure cases of chronic progressive cortical cerebellar degeneration as described by Richter and by Holmes; the cases of primary parenchymatous atrophy of the cerebellar cortex complicated by mental deterioration as described by Akelaitis; the cases of cortical cerebellar degeneration complicated by epilepsy as described by Thorpe; the cases of primary degeneration of the granular layer of the cerebellum as described by Norman; the cases of cerebello-olivary degeneration described by Parkes Weber and Greenfield; as well as many others.

Any of these disease entities may occur sporadically and/or be complicated by the co-existence of Friedreich's ataxia, Charcot-Marie-Tooth peroneal nerve atrophy, primary optic atrophy, so-called primary lateral sclerosis, spinal muscular atrophy and nuclear atrophy of some of the motor cranial nerves, particularly the facial and the hypoglossal.

For the detailed study of any brain showing evidence of cerebellar atrophy an analytical form has been proposed. This form may be modified or elaborated upon as need for changes arise. In a sense it forces the neuropathologist to declare which histopathologic changes in a given case of cerebellar atrophy are primary, which are secondary, and which are of a complicating nature.

The formulation of disease entities and the development of worth while classifications of the cerebellar atrophies can only follow the detailed analysis of many cases. (Author's abstr.)

Hemosiderin and Tissue Iron in the Brain: Its Relationship, Occurrence and Importance.

Formation of hemosiderin after traumatic and spontaneous cerebral hemorrhages was studied, and its microscopic appearance was compared with that of increased content of tissue iron in selected areas of the brain in which no signs of a preceding hemorrhage or thrombosis were present.

It was found that in many instances the hemosiderin and the tissue iron gives the same staining reactions and a similar microscopic appearance. One of the differences is the presence of histiocytes containing fine hemosiderin granules in areas of old hemorrhages and thrombosis, normally not seen.

Incrustations of blood vessel walls with iron salts occur in globus pallidus very frequently without a hemorrhage. They were observed in other areas after an effusion of red cells into the brain substance, or after a general increase of tissue iron in the brain.

Large amounts of tissue iron were often seen in globus pallidus in patients over 40 years of age suffering from various types of psychosis.

This increased iron content is considered a manifestation of an involuntal process, irrespective of the age of the patient or the duration and type of the illness. (Author's abstr.)

Occurrence and Distribution of Acid-fast Pigment in the Central Nervous System.

Although the series of cases studied is too small to be representative, the relation of the pigment to the lesions encountered, deserves brief comment.

In a case of senile psychosis, pigment in the nerve cells was intensely red and extremely abundant, and it was also present in glial cells and blood vessels. The pigment was almost as abundant in a 68-year arterio-sclerotic male with cerebral cortical atrophy.

In two cases of encephalomalacia the large mononuclear phagocytes of microglial origin were loaded with acid-fast pigment, in addition to ordinary fat droplets.

In two glioblastomata no pigment was present even in necrotic areas. This was rather surprising in view of its occurrence in encephalomalacic areas, due to vascular obstruction. It was absent also in cerebral metastases from mammary and lung carcinomata.

We have purposely refrained from identifying the pigment with "ceroid" until the chemical identity of the "ceroid" pigment shall have been more completely worked out. Until more precise methods for its histochemical identification become available, discussion of the point is rather meaningless. The most specific feature of the "ceroid" pigment is probably its resistance to acid decolorization after staining with carbol fuchsin. The fluorescence of the pigment in the central nervous system has not been studied and this may prove to be a differential feature should it be absent. The "ceroid" pigment retains a certain affinity for Sudan 4, even after paraffin embedding. This has not been striking in the few brain sections which we have examined by this method. The pigment takes a bluish-green color with the Giemsa stain as does the "ceroid." To sum up, one cannot at this time make any positive statement as to the identity of this acid-fast pigment with the "ceroid" found in experimental cirrhosis. Its acid-fastness does, however suggest a chemical relationship.

The conditions under which "ceroid" pigment is deposited in the tissues are still under experimental investigation. An observation that suggests a possible relationship to vitamin E deficiency is the regular occurrence of acid-fast pigment in the ganglion cells of rats that have been for a long time on vitamin E deficient diets, and its absence in the ganglion cells of rats which have received protective doses of wheat germ oil or tocopherol (8). We do not wish, however, to imply that this is the only, or perhaps the most important factor, controlling its deposition. The familiar "lipochrome" pigment is commonly believed to increase progressively with age. This seems not necessarily to be associated with a change in acid-fastness, since ganglion cells containing yellowish-brown pigment which is non-acid fast may be found in abundance even at an advanced age. It seems probable that other factors are concerned in this transformation. (Authors' abstr.)

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The Influence of Hypothalamic Stimulation on Cortically Induced Movements and on Action Potentials of the Cortex.

1. Simultaneous stimulation of the hypothalamus (sub-threshold for somatic reactions) and of the motor cortices (cat, monkey) results in intensification of motor discharge in the peripheral musculature. This intensification is expressed as decrease in the period of latency of response, increase in magnitude of movements through the same joints activated during cortical stimulation alone, spread of motor discharge, contralaterally and ipsilaterally, and the evocation of muscular

contractions when a sub-threshold stimulus is applied to the cortex. Those areas in the hypothalamus which are productive of a facilitatory effect are likewise productive of a sympathetic autonomic effect. Facilitation, however, is independent of sympathetic discharge; indeed, elimination of sympathetic pathways to the brain intensifies the facilitatory effect. Both cortices (ipsilateral and contralateral) are under the influence of the hypothalamus of one side of the brain. Generally speaking, wherever a motor response is obtainable from the cortex, facilitation can be found as well. The optimal area in the basal forebrain concerned with this function is the posterior hypothalamus, but such potentiality is not restricted here. Since hypothalamic facilitation of the cortically induced motor response persists after a small cortical area has been isolated from adjacent parts of the cortex, the intensification of the response is not due to functional spread to other parts of the motor cortex.

2. Stimulation of the hypothalamus results in a distinctive, enduring excitatory effect on the cerebral cortex, as manifested by increased rate and amplitude of discharge in the spontaneous electrocorticogram, and in suppression of "Dial" potentials during and following hypothalamic stimulation. Firing of cortical neurons initiated by local application of strychnine is likewise increased in frequency as a result of hypothalamic excitation. This facilitatory influence, resultant from stimulation of the hypothalamus, is found in motor and in primary sensory receptive and association areas as well. It is bilateral in nature, but most marked ipsilateral with the site of hypothalamic stimulation. The nuclear areas in the basal forebrain responsive with such an effect are likewise productive of sympathetic autonomic phenomena. The changes are independent of sympathetic autonomic phenomena as such and persist after elimination of the adrenals. The alteration in the electrocorticogram is thought to be due to increased frequency of discharge of cortical ganglion cells, as a consequence of a lesser degree of synchrony of discharge, and firing of a greater number of neurons than those responsible for the normal electrocorticogram. The fact that hypothalamic potentials following stimulation recorded from the stimulated area are unchanged, while increased cortical potentials persist, indicates that the changes in the E.E.G. are only initiated by hypothalamic impulses, but are self-sustained at the cortical level.

The complete parallelism between the two sets of experiments summarized in 1 and 2 suggests as one important site of hypothalamic facilitation of the pyramidal system the sensorimotor cortex. It is thought that hypothalamic cortical facilitation may be responsible for the overcoming of paralysis under conditions of emotional stress, and possibly for the initiation of epileptic seizures as well.

The experimental finding that cortical activity in sensory projection and association areas is likewise altered as a result of hypothalamic stimulation indicates that hypothalamic cortical facilitation is not restricted to the motor system. The functional evaluation of these studies, however, will depend on further experiments.

(Authors' abstr.)

Transsynaptic and Direct Stimulation of Post-fibres in the Artificial Synapse Formed by Severed Mammalian Nerve.

The excitatory properties of the artificial synapse (stimuli at motor, leads at sensory root) formed by a severed mammalian nerve have been studied. The aim of this work has been to compare direct and transsynaptic stimulation of the post-fibres.

1. In Section 1 measurements are given, correlating the size of the prefibre potential with the size of the volley transmitted in the post-fibres, as well as measurements of the transsynaptic effect in per cent. of maximum alpha activity in post-fibres, directly stimulated at the cut end. Transmission in the isolated nerve-root preparation has been compared with transmission of circulated nerve *in situ*.

2. Recovery curves for transsynaptic and direct stimulation of the post-fibres have been compared, and in the main found to be identical; some discrepancies have been taken up for discussion.

3. Increase of stimulus frequency causes accumulative depression with transsynaptic stimulation, evident even at such low rates of repetition as to give no effects upon the volleys elicited by direct stimulation. Higher frequencies are

needed to cause the same amount of depression with direct stimulation of the post-fibres. Experiments are presented showing that the greater depression caused by transsynaptic stimulation can be imitated by increasing the duration of the electrical shock in direct stimulation. The amount of the depression is shown to be dependent on the accommodative properties of the postfibres engaged.

(Author's abstr.)

Modification by Electrotonus of the Transmission in the Artificial Synapse Formed by Severed Mammalian Nerve.

Transmission in the artificial synapse formed by the severed region of the sciatic nerve of cats has been studied under the influence of a polarizing constant current.

1. Depending upon the polarity of the constant current traversing the artificial synapse the transmitted volley may be facilitated or depressed. Quantitative measurements are presented in which the degree of facilitation or depression is related to the strength of the polarizing current in rheobase multiples.

2. Under the influence of polarization the recovery curve for synaptic transmission may change from a type indicating mere subnormality after a conditioning volley to one also showing supernormality, in which this volley is followed by periodic variations of subnormality and supernormality.

3. During polarization an early secondary volley may arise in the synapse. Evidence is presented in favour of the view that it is elicited by the falling phase of the prefibre potential.

(Author's abstr.)

The Localization of the Premotor Interneurons Discharging through the Peroneal Nerve.

Needle electrodes, isolated down to the tip, have been placed in the segments L_4-S_1 of the spinal cord and the effects elicited from various regions recorded in the peroneal nerve. The waves, relayed over one synapse, have histologically been localized to needle positions in the lateral part of the zona intermedia.

(Authors' abstr.)

Distribution of Internuncial Activity in a Multineuron Reflex Chain.

Stimulation of the popliteal nerve in cats elicits in the peroneal nerve a complex multineuron flexor reflex discharge, studied in this paper.

The form of this reflex response is determined by the afferents excited and by the distribution of internuncial activity in the spinal cord, both factors influenced by stimulus strength. Moderately strong stimuli engaging coarse, muscular and cutaneous afferents elicit a reflex response characterized by rhythmic grouping of volleys. An initial wave with a central reflex time of about 2.5 msec. is succeeded by two secondary volleys differing 2-3 msec. in latency.

The periodic properties of the reflex response are shown not to depend upon afferents with different conduction velocities. Nor do they depend upon a periodic variation of excitability at a single synaptic structure. The experiments support the view that the volleys with different latencies arise in interneuron chains of different lengths, and that some of these chains are "closed circuits" in which reverberation takes place.

An increase of stimulus strength shortens the rhythmic reflex response from its tail end until only the first volley remains ("inhibition by subnormality").

Even when the popliteal stimulus is subliminal from the point of view of reflex excitation, it leaves a fluctuating state of excitability which has been entested with the aid of a peroneal volley, elicited over one synapse from stimulating electrodes placed in the lateral intermediary region of the spinal cord. The conditioning popliteal stimulus then causes an early inhibition followed by prolonged facilitation and interrupted by periodic inhibitory deficits, corresponding temporarily to the rhythmic volleys of the flexor reflex, mentioned above, therefore interpreted as refractory periods left by these volleys.

The early inhibitory effect is discussed, and a schematic diagram given which describes the organization of the multineuron flexor reflex arc in the light of the evidence obtained.

(Author's abstr.)

The Relations Between Multiple Innervation and "Segmental" Response of Skeletal Muscle of the Dog.

By a combination of photographic procedures the movement of exposed muscles, "segmented" transversely by markers, were recorded in experiments on 46 dogs. Direct and indirect tetanizing faradic stimuli were employed.

Isometric and isotonic contraction and stretch occur simultaneously. The ratio of the number of the isometrically to the isotonicly contracted "segments" is never constant, but varies as the distance between the points of attachment. Completely isotonic contractions are obtainable only by detaching one end of the muscle. The stretch lasts never longer than 60 msec. Afterward the stretched segments behave either isometrically or participate in the shortening. Thus, the initial stretch acts as a "shock absorber" during the initial contraction; the subsequent "locking" prevents further loss of effective shortening. These results are obtained by a minimal tetanizing current applied to the entire trunk of the nerve supplying the muscle.

When but one main branch of the nerve supplying the muscle is stimulated, the other branches having been cut, the part of the muscle stimulated shortens and the parts unexcited by the stimulus show considerable stretch. †

When curarized muscle is stimulated directly, shortening is confined to an area around the point of stimulation. The extent of the responding area depends on the strength of the stimulus. The other portions of the muscles stretch. This stretch may last 74 msec. (Authors' abstr.)

Anatomic and Physiologic Properties of Cutaneovisceral Vasomotor Reflex Arcs.

In unanesthetized white rats with the spinal cord transected in the lower cervical region and in rats with the cerebrospinal axis intact, under nembutal anesthesia, localized warming of the skin in the caudal half of the thoracic region to approximately 45° C. consistently elicited reflex vasodilatation in the small intestine. Localized cooling of the skin in the same area consistently elicited reflex vasoconstriction in the small intestine. These reactions are carried out through segmental and intersegmental reflex arcs, and neither require suprasedgmental reflex centers nor involve parasympathetic nerves.

The sympathetic innervation of the gastro-intestinal blood vessels includes both vasoconstrictor and vasodilator nerve fibers. The former appear to be adrenergic, the latter cholinergic.

Thermal stimulation in a cutaneous area which has been rendered hyperemic by repeated warming and cooling elicits no appreciable reflex vasomotor reaction in the corresponding portion of the intestine. In the absence of disturbing stimuli the vascular bed in this portion of the intestine is dilated while the cutaneous hyperemia persists. Somatic pain producing stimulation during this interval elicits prompt vasoconstriction throughout the gastro-intestinal tract.

The receptors through which thermal sensations and reflex vasomotor reactions in viscera, elicited by thermal stimulation of the skin, are mediated, appear to be closely associated with cutaneous blood vessels. Tissue deformations incident to tonic changes in the musculature of these vessels probably play an essential role in the activation of the receptors in question and, consequently, in sensory adaptation. (Author's abstr.)

Further Investigations on Diencephalic-cortical Relations and Their Significance for the Problem of Emotion.

The relation between the various areas of the cortex of the brain and diencephalic nuclei was investigated by local application of strychnine to the cortex and exploration of the forebrain nuclei for strychnine spikes, as well as by injection of the latter with strychnine and exploration of other forebrain nuclei and the cortex for convulsive potentials. The results were as follows:

(i) Injection of strychnine into the hypothalamus causes first "firing" of the dorsomedial thalamic nucleus and later of the cortex. This may be followed by the appearance of spikes in the contralateral hypothalamus, the dorsomedial nucleus, and the cortex. The ventrolateral thalamic nucleus remains constantly negative under these conditions.

(ii) Strychninization of the dorsomedial nucleus causes "firing" in the ipsilateral and then in the contralateral cortex. In addition, with repeated injection, or after a sufficient interval of time, the ipsi- and contralateral hypothalamus and the ventrolateral thalamic nuclei as well as the contralateral dorsomedial nucleus show strychnine spikes. A study of the cortical potentials and their comparison with the potentials in the nuclei which initiated the strychnine "firing" indicates that the discharge in the cortex is sustained, and may show a convulsive activity many times greater than that found in the forebrain nucleus.

(iii) Strychninization of the ventrolateral thalamic nucleus causes "firing" in the hypothalamus and dorsomedial thalamic nucleus on both sides, as well as in the contralateral ventrolateral thalamic nucleus. The "firing" of the cortex as described by Dusser de Barenne was confirmed.

(iv) Strychninization of various cortical areas (gyrus proreus of the pre-frontal lobe, the sensorimotor cortex, the primary acoustic area and the gyrus cinguli) causes the appearance of spikes in the anterior and posterior hypothalamus, the dorsomedial and the ventrolateral thalamic nuclei. In these, as well as in all other experiments, the ipsilateral discharges appeared earlier and showed greater intensity than contralateral spiking.

(v) Simultaneous recordings of the resting potentials from the cortex and forebrain nuclei show the appearance of "Dial" bursts not only in the dorsomedial thalamic nucleus as found by Morison, Findley and Lothrop, but also in the hypothalamus and ventrolateral thalamic nuclei. These observations suggest the hypothalamus as a site of origin of these grouped potentials.

The significance of these findings, particularly for the physiology of the emotional process, is discussed. (Authors' abstr.)

Relation of Electroencephalogram to Photometrically Observed Vasomotor Changes in the Brain.

Areas of cortex adjacent to ECG electrodes were photometrically matched with a standard, and physiologically induced changes were recorded along with ECG, EEG and EKG. A tendency for increase of frequency, increased potential of fast waves and decreased slow activity to be associated with vasodilatation, and for decrease of frequency, increased potential of slow waves and decreased fast activity to be associated with paling or cerebral vasoconstriction, was demonstrated. (Authors' abstr.)

The Acoustic Projection System: A Comparative Study.

The most significant finding of these experiments appears to be the difference in effect of partial section of the auditory pathway in the different species. In the monkey, boundaries between post-operatively active and inactive areas are generally sharp and characterized by presence or absence of response, whereas in the cat, there was always an intermediate zone of impaired, but not abolished, function. This is explicable on the assumption of corresponding difference of degree of dispersion and overlapping of bundles of fibers which are activated as a result of stimulation of different segments of the organ of Corti, and probably can be explained in no other way. This would imply that in the cat there is relatively less specificity of point-to-point projection than in the monkey, an implication supported for the geniculo-cortical segment of the pathway by the evidence of retrograde degeneration cited above. The latter gives the additional suggestion that there is still less precision in the rat's auditory projection.

If now a "place" theory of cochlear function is assumed on the basis of frequency of stimulation, which is certainly justifiable, there is an implicit correlation of functional (frequency) specificity with anatomical specificity of projection. This means, in turn, that in the cat there is a tendency toward frequency segregation on different fiber bundles, and in the monkey, a still greater degree of differential activation of fibers by different stimulus frequencies.

The foregoing conclusions are supported by the evidence of Licklider and Kryter, who demonstrated differential activation of auditory cortex in both cat and monkey, with the difference between the two that the resultant frequency map of the monkey's cortex is far more clearcut and regular than that of the cat. In the cat, while certain frequencies seemed to give the best response in a given region,

a response might occasionally be elicited by other tones. This overlapping was far less noticeable in the monkey. Further confirmation comes from the experiments of Bailey *et al.* on monkey and chimpanzee. These authors call attention to the recent phyletic origin of tonotopic localization, but indicate no further advance in the process from monkey to chimpanzee. (Authors' abstr.)

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Personality Structure, Lactic Acid Production and Work Performance in Psychiatric Patients.

1. A fatigue experiment was carried out in 72 psychiatric patients in order to determine the relationship of work performance before exhaustion, production of blood lactic acid, and working efficiency to spontaneous complaints of fatigue, to psychiatric diagnoses, and measurements of personality.

2. While similar experiments on normals by other authors showed a significant positive correlation between lactic acid production and work, studies on patients did not reveal such a correlation. These findings warrant the conclusion that psychological factors determine the point of exhaustion in a fatigue experiment carried out with patients.

3. Except for cases with brain disease the personality disorders complain more about fatigue in general than do the psychoses. This finding contrasts with the index of efficiency (work : lactic acid), which is higher in the personality disorders than in the psychoses.

4. The experiments seem to indicate that general complaints of fatigue and inability to endure strain found in psychopathic personalities, psychoneuroses and cases of delayed recovery are due to psychological causes and are not a function of physical fitness.
(Author's abstr.)

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The Diary of a Schizoid.

Presentation of a case of mixed psychosis exhibiting three well-defined syndromes, schizoid, psychasthenic and paranoid. Extracts from the patient's journal emphasize the richness of his autistic life as contrasted with his apragmatic behaviour. There is some discussion as to the causal sequence of the three syndromes.
 S. M. COLEMAN.

The Body-Image.

A critical appreciation of Lhermitte's book of the same name.

S. M. COLEMAN.

(3) 1939/1940/1941.

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Anorexia Nervosa.

According to some, anorexia nervosa is closely allied to Simmond's disease, and is caused by a pituitary insufficiency. Others take the view that it has a psychological origin. In an attempt to elucidate this problem a detailed study of the physiological and psychological processes responsible for hunger and appetite is undertaken. It is concluded that fundamentally anorexia nervosa is an endocrine disorder, but that psychological factors are responsible for individual reactions.

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(4) 1939/1940/1941.

- *Psychasthenia and Schizophrenia. *Claude, H., and Micoud, R.* 421
 Hereditary Alcoholism. *Deshaies, G.* 446

Psychasthenia and Schizophrenia.

An inquiry into the relationship between obsessions on the one hand and Janet's psychasthenia and Bleuler's schizophrenia on the other. It is concluded that obsessionals can be classified in a series of sub-groups in increasing malignancy: (1) Anxiety states with obsessions as a secondary feature. These are "border-line" cases. (2) The true anxiety-obsessional state with occasional paroxysms. (3) Pure obsessional states with fixed compulsions and anxiety as a less prominent feature. These patients are well adapted and pragmatic. (4) Obsessionals as for (3), but anxiety is still less marked and associated with Janet's psychasthenia.

In the rest of the series, true psychasthenia, the schizomanias, the schizophrenias and Claude's hysterias, there is progressively less anxiety and true obsessions are, to an increasing degree, replaced by stereotypy.

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(5) 1939/1940/1941.

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Pseudo-schizophrenic Forms of Psychasthenia.

Two cases of psychasthenia are presented in which the presence of certain symptoms is suggestive of schizophrenia. The authors incline to the view that there is common ground between these two disease entities. They are of the opinion that obsessional thoughts can progress to hallucinations, and that feelings of de-personalization can give rise to delusions of external influence.

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The Treatment of Psychoses with Methyl Guanidine Sulfate.

In a series of 12 Service men whose psychoses demonstrated schizophrenic or depressive characteristics, better results were obtained with electric convulsive therapy than with methyl guanidine sulfate. (Authors' abstr.)

The Clinical Measurement of Anxiety.

1. A simple and objective method and apparatus are described for the detection and the measurement of anxiety.
2. This method consists in a simplified form of mirror drawing and the consequent interpretation of the subject's motor performances.
3. The interpretation of the data is based on the disintegration concept of anxiety.
4. A number of cases are presented to illustrate the practical application of the method and its possibilities in diagnostic work. (Authors' abstr.)

Prevalence of Pulmonary Tuberculosis in New York State Institutions for the Mentally Ill.

1. Chest X-ray surveys of all the public mental institutions in New York State have been completed.
2. Clinically significant pulmonary tuberculosis was diagnosed in 5.6 per cent. of the patients in the State hospitals and in 2.4 per cent. of the patients in the State schools and Craig Colony.

3. The prevalence rates increase with the length of time between first admission and the X-ray survey. They also increase with age, in the hospitals up to age 45, and in the schools at all ages.

4. Among patients with time periods up to five years between first admission and X-ray, the prevalence of tuberculosis among dementia praecox patients is in general lower than, or approximately equal to, the prevalence among patients with other types of mental disease.

5. Clinically significant pulmonary tuberculosis was diagnosed among 1.1 per cent. of the employees of the State hospitals and 0.7 per cent. of the employees of the State schools and Craig Colony.

6. Facilities for the segregation of patients with clinically significant pulmonary tuberculosis are inadequate at present, but plans are being made for the provision of well-equipped centers for the segregation and treatment of these patients.

(Authors' abstr.)

A Comparison of the Wechsler-Bellevue and the Revised Stanford-Binet Scales for Adult Defective Delinquents.

A group of 50 adult mental defectives in an institution for defective delinquents was tested with both the Wechsler-Bellevue and the Revised Stanford-Binet Scale—Form L in ABBA order. The following conclusions are justified by the test results :

1. The Wechsler-Bellevue Adult Intelligence Scale gives consistently higher I.Q. scores for mental defectives in 84 per cent. of the cases.

2. The mean I.Q. difference in favor of the Bellevue Full Scale over the Stanford-Binet is 10.92 I.Q. points ; in favor of the Bellevue Verbal Scale 12.50 I.Q. points ; and in favor of the Bellevue Performance Scale 13.78 I.Q. points.

3. The size of the difference in I.Q. score in favor of the Bellevue over the Binet varies directly with the increase in chronological age of the subjects. A large part of the discrepancy in I.Q. results between the two scales may be attributed to the differences in norms and principles of standardization. Thus, the Bellevue Scale allows for the normal deterioration due to age, whereas the Stanford-Binet does not ; and, therefore, old subjects will score much higher on the Bellevue.

4. Significant differences in comparative performances on the two scales are found in the low grade mental defect group and the borderline group when the Bellevue Full Scale and Verbal Scale are involved. With respect to the Bellevue Performance Scale as compared with the Stanford-Binet, the significant differences in comparative performance are found in the moron and borderline groups.

5. A coefficient of correlation of $.765 \pm .04$ is found between the Bellevue Full Scale and the Stanford-Binet, $.733 \pm .044$ between the Verbal Scale and the Stanford-Binet, and $.506 \pm .071$ between the Performance Scale and the Stanford-Binet.

6. Regression equations are provided for predicting probable Binet I.Q. from Bellevue Full Scale, Verbal Scale or Performance Scale I.Qs., and *vice versa*.

7. On the basis of this study, it is concluded that, particularly in the borderline groups, either test alone must be supplemented by social history data and psychiatric interview, in order to diagnose mental deficiency properly. Also, other tests should be used to supplement the data.

(Author's abstr.)

The Anticonvulsant Action of Tridione.

Tridione (3,5,5-trimethyloxazolidine-2,4-dione) is a new compound showing marked anticonvulsant and slight sedative action in humans. A preliminary report is made concerning the effectiveness of tridione as compared with phenobarbital and dilantin. In a group of 11 mentally defective institutionalized epileptics, three were better controlled by tridione than with previous medications, six were essentially unchanged, and two had more seizures with tridione than with phenobarbital and dilantin. Nine of the 11 subjects showed a strong anticonvulsant action with tridione, which appears to be as effective as phenobarbital or dilantin in antagonizing convulsions. No major toxic effects were noted, although two patients died of extraneous causes during the experiment. The sedative action of tridione in large dosages is effective in decreasing the noisy overactivity of deteriorated epileptics. It is concluded that tridione is a strong anticonvulsant drug which deserves further intensive investigation.

(Author's abstr.)

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Psychological Changes in Organic Brain Lesions and Ablations.

There are three fundamental questions which arise in relation to the clinical value of systematic investigations of the psychological alterations in organic disease of the cerebral cortex. These might be stated as follows:

1. Is there a group of psychological changes which occurs with sufficient frequency and consistency to be considered as an "organic psychological syndrome"?
2. Can such mental symptoms be of any potential value in contributing toward the localization of the pathological process in the cortex?
3. Can an investigation of the mental changes contribute toward a knowledge of the nature of the pathological process?

A review of the descriptive or qualitative studies of the mental changes in organic brain disease enables one to hazard a reply to each of these questions.

With respect to the first question, it may be stated that there is a group of general and diverse mental symptoms which occurs with sufficient frequency and consistency to be considered, at least tentatively, as constituting a "frontal-lobe mental syndrome." Intellectual deterioration, memory defects, impaired abstract-thinking ability, loss of initiative, difficulties in sustaining attention, alterations in the general personality structure, and changes in psychomotor tempo and mood tone are particularly characteristic of tumors and other lesions of the frontal region of the cortex. These changes are less severe and less consistent in instances of ablation of frontal lobe tissue. These same psychological symptoms apparently occur frequently in temporal lobe involvement, especially in tumors and some types of progressive lesions in that area. However, it may be noted that mental symptoms in temporal lobe disease are apparently not as marked or consistent as in frontal lobe disease process than in the case of focal frontal-lobe involvement.

It is possible, therefore, that the mental changes cited above are related to frontal-lobe disease, and that their appearance in certain types of focal temporal region disease is a result of secondary involvement of the frontal cortex by virtue of either increased intra-cranial pressure of a generalized nature or some type of progressive degenerative lesion implicating the frontal region. Goldstein has stated that damage in any area of the cerebral cortex will eventually irradiate to the frontal region. However, qualitative studies of parietal and occipital disorders yield no mental changes similar to those observed in cases of fronto-temporal involvement. It appears, therefore, that the mental symptoms are of some value in the localization of the disease process within the cortex, being indicative of either primary or secondary involvement of the frontal cortex. This would seem to

imply a positive answer to the second question posited above; the time of onset of the mental changes in the disease process has important implications for temporal-region localization in that a relatively late appearance of the mental syndrome would be suggestive of focal temporal-lobe disease. These conclusions are, of course, derived entirely empirically.

The third question asked is the most difficult, and any positive statements must be considered as highly tentative. However, it is felt that some indication of the nature of the disease process may emerge from a study of the severity, as well as the number, of the mental symptoms which are present. Frontal lobe tumors and other focal lesions along with temporal tumors appear to give rise to the most severe and consistent mental symptoms, and temporal lesions of a progressively degenerative type are next in importance. In the case of the latter, the psychological changes appear later in the disease process. Finally, it is found that the symptoms are consistently less severe and least frequent in cases of partial bilateral or unilateral frontal or temporal ablation.

The hypotheses of inter-lobular and intra-lobular transfer of functional ability have been suggested by various authors as possible bases for the absence of marked mental changes where cortical tissue has been excised. It is conceivable, as Brickner has pointed out, that psychological function is bilaterally represented within the prefrontal cortex. It is further possible that representation of functional ability is of a generalized nature within the entire association area of any one frontal lobe. The process of transfer of psychological function within the prefrontal cortex requires the integrity of the commissural fibres through the corpus callosum as well as the association fibres, and may be thought of in terms of a gestalt-like mechanism of interacting nerve fibres. This process of nerve fibre interactivity is presumably disturbed, and cannot be carried out adequately in the presence of pathological tissue in the frontal region, as evidenced in the severity and frequency of the mental symptoms in frontal tumors and other lesions of that area. It appears that only in the absence or excision of prefrontal tissue is it possible for such a transfer of function to take place with the resultant mild psychological changes which have been observed. Psychological studies, however, have demonstrated that such a transfer of functional ability is hardly of a complete nature, although it seems sufficient to escape general qualitative and clinical symptomatic detection. Specialized test methodologies suggest the presence of certain apparently irreversible mental deficits following excision of prefrontal tissue, which may well be missed unless a specific controlled situation is brought before the patient. Such a definitely controlled situation is that of psychological test procedure. Also, such test methods have served to break down certain of the broad and more general mental changes qualitatively observed into more specific and definite functional defects.

The approach to the problem of the mental changes in organic brain disease through the media of psychological test techniques has been described as being of two basic kinds. Both types of studies are primarily concerned with the relationship between the frontal cortex and mental function. One approach has employed conventional or *unspecialized* tests of formal intelligence, and general results indicate negative findings with reference to the presence of "general intellectual deterioration." Pre-operative and post-operative test comparisons upon patients undergoing excision of frontal tissue yield no gross lowering in the intelligence test scores following brain surgery. In fact, in some instances, a definite gain in the intellectual level has appeared following frontal ablation.

However, with the development and application of *specialized* psychological test procedures to this general problem, certain subtle but definite mental defects emerge. Such test development has consisted largely in an analysis of certain of the component elements of the so-called "general intellectual process" such as abstract thinking, memory ability, or judgment and comprehension. Other symptomatic and specialized tests have also yielded positive findings. Among these are the Rorschach, the Bender test of visuo-motor gestalt function, and tests of sustained attention. Such studies have been primarily applied in cases of partial unilateral frontal excision, in which the qualitative studies have noted either mild mental changes or complete absence of any mental defects after surgery.

The conclusion seems warranted that specialized test procedures can and do reveal definite impairment in mental functioning in cases in which prefrontal lobe

tissue has been removed surgically, whereas clinical observation of a qualitative kind finds no psychological deficits in such cases. The presence of certain subtle irreversible mental defects points to the fact that the existence of any mechanism for the lobular transfer of psychological function within the frontal cortex cannot be visualized as a complete "regenerative" process. Certain mental functions suffer irreparable damage when frontal tissue is removed, but such defects can be studied or detected only by means of a highly specialized and controlled type of situation. The principal contribution of psychological test procedures in this problem must lie in the subsequent development of specialized situations, which would call forth and reveal impairment in mental functioning which escapes qualitative clinical detection.

At present, superficial study of the investigations utilizing test procedures reveals a somewhat confused picture. One must not minimize, however, the emergence of some consistent positive trends. The difficulties in obtaining adequate quantitative sampling at the human level in such cases along with the problems inherent in clinical diagnosis and localization must be recognized. However, despite the use of a great variety of tests upon all manner of organic clinical entities in an unsystematic manner, it has been shown that certain definite conclusions are possible from an organized survey of the field. The mental changes in organic brain disease appear clearly to embrace more than any single psychological functional sphere. Experimental investigation must proceed from numerous and different directions if the parts of the puzzle are to be joined together.

It is felt that experimental progress demands the satisfaction of two basic methodological considerations. First, it would seem that the primary and fundamental situation must involve comparisons between the test performances of patients with organic brain disorders and normal persons. Logically, one would expect to see the more obvious differences emerge in such a comparison. Then one could proceed to a study of patients with respect to the problems of different types of brain disease and differential localization of brain damage with chances of attaining greater understanding and accuracy. Second, it is felt that specialized test development should be directed toward the various spheres of possible psychological impairment. The diverse nature of the mental defects qualitatively seen in organic cases must be totally explored with the use of specialized test techniques. The problem of mental alteration in organic disease of the brain cannot attain certainty and generalization in terms of a single test procedure. A battery of test techniques which will attack psychological functioning in the organic patient at every potential vulnerable point appears to be most advantageous. It is felt that one of the principal justifications for a review of this kind lies in its demonstration of the type and multiplicity of such vulnerable points of attack.

(Author's abstr.)

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Treatment of Experimental Liver Cirrhosis.

Rats were maintained on a cirrhosis-producing diet for 63 to 84 days, and the status of the liver of each rat was determined at that time by means of a biopsy. The rats were then treated by the daily administration of large amounts of choline chloride, or by using a diet containing larger amounts of casein. The gross and histological appearance of the liver after treatment was compared with the biopsy findings. During the period of treatment a striking improvement in the gross and microscopic appearance of the liver occurred. Although therapy had no recognizable effect on the fibrous tissue present, it apparently prevented further progression of the cirrhotic process and produced a marked improvement in the histological appearance of the parenchyma. (Authors' abstr.)

Alcohol as a Preventive of Experimental Neuroses.

Nine cats were trained in a feeding-response situation, and then on three to seven occasions were given 2 to 2.5 c.c. of alcohol per kgm. body-weight before being subjected to shock stimuli that induced severe conflicts in the feeding situation. Of the nine animals, only three developed relatively mild neuroses. When, however, the conflicts were repeated without antecedent intoxication, these three animals became more severely neurotic, and five of the six others also developed marked neuroses. These reactions, when graded according to an objective scale and analyzed statistically, were found to be stable and significant. It is concluded, therefore, that alcohol affords partial protection against the neurotogenic effects of conflictful experiences, probably by (a) diminishing the acuity of sensory experiences, (b) disorganizing perceptual-integrative response formations, and (c) impairing the retention of such reaction patterns as are temporarily formed. The correlation of these observations with parallel phenomena in human behavior is discussed briefly. (Authors' abstr.)

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1. Biochemistry, Physiology, Anatomy, Pathology, &c.

Acid Phosphatase in Growing Axons and Degenerated Nerve Tissue. Lassek, A. M., and Hard, Walter L. [*Science*, **102**, 123-4 (1945).]

Using a new method of determination to be described later, the authors have studied acid phosphatase in the central nervous system of cats and monkeys (*cf.* Wolf *et al.*, *C.A.*, **37**, 6334¹). Studies of the growing neuron in the cat indicate that variations in the time of appearance of the enzyme in the axons are to be correlated with the phylogenetic background of the several nerve tracts as well as the ontogenetic age of the animal. The tracts which react positively at birth are known to be the first to become myelinated. Studies of the degenerating neuron in the monkey show a marked acid phosphatase reaction. Myelin sheath degeneration following axonal damage may be due to the liberation of an enzyme from the latter structure. Conclusion: Studies on acid phosphatase in the nervous system open up possibilities in the field of neuronal metabolism and function, and an additional method is offered for demonstrating both normal and degenerated nerve tissue.

H. G. STEINMAN (Chem. Abstr.).

Relation Between Fiber Diameter and Action Potential of Single Nerve Fibers. Hertz, Helge. [*J. Physiol.*, **104**, 1-2P (1945).]

Solutions of NaCl or glucose up to 7 times hypertonic strength or $\frac{1}{3}$ hypotonic had no effect on the diameter or action potential of single nerve fibers during 10 minutes' exposure. Irreversible changes occurred thereafter. Immersion of the nerves in isosmotic solutions with KCl content 6-10 times normal caused immediate and reversible reduction of the amplitude of the action potential without change in shape of the fiber. The effect could be only partially counteracted with a corresponding increase in CaCl₂ concentration. Removal of Ca⁺⁺ was without effect for three-quarters of an hour; MgCl₂ (200 mgm. per cent.) and acetylcholine chloride (1 mgm. per cent.) were without effect in two hours.

H. L. WILLIAMS (Chem. Abstr.).

Experimental Technique and Electric Shock. Delmas-Marsalet, P., Servantie, L., and Faure, J. [*Compt. rend. soc. biol.*, **138**, 589-90 (1944). *Discussion.*]

Variations in total blood CO₂ in electric shock.

L. E. GILSON (Chem. Abstr.).

Role of Muscle Activity. Servantie, L., Delmas-Marsalet, P., Faure, J., and Blanc, M. [*Ibid.*, **138**, 591-2.]

In convulsions induced by electric shock there is a large decrease in the alkali reserve. This and the other chemical changes observed in the blood are the result of the intense muscular contractions.

L. E. GILSON (Chem. Abstr.).

Experimental Study of the Hyperglucemia Following Electrically Provoked Epileptic Convulsions in the Rat. Delay, Jean, and Soulaïrac, Andre. [*Compt. rend. soc. biol.*, **138**, 490-1 (1944).]

Electric shock convulsions produce an important increase in blood sugar which is not entirely prevented by bilateral adrenalectomy or administration of insulin, or both. The hyperglucemic mechanism of the hypothalamic-hypophyseal region of the central nervous system appears to be involved.

L. E. GILSON (Chem. Abstr.).

Muscle-action Potentials During Electric and Chemical Stimulation of the Motor Area of the Cortical Cortex in the Waking Animal and Under Anesthesia. Juul, Aksel. [*Acta Physiol. Scand.*, **5**, 152-64 (1943).]

Muscle-action potentials show a frequency of 2-3 per second during electric stimulation of the cortex and about 80-90 per second during chemical stimulation. Under the influence of strychnine, frequencies up to 125 per second have been recorded. This is not influenced by Ca, but quinine does inhibit the muscle-action potentials provoked by the action of strychnine on the cortex. PicROTOXIN affects the cortex motor area very much like strychnine, while cardiazole in 10 per cent. solution has a very slight central effect.

S. MORGULIS (Chem. Abstr.).

Excitability of the Respiratory Center During Sleep and During Evipan Anesthesia. Østergaard, Torsten. [*Acta Physiol. Scand.*, 8, 1-15 (1944).]

The excitability of the respiratory center is lowered during sleep, and even more so in sleep induced by hypnotic doses of evipan. The depressive action of evipan increases with its concentration in the blood, and at a certain concentration the center is the first to be put out of commission, the respiration being paralyzed. The ventilation in sleep is decreased 20-38 per cent. and in evipan anesthesia 48-80 per cent., while the alveolar CO₂ tension is raised 3-6 mm. and 8-9 mm. respectively. In the former the effect was due to a reduction in frequency, in the latter to a reduction in both frequency and depth of breathing.

S. MORGULIS (Chem. Abstr.).

Action of Ergotamine on the Chemical and Mechanical Reflexes from the Carotid Sinus Region. Euler, U. S. v., and Schmitterlow, C. G. [*Acta Physiol. Scand.*, 8, 122-33 (1944).]

Small doses of ergotamine inhibit the pressor reflex of the carotid sinus, which can be released by lowering the pressure, while leaving unaffected the response to chemical stimuli (cyanides, nicotine) and hypoxia.

S. MORGULIS (Chem. Abstr.).

A Sympathomimetic Pressor Substance in Animal Organ Extracts. Euler, U. S. v. [*Nature*, 156, 18-19 (1945).]

The active substance was obtained by continuous fluid extraction with ether of extracts of liver, spleen, kidney, heart, lung, voluntary muscle, smooth muscle, brain, pancreas, and testis. No pressor activity was found in extract from human placenta. The biological reactions point to a sympathomimetic substance probably related to the "sympathicusstoff" of Loewi.

E. D. WALTER (Chem. Abstr.).

Functional and Organic Injuries of the Central Nervous System of Cats in Low-pressure Experiments. Altmann, Hans-Werner, and Schubotho, Helmut. [*Beitr. path. Anat.*, 107, 3-116 (1942).]

Cats were exposed on successive days, after a short adaptation period, for 6-8 hours to a degree of air dilution which was just compatible with life, and corresponded on an average to a nominal altitude of 10,000-11,000 m. Some of the animals died spontaneously during or after the experiment; others were decapitated or otherwise killed by rapidly lowering the pressure. During the daily experiments, as well as in the intermediate periods, severe neurological symptoms were noted which were explained as consequences of the reduced oxidative metabolism in the central nervous system. Four phases were observed: Pre-asphyctic stimulation, asphyctic paralysis, post-asphyctic stimulation, and residual states of post-asphyctic paralysis. These stages are also evident in various states of cerebral asphyxia from different sources in man and animals described in the literature. In all animals with rather prolonged residual disturbances a pathologic-anatomical finding arises which can consist of elective parenchyma necrosis or complete softening according to the duration of the O deficiency. The various pathological types of ganglion cells were explained by the differences in intensity of the O deficiency. Chiefly "ischemic," "homogenizing," and "severe" forms were found. The cortex of the cerebellum is the most sensitive to O withdrawal, followed by the cerebral cortex; damage to the brain stem is always less. The prolonged hypoxia, which can be intensified locally by circulatory disturbances, is considered the most important cause of the development of the histopathological changes described.

RUTH BERGGREN (Chem. Abstr.).

Androgens in Mongoloid Deficiency. Bixby, Emily M., and Benda, Clemens E. [*Am. J. Mental Deficiency*, 49, 138-48 (1944).]

The amount of androgen (I) present in a 24-hour urine specimen was determined in 13 male and 10 female mongoloid patients by extraction with CCl₄ and development of color by a semiconcentration modification of the Zimmermann reaction. The results were in agreement with 13 similar determinations by Talbot *et al.*

(*C. A.*, 37, 5479¹) in showing no deviation from the normal range in male mongoloids from 8 to 18 years old. Above this age the (I) level was either in the lower part of the normal male range or in the female range, which is lower than the male. In the female subjects, most of whom were over 18 years old, a large proportion of the values were below the normal range, but two, from patients showing hirsutism, were abnormally high. The findings are considered to show that in mongoloids the formation of (I) in the adrenal cortex is normal, but no (I) is made in the male gonads.

WARREN M. SPERRY (Chem. Abstr.).

The Role of Pyruvic Acid in Fatigue. Meyer, Nathaniel. [*N.Y. State J. Med.*, 45, 1450-1 (1945).]

The blood pyruvic acid was lowered to normal levels in a group of fatigued individuals who received a nutritional concentrate comprised of a combination of several types of brewer's yeast and yeast extract. There was little or no significant reduction in the blood pyruvic acid in a control group, or in a group given a brewer's yeast extract. The progress of fatigue elimination was parallel to the reduction of the blood pyruvic acid content to normal.

RUTH BERGGREN (Chem. Abstr.).

Cholinesterase. I. Gold Salts and Cholinesterase. Frommel, Edouard, Herschberg, Alexandre D., and Piquet, Jeanne. [*Compt. rend. soc. phys. hist. nat. Geneve*, 60 (in *Arch. sci. phys. nat.*, 25), 97-100 (1943); cf. *C. A.*, 39, 2346⁹; 39, 2333⁹, 2518¹.]

Au Na thiosulfate (Sanocrysin) and Ca aurothioglycolate (Myoral) inhibited the cleavage of acetylcholine *in vivo* and *in vitro* by cholinesterase from horse serum or from leech muscle by 25-40 per cent., depending on concentration. Since the more dilute solutions were the more inhibitory, an ion effect was postulated. Eserine 1 : 1,000,000, employed as a standard for the inhibitory reaction, gave 90-95 per cent. inhibition.

II. *Influence of Arsenic and Lead on Enzymic Cleavage of Acetylcholine.* [*Ibid.*, 100-4.]

Arsenic in the form of nearsphenamine partially inhibited cholinesterase *in vivo*. Pb tetraethyl gave 25-75 per cent. inhibition *in vivo* and *in vitro*.

III. *Three Other Inhibitors of Cholinesterase: Aluminum, boron, zinc.* [*Ibid.*, 123-8.]

Salts of Al, B and Zn gave 15-37, 20-30 and 18-48 per cent. inhibition, respectively, *in vitro*. In the case of Al and B salts a 1 : 100,000 solution was more inhibitory than a 1 : 1,000 solution, while the reverse was the case with Zn. *In vivo* the effects were more marked; Zn salts gave 55 per cent. inhibition. Ni inhibited or accelerated cholinesterase activity, depending on concentration.

IV. *So-called Desensitizing Medicaments and Their Relation to Cholinesterase.* [*Ibid.*, 128-35.]

Na hyposulfite, MgCl₂, Ca galactogluconate, and ascorbic acid activated cholinesterase. The first two were true activators, and the others appeared to be reactivators of previously destroyed enzyme.

V. *Action of Ionized Inhibitors and Activators on the Cholinesterase of Snail Lymph.* [*Ibid.*, 175-8.]

Cholinesterase from the hemolymph of *Helix pomatia* was inhibited by Au, As, Pb, Zn, B, Hg, H, Sb, Cu and Na hypophosphite, activated by Mg, Ca, and Na hyposulfite, and inhibited or activated, depending on concentration by ascorbic acid. In general this cholinesterase behaved like the mammalian enzyme, except for differences in degree of inhibition or activation.

VI. *Action of Antimony, Bismuth, Mercury, Barium, Copper, and Phosphorus Ions on the Enzymic Cleavage of Acetylcholine.* [*Ibid.*, 179-84.]

Cholinesterase from horse or guinea-pig serum was more or less strongly inhibited by Sb, Bi, Hg, Ba, Cu and P. Through *Chem. Zentr.*, 1944, (I), 1387-8.

MARION HORN PESKIN (Chem. Abstr.).

Comparative Action of Histamine and Acetylcholine on Secretion of Adrenaline, and the Action of Atropine on Cholinesterase and Histaminase. Danielopolu, D., Popesco, M., and Mezincesco, Ed. [*Comp. rend. soc. biol.*, 138, 381-2 (1944).]

In dogs anesthetized with phenobarbital the injection of histamine or acetylcholine directly into the adrenal capsule produced an immediate marked hypertension from adrenaline discharge. Pre-treatment with atropine intensified the effect. Histamine injected intravenously produced marked hypotension; histamine after atropine produced hypertension in intact dogs, but not in adrenalectomized dogs. Acetylcholine injected intravenously produced first hypotension, then a mild hypertension, due to adrenaline discharge; acetylcholine after atropine produced immediate hypertension in intact dogs, but not in adrenalectomized dogs. Hence it appears that acetylcholine and histamine provoke adrenaline discharge by direct action on the chromaffin tissue of the adrenal medulla, and atropine intensifies the effect by inhibiting the destruction of acetylcholine by cholinesterase and possibly of histamine by histaminase.

L. E. GILSON (Chem. Abstr.).

The Effect of Drugs on Cholinesterase. Nachmansohn, David, and Schneemann, Helen. [*J. Biol. Chem.*, 159, 239-40 (1945).]

The inhibitory effect of various drugs was studied on four enzyme preparations. Two representing specific cholinesterase were prepared from electric tissue, and from the nucleus caudatus of ox brain. Unspecified esterase preparations were prepared from horse serum and from guinea-pig pancreas. The first three preparations were purified. Of the drugs studied (caffeine, quinine, quinidine, cocaine, lobeline) only caffeine acted exclusively on cholinesterase. It shares this property with theobromine. The other drugs showed only quantitative differences. Nicotine was found to be a weak inhibitor of both types of esterases, and strychnine and veratrine were found to be strong inhibitors of both.

MARJORIE ANCHEL (Chem. Abstr.).

Influence of Vagotonin on the Cholinesterase Activity of the Blood Serum of the Dog. Bovet, D., and Santennoise, D. [*Compt. rend. soc. biol.*, 135, 844-7 (1941).]

In normal and depancreatized dogs the intravenous injection of 1 mgm./kgm. of vagotonin causes a marked decrease in serum cholinesterase activity lasting several hours. Insulin free from vagotonin has no such action.

L. E. GILSON (Chem. Abstr.).

Cholinesterase Activity of Peripheral Nerves. Boell, Edgar J. [*J. Cellular Comp. Physiol.*, 25, 75-84 (1945).]

The favorable influence of frozen-dried nerves on the growth of nerve fibers during regeneration led to study of the biochemistry of such preparations. The cholinesterase (I) activity was chosen as probably characteristic. It was not affected by the freezing-drying process when the freezing temperature was below -130° . Above that temperature there was an inverse relation between (I) activity and freezing temperature. Degeneration of fresh and frozen-dried nerves caused a marked reduction of (I) activity. Unlike brain tissue, peripheral nerves contained both (I) and pseudo-(I). Measurement of (I) activity gave an accurate indication of the biochemical state of nerves under various conditions and of the effects of variations in the technique of processing.

H. L. MASON (Chem. Abstr.).

Cholinesterases. Augustinsson, K. B. [*Nature*, 156, 303 (1945).]

Results of electrophoresis experiments support the view that the cholinesterase of blood serum and that of the erythrocytes are not identical.

L. E. GILSON (Chem. Abstr.).

Fumaric Acid Oxidation by Ground Preparations of Pigeon Brain. Long, C. [*Biochem. J.*, 39, 143-8 (1945).]

Fumarate added in small amounts increases the O uptake of dialyzed pigeon-brain suspension but not of minced brain tissue. Pyruvic acid is formed in the presence of arsenite, this being catalyzed by inorganic phosphate, inhibited by malonate, and unaffected by adenine nucleotide. *l*-Malate seems to behave like fumarate.

S. MORGULIS (Chem. Abstr.).

Nervous Transmission. (1) *The Axon.* Kellaway, Peter E. [Rev. Can. biol., 4, 295-320 (1945) (in English).]

The dynamics of the propagation of excitation along thin chemically alterable interfacial films in non-living polyphasic systems is considered in relation to the problem of nervous transmission in peripheral nerve fibers. From the experimental evidence it is concluded that the propagation of the axonal impulse depends upon travelling waves of re-excitation which are electric in nature, and such that the potentials arising in each active region along the fiber are responsible for the initiation of activity in resting adjacent regions.

A. PAPINEAU-COUTURE (Chem. Abstr.).

The Effect of Augmenting the CO₂ Intake on the Blood Supply and Oxygen of the Brain and the Extremities Under Conditions of Hypoxemia. Ardashnikova, L. I., and Aronova, G. N. [Byull. Eksptl. Biol. Med., 18, Nos. 1-2, 34-7 (1944).]

Experiments with dogs in which the O₂ supply was lowered and the CO₂ supply raised resulted in a decrease in the O₂ consumption of the brain and the muscle extremities. Under these conditions the arterio-venous difference in O₂ was unchanged in the brain and decreased in the muscle extremities. The effect of these changes on the amount of blood supplied to the brain and muscle extremities is also discussed.

S. GOTTLIEB (Chem. Abstr.).

The Interaction Between the Hormones of the Ovary and the Hypophysis. Eskin, I. A. [Byull. Eksptl. Biol. Med., 18, Nos. 1-2, 68-72 (1944).]

The effect of the administration of adrenaline and ergotoxine on the development of luteinizing activity by folliculin benzoate was studied on rabbits. These results, together with those obtained by the study of the administration of atropine and acetylcholine, are discussed in the light of the mechanism of the interaction of the hormones of the ovary and the hypophysis.

S. GOTTLIEB (Chem. Abstr.).

Mechanism of Glycolysis in the Brain of Animals During Different Stages of Ontogeny. IV. *Inhibition of the Glycolytic Capacity of the Brain by Glycerol Aldehyde.* Khaikina, B. I. [Biochem. J. (Ukraine), 17, 359-68 (in Russian, 369-70; in English, 370-2) (1941); cf. C. A., 35, 7014^b.]

Addition of 0.25 per cent. of glyceraldehyde under anaerobic conditions to the brains of rabbits and chickens, in embryonic and postnatal stages, blocked the formation of lactic acid from the glucose substrate, but not in presence of hexose phosphate.

BORIS GUTOFF (Chem. Abstr.).

Is Cerebrospinal Fluid an Ultrafiltrate? Ambard, L., and Trautmann, S. [Compt. rend. soc. biol., 138, 187-8 (1944).]

Human spinal fluid contains 0.43-0.44 per cent. of Cl. Blood plasma containing 0.36 per cent. of Cl gives an ultrafiltrate containing 0.39 per cent. by the usual method of ultrafiltration. The difference between 0.43 and 0.39 is larger than can be explained by the difference in protein content of spinal fluid and plasma. Experiments show that when a protein solution containing chloride is well stirred during ultrafiltration, the Cl of the ultrafiltrate is about 10 per cent. higher than without stirring as in the usual procedure.

L. E. GILSON (Chem. Abstr.).

Remarks on Ultrafiltration. [Ibid., 227-9.]

As the ultrafiltration of serum or plasma continues the successive portions of ultrafiltrate contain less and less Cl. Since blood flows rapidly, the physiological ultrafiltration through the capillary walls is like ultrafiltration with stirring; hence the ultrafiltrate should contain about 10 per cent. more Cl than the classical value of 0.39 gm. per 100 c.c. This makes it possible to regard spinal fluid as an ultrafiltrate.

L. E. GILSON (Chem. Abstr.).

The Transfer of Penicillin into the Cerebrospinal Fluid following Parenteral Administration. McDermott, Walsh, and Nelson, Russell A. [*Am. J. Syph., Gon., Ven. Dis.*, 29, 403-15 (1945).]

With dilution techniques of bio-assay (sensitive to 0.02 units), no penicillin (I) was demonstrable in the cerebrospinal fluids obtained from 70 patients who had received (I) in usual dosages by parenteral routes. The presence of neurosyphilis and tuberculous meningitis did not alter these results. Approximately 0.02 per c.c. units of (I) was found in the cerebrospinal fluids of patients who had received one or two intramuscular injections of 300,000 to 500,000 units of (I) 3-4 hours previously. At concentrations of 0.078-1.25 units per c.c. of serum, (I) is diffusible through artificial membranes *in vitro* and into ascitic fluid *in vivo*. Thus the failure of (I) to appear in the cerebrospinal fluid is not because it is bound to non-diffusible elements in the serum. The interpretation of these findings with respect to the (I) treatment of neurosyphilis and purulent meningitis is discussed.

A. DIETZ (Chem. Abstr.).

Changes of the Cerebrospinal Fluid and Blood in Closed Traumas of the Central Nervous System. I. Study of the Cerebrospinal Fluid and Blood Pressures. Mandel'boim, A. B. [*Byull. Ekspl. Biol. Med.*, 17, Nos. 1-2, 22-6 (1944).]

Thirty-five patients were studied: (Group 1) those with cerebral contusion of 3-6 months' duration; (Group 2) those with spinal contusion of 3-9 months' duration; (Group 3) those with commotio-contusion syndrome of 3-8 months' duration. The cerebrospinal fluid was clear and colorless; its pressure was not constant and varied greatly. In patients with cerebral contusion two types of initial fluid pressure were observed: (1) Low (60-100 mm. of H₂O); (2) high (280-390 mm. of H₂O). The low pressure was characteristic of patients with general retardation, increased somnolence and persistent disorders of the sympathetic nervous system. The high pressure was characteristic of patients with various forms of hyperkinesis. The fluid pressure changed with the change in the clinical picture. All the patients had normal blood pressure, and the pulse rate was 68-100 per minute. In patients with spinal contusion, increased initial fluid pressure was observed (190-350 mm. of H₂O). The pressure varied slightly. Blood pressure was normal; pulse rate, 66-105 per minute. Patients with commotio-contusion syndrome had variable values for the initial and final fluid pressure. Blood pressure was normal; pulse rate, 90-110 per minute.

II. Chemical Variations of the Cerebrospinal Fluid and Blood. [*Ibid.*, No. 3, 13-16.]

Morphological changes have not been observed in cerebral and spinal contusions or in commotio-contusion syndrome. Pandy's and Nonne-Apelt globulin tests were negative. The total protein content, 0.16-1.33 per cent., was determined by the Roberts-Brandberg-Stol'nikov method. Reducing substances in the cerebrospinal fluid and blood were investigated by the Hagedorn and Jensen method (*cf. C. A.*, 17, 272). Electrolytes in cerebrospinal fluid and blood were determined: K by Kramer's method; Ca by de Vaard's method; Cl by the modified method of Bang. Colloidal reactions, Takata-Ara and Goldsol (Lange) were carried out in some cases. In cerebral contusion the content of electrolytes in the cerebrospinal fluid and blood varied widely. In patients with general retardation and a sharply decreased motor initiative, an increased Ca content in the cerebrospinal fluid was observed. The improvement in the condition of the patients was accompanied by a slow decrease of the Ca content in the cerebrospinal fluid to normal. In patients with cerebral contusion the sugar content in the cerebrospinal fluid was increased; the blood sugar was also increased. No change in Cl was observed. In the presence of various forms of hyperkinesis there was an increase of K in the blood and an increase of the K/Ca index in the cerebrospinal fluid. The sugar contents in the cerebrospinal fluid and the blood were decreased. Colloidal reactions, goldsol (Lange) and takata-ara in the cerebrospinal fluid showed curves of a distorted type. In patients with spinal contusion an increase of K in the blood was usually observed and, in some cases, also of the K/Ca index. The blood-sugar content was normal. Colloidal reactions in the cerebrospinal fluid showed distorted curves. In patients

with commotio-contusio syndrome the electrolyte content varied. The K content was increased in most cases. The ratio of K/Ca was not constant. The sugar index was normal or slightly decreased. Colloidal reactions had a Leuzacke-type curve and, in rare cases, curves of the type lues cerebrosplanialis.

SONYA G. MACHELSON (Chem. Abstr.).

Permeability of Hemato-encephalic Barrier in Spinal Cord Traumas. Kirichenko, A. M., Lukina, T. S., and Freidin, Kh. M. [Byull. Ekspil. Biol. Med., 17, No. 6, 13-15 (1944).]

The investigation of the permeability of the hemato-encephalic barrier and of the composition and pressure of the spinal cord fluid disclosed a considerable number of pathological changes in the fluid. It seems that these changes are fundamentally connected with results of an injury of the membrane characterized as a chronic process after hemorrhages into membranes and into cerebral substance. In some traumas, especially in the lower section of the spinal column, the constant influence of the infection from the adjacent osteomyelitic nidus of the spinal column ought to be taken into consideration.

SONYA G. MACHELSON (Chem. Abstr.).

Oxidation of Pyruvate and Glucose in Brain Suspensions from Animals Subjected to Irreversible Hemorrhagic Shock, Carbon Monoxide Poisoning, or Temporary Arrest of the Circulation: A Study of the Effects of Anoxia. Rosenthal, Otto, Shenkin, Henry, Drabkin, David L., Parkins, Wm. M., and Gibbon, Mary H. [Am. J. Physiol., 144, 334-47 (1945).]

Experimental findings suggest that a destruction of respiratory enzymes or a critical deficiency of co-enzymes in the brain is not a primary consequence of anoxia, nor do such factors account for the development of irreversible functional and histologic alterations that may follow anoxia.

E. D. WALTER (Chem. Abstr.).

Excitant Action of Ascorbic Acid on the Nervous System. Chauchard, Paul. [Compt. rend. soc. biol., 135, 1574-7 (1941); cf. C. A., 38, 1770^b.]

In normal rats and guinea-pigs the intraperitoneal injection of ascorbic acid produces a decrease in chronaxia, probably by a direct action on the nervous system.

L. E. GILSON (Chem. Abstr.).

Chronaximetric Study of the Neuromuscular Disturbances Accompanying Avitaminosis E. Lecoq, Raoul, Chauchard, Paul, and Mazoue, Henriette. [Compt. rend. soc. biol., 138, 408-9 (1944); cf. C. A., 38, 2078^a.]

When young rats were given a diet low in vitamin E and containing 22 per cent. of salad oil, they showed, after 25 days, changes in chronaxia which indicated excitation of the brain and medulla, hence these are sites of action of the tocopherols. The changes in chronaxia were prevented if wheat germ and yeast were added to the ration, or if the salad oil was reduced to 7.7 per cent. Apparently a high lipide intake accentuates the effect of vitamin E deficiency.

L. E. WILSON (Chem. Abstr.).

Pharmacodynamics of Thiamine. Action on Nerve Conduction (Neuromuscular and Ganglionic Transmission). Chauchard, Paul. [Compt. rend. soc. biol., 135, 869-72 (1941); cf. C. A., 36, 2594^a.]

A 0.5 per cent. concentrate of thiamine in Ringer solution acts like a very dilute solution of strychnine on the frog nerve-muscle preparation.

L. E. GILSON (Chem. Abstr.).

Inhibition by Thiamine of the Drop in Vestibular Chronaxia Provoked by Thyroxine. Mouriquand, G., Coisnard, J., and Edel, Mme. V. [Compt. rend. soc. biol., 138, 552-3 (1944).]

In pigeons the large drop in chronaxia produced by 66 γ of thyroxine as previously described (C. A., 39, 3342^b) is prevented by 2 mgm. of thiamine. In children the effect of 1 mgm. of thyroxine on chronaxia is antagonized by 15 mgm. of thiamine.

L. E. GILSON (Chem. Abstr.).

Pharmacological Study of Various Drugs in Relation to Their Influence on So-called Vestibular Chronaxia and on Disorders of Chronaxia. Mouriquand, G., and Coisnard, J. [*Ibid.*, 563-5; cf. *C. A.*, 37, 4137^{7,8}.]

In pigeons and in children, acetylsalicylic acid or caffeine, or both together produce a large decrease in chronaxia. Thiamine inhibits this action. In pigeons, 0.5 gm. of antipyrine causes a large decrease in chronaxia followed by death; 0.1 gm. pyrimidone causes a large decrease, which is prevented by intramuscular injection of 2 mgm. of thiamine; 0.05 mgm. of strychnine sulfate causes a large drop in two hours followed by a return to normal in 7 days; and 10 mgm. of quinine sulfate a large drop within 3 hours, with return to normal in 5 days. One mgm. of thiamine counteracts the action of 10 mgm. of quinine sulfate. Phenylethylmalonylurea in moderate doses has no effect on chronaxia in pigeons or children. Insulin produces a large drop in chronaxia in pigeons and in diabetic children; in the latter 40 units daily maintains the chronaxia at a low level.

L. E. GILSON (Chem. Abstr.).

A Special Reaction of Neurons, Especially in the Sympathetic System and the Motor Endings of Central Neurons. Champy, C., Coujard, R., and Coujard, C. [*Compt. rend. soc. biol.*, 135, 938-40 (1941).]

An osmic-acid alkali iodide reagent (cf. *J. anat. physiol.*, 1913, 323) stains sympathetic nerve-endings a more intense black than other tissues. It blackens certain parts of each sympathetic motor neuron. It darkens only the adrenaline-containing cells of the adrenals of birds and bacrachians. The black coloration is probably due to reduction of the reagent by adrenaline or an adrenaline-like substance.

L. E. GILSON (Chem. Abstr.).

Action of Calcium Chloride on the Nerve-ending of the Skeletal Muscle. Yudenich, N. A. [*Byull. Ekspil. Biol. Med.*, 17, Nos. 4-5, 55-7 (1944).]

Tests were made on the sciatic nerve and gastrocnemius muscle of a frog. A weak solution of CaCl_2 in Ringer solution (concentrate 0.05-0.3 per cent.) was used. In some cases the solution contained KCl. The changes in the nerve-endings were achieved by perfusion of the muscle. Two stimulations rapidly following each other were applied to the nerve at various intervals, or were applied to the nerve at the rate of 5-500 per second. The muscular contractions were recorded. In muscle perfused with CaCl_2 solution the end of the absolute and the beginning of the relative refractory phases are characterized by a slight and slow increase in the summation contractions, not exceeding the sum of heights of contractions from two separate stimulations. By use of tetanic stimulation the action of CaCl_2 is more evident than in individual stimulations. In muscle perfused with a 0.05 per cent. CaCl_2 solution the magnitude of the contractions caused by individual maximum stimulations over a period of 8 hours or more does not decrease. The thresholds of stimulation are not changed. With tetanic stimulation, changes occur 20-30 minutes after the beginning of perfusion (pessimum phenomena). When perfused with Ringer solution pessimum phenomena develop at 100 (sometimes 50) stimulations per second. When K is removed from the Ringer solution and the Ca content is increased to 0.5 per cent. pessimum phenomena develop at weaker and less frequent stimulations. The functional ability of the nerve-muscular combination to respond to a stimulation after a pessimal reaction is decreased for a while.

SONYA G. MACHELSON (Chem. Abstr.).

Origin of Hyperglycemia Under Action of Substances Stimulating the Central Nervous System. Lerman, I. A. [*Byull. Ekspil. Biol. Med.*, 17, No. 6, 23-5 (1944).]

The method used consisted of the preliminary introduction of barbiturates in order to elucidate the origin of hyperglycemia under the influence of poisons stimulating the central nervous system. Injections of strychnine, caffeine and picrotoxin were given to dogs, in some cases during phenobarbital narcosis. A preliminary introduction of phenobarbital causes the disappearance of hyperglycemia brought on by strychnine, caffeine and picrotoxin; this makes it possible to assume that hyperglycemia from stimulating poisons and the decrease of sugar in the blood by barbiturates is of central origin. Hyperglycemia, developed under the action

of substances stimulating the central nervous system, does not depend on convulsions and asphyxia; hyperglycemia is absent in dogs in which one suprarenal gland has been removed and the other denervated, although convulsions and other symptoms of poisoning with picrotoxin are evident.

SONYA G. MACHELSON (Chem. Abstr.).

Effect of Eserine and Prostigmine on a Nerve Absolute Refractory Phase. Babskii, E. B., and Kovyrev, I. G. [Byull. Eksptl. Biol. Med., 17, No. 6, 30-3 (1944).]

Acetylcholine formed in nerve centers and fibers is a resulting component of the nerve impulse and is a factor for the excitability of the nerve tissue. The effect of eserine and prostigmine, i.e. substances paralyzing cholinesterase, was investigated in order to elucidate the role of acetylcholine in the development of absolute refractoriness. The experiments were carried out with sciatic nerve-gastrocnemius muscle of *Rana temporaria*. Eserine was used in concentrations of 1 : 10,000, 1 : 5,000 and 1 : 2,000; prostigmine in concentrations of 1 : 5,000, 1 : 3,000, 1 : 1,000 and 1 : 500. Under the action of eserine the duration of the absolute refractory phase increased; eserine (1 : 2,000) caused prolongation of the absolute refractoriness 2-5 times; on prolonged washing of the eserinated nerve section with Ringer solution, the duration of absolute refractoriness returned to a value approaching the initial. In a concentration of 1 : 5,000 the change of the absolute refractory phase of the nerve was slighter, and in a concentration of 1 : 10,000 no change was observed. The effect of prostigmine is less strong; in a concentration of 1 : 500 it increased the absolute refractoriness of the nerve 1.5-3 times. Eserine and prostigmine inactivate cholinesterase, and thus inhibit the hydrolysis of acetylcholine formed in the nerve on stimulation. Acetylcholine accumulates in the nerve and causes prolongation of the absolute refractoriness. In large concentrations, acetylcholine decreases excitability of the nerve tissue.

SONYA G. MACHELSON (Chem. Abstr.).

Some Effects of Acetylcholine, Eserine and Prostigmine when Injected into the Hypothalamus. Emmelin, Nils, and Jacobsohn, Dora. [Acta Physiol. Scand., 9, 97-III (1945).]

Injections of acetylcholine into the hypothalamic region affect respiration and intestinal motility in the same manner as was observed with electric stimulation of the hypothalamus. Similarly, injections of eserine and prostigmine into the third ventricle produce apnea and inhibit the motility and tone of the intestine and bladder, as was observed in electric stimulation. It is suggested that the hypothalamic cells of that region constitute a sympathetic center, and that they are affected by acetylcholine, eserine and prostigmine.

S. MORGULIS (Chem. Abstr.).

The Appearance of Acetylcholine and Other Changes in the Blood and Spinal Fluid of Man During Electric Shock. Brecht, B., and Kummer, H. [Klin. Wochschr., 22, 741-2 (1943); Chem. Zentr., 2, 34 (1944).]

The acetylcholine content of the blood and spinal fluid of man during electric shock is not increased, as was demonstrated in the lung preparation of the frog. Neither was there a change in the spinal fluid in its content of cells and NaCl, nor in the blood in protein and sugar. The Wassermann reaction was not influenced. The blood showed leucocytosis.

A. E. MEYER (Chem. Abstr.).

Spread of Acetylcholine-induced Electrical Discharges of the Cerebral Cortex. Forster, Francis M., and McCarter, Robert H. [Am. J. Physiol., 144, 168-73 (1945).]

The application of acetylcholine (I) to the cortex resulted in a diminution in the electrical activity, which was rapid in onset. This was followed by the appearance of (I) discharges which varied in type and tended to remain sharply localized to a small region. Spontaneous spread of (I) discharges occurred along anatomical structures and followed neuronal paths in dromic fashion. Secondary (I) discharges were possibly neuronal and not axonal discharges. Certain differences between primary, secondary and tertiary (I) discharges were discussed.

E. D. WALTER (Chem. Abstr.).

A Note on the Action of Lobeline, Nicotine and Acetylcholine on the Afferent Nerves of the Tongue. Zotterman, Yngve. [*Acta Physiol. Scand.*, 8, 377-9 (1944).]

Lobeline, nicotine and acetylcholine act on the chemo-receptive mechanism of the carotid body. Their action is shown to be specific, because they have no effect at all when introduced intra-arterially upon the afferent mechanism of the tongue.
S. MORGULIS (Chem. Abstr.).

Formation of Acetylcholine in the Nerve Axon. Nachmansohn, David, and John, Hedda M. [*Science*, 102, 250-1 (1945); *cf. C. A.*, 38, 5513⁶.]

Choline acetylase was determined in the axon of sciatic nerves of rabbits by a previously described method. The esterase formed about 50% acetylcholine per hour. Acetylcholine production diminished about three days after section, and was considered responsible for the conduction of the nerve impulse.

HELEN LEE GRUEHL (Chem. Abstr.).

Detection of Lecithin in the Acetylcholine Complex of Brain Tissue by the Actions of Cobra Venom and Bile Salts. Gautrelet, J., Corteggiani, Elisabeth, and Carayon-Gentil, Mme. [*Compt. rend. soc. biol.*, 135, 832-5 (1941); *cf. C.A.*, 33, 8299⁷, 9402¹.]

As previously shown, brain contains acetylcholine bound in a phosphatide complex. When cobra venom is heated at 100° for 20 minutes all its proteinase is inactivated, but its lecithinase is not. This heat-treated venom liberates acetylcholine, lysolecithin, and a fat acid from brain tissue suspension. A concentrated solution of bile salts also liberates acetylcholine from brain suspension.

L. E. GILSON (Chem. Abstr.).

Factors Influencing the Formation of Acetylcholine in Cell-free Extracts from Brain. Feldberg, W., and Mann, T. [*J. Physiol.*, 104, 17P, 8-20 (1945); *cf. C. A.*, 39, 972¹.]

Adenosinetriphosphate (ATP) can be replaced by citrate and fresh boiled juice from brain. The activator in the latter was not identical with either ATP or choline, since the synthesis of acetylcholine in the presence of citrate and the juice was not influenced by glucose. If all three activators, ATP, citrate and boiled juice, were added together, the rate of formation of acetylcholine rose to 1,200% (rat) and 1,800% (guinea-pig) per gm. acetone powder per hour at 37°. The corresponding values for ATP alone were 300 and 700%; for ATP and boiled juice, 700 and 900%; and for ATP and citrate, 1,000 and 1,200%. Citric acid could not be replaced by succinic, fumaric or tartaric acids; malonic, glutamic and aconitic acids were slightly effective. Brain extract lost its ability to synthesize acetylcholine during dialysis, which activity could be restored by the addition of citrate and boiled juice or ATP, but not by citrate or boiled juice alone.

H. L. WILLIAMS (Chem. Abstr.).

Acetylcholine and the Mechanism of Nerve Activity. Nachmansohn, David. [*Exptl. Med. Surg.*, 1, 273-7 (1943).]

MARION HORN PESKIN (Chem. Abstr.).

2. Pharmacology and Treatment.

Synthetic Anticonvulsants. 5,5-Disubstituted Hydantoins Containing a Hetero Atom in the Side Chain. Merritt, H. Houston, Putnam, Tracy J., and Bywater, W. G. [*J. Pharmacol.*, 84, 67-73 (1945).]

A series of 62 5,5-disubstituted hydantoins containing O or S in one alkyl side chain were tested for anticonvulsant activity in the cat. Some were inactive. The 5-phenyl-5-alkoxymethyl- and 5-phenyl-5-alkylthiomethylhydantoins possess pronounced anticonvulsant activity. The two most promising derivatives from a standpoint of anticonvulsant activity with a minimum of hypnotic effect are 5-phenyl-5-propoxymethyl- and 5-phenyl-5-isopropoxymethylhydantoin. The last named, in cats, affords full protection against electrically induced convulsions in doses of 33-37 mgm./kgm. in acute experiments, and gives a lasting and consistent rise in the convulsive threshold in chronic tests. It is recommended for clinical trial.

L. E. GILSON (Chem. Abstr.).

The Chemical Basis of Marihuana Activity. Loewe, S. [*J. Pharmacol.*, **84**, 78-81 (1945).]

The interrelation between the two main pharmacology actions of cannabis, motor ataxia and corneal areflexia, still remains obscure. Experiments on rabbits with hemp-resin fractions indicate that in the resin these two biological actions of the drug are in part combined in the same molecule and in part embodied independently in separate molecules. While the identification of the substances of the former type, the areflexia and ataxia active isomeric tetrahydrocannabinols, is well advanced, the principles having only areflexia activity are as yet unidentified. They may be either unknown tetrahydrocannabinols or compounds of entirely different structure.

L. E. GILSON (Chem. Abstr.).

Barbituric Acid Derivatives. Pharmacological Relationship of a Series of Butenyl-alkylbarbituric and -thiobarbituric Acid Compounds. Swanson, E. E., Fry, W. E., and Reagen, O. W. [*J. Am. Pharm. Assoc.*, **34**, 183-7 (1945); cf. *C. A.*, **35**, 3334¹.]

A study was made of disubstituted barbituric and thiobarbituric acids in which one of the substituents in the 5-position was 1-, 2-, or 3-methylallyl, and the other substituent was ethyl, allyl, propyl, isopropyl, butyl, *sec*-butyl, isobutyl, amyl, *sec*-amyl, or isoamyl. As the number of C atoms increases in the substituted alkyl chain, the duration of action decreases. In the isomeric butenyl compounds, as the Me radical changes from position 1 to 2, to 3 in the carbon chain, the duration of action becomes shorter. Many of the thiobarbiturates are stimulating or convulsive in action, particularly (1-methylallyl)isobutylthiobarbituric acid, which is a severe convulsant to warm-blooded animals and a depressant to cold-blooded animals.

A. PAPINEAU-COUTURE (Chem. Abstr.).

Cocaine and Excitability of the Cerebral Cortex. Chauchard, A., Chauchard, B., and Chauchard, Paul. [*Compt. rend. soc. biol.*, **136**, 492-3 (1942).]

Effects of cocaine on chronaxia under various conditions are discussed.

L. E. GILSON (Chem. Abstr.).

Liberation of Phosphate by the Cerebrum of the Dog Excited by Convulsant Drugs. Cicardo, Vicente H. [*Rev. soc. argentina biol.*, **21**, 54-62 (1945); cf. *C. A.*, **39**, 3345¹.]

In dogs, after destruction of the spinal cord, brain stimulation by metrazole or picrotoxin causes an increase in the total acid-soluble P of the plasma of blood withdrawn from the superior longitudinal sinus exposed by trepanation. Samples of blood withdrawn from the femoral artery or vein do not show this increase. The increase in the P of the blood from the brain may continue for as long as 15 minutes after the stimulation. The above effect is not seen in curarized dogs treated with metrazole or picrotoxin, perhaps because of the central action of the curare. Sometimes in curarized dogs a progressive decrease in blood P is observed.

L. E. GILSON (Chem. Abstr.).

Effects of Alcohol and Sodium Amytal on Intelligence-test Score. Sargent, Wm., Slater, Patrick, Halstead, Herbert, and Glen, Margaret. [*Lancet*, **1**, 617-18 (1945).]

Na amytal in doses of 1-3 grains is a more efficient and less toxic sedative than the EtOH equivalent of a double whisky (20 c.c. abs. EtOH) and has no greater effect than EtOH on intelligence-test scores. Small doses of Na amytal are preferable to EtOH for prophylactic sedation in times of acute stress.

E. R. MAIN (Chem. Abstr.).

Action of Inhibiting Substances on the Autonomic Nervous System. Danielopolu, D., Popesco, M., and Mezincesco, Ed. [*Compt. rend. soc. biol.*, **138**, 380-1 (1944).]

The antagonistic action of small and large doses of atropine, ergotamine, yohimbine, diethylaminomethylbenzodioxan (F 883), piperidylmethylbenzodioxan (F 933) and N-dimethylaminoethyl-N-benzylaniline (Antergan RP 2339) toward adrenaline, acetylcholine and histamine is discussed.

L. E. GILSON (Chem. Abstr.).

A Method for the Determination of Analeptic Activity. Goodwin, L. G., and Marshall, P. B. [*J. Pharmacol.*, **84**, 12-15 (1945).]

A modification of Chakravarti's "mouse-awakening" analeptic test (*C. A.*, **33**, 9442⁴) is described, in which adequate controls are used in each experiment. Effects of several widely used stimulants on mice anesthetized with Na pentobarbital are compared.
L. E. GILSON (Chem. Abstr.).

Stimulation and Depression of the Central Nervous System by Derivatives of Barbituric and Thiobarbituric Acids. Knoefel, P. K. [*J. Pharmacol.*, **84**, 26-33 (1945).]

The effects of numerous barbiturates in intact and decerebrate animals were studied. 5-(1,3-Dimethylbutyl)-5-ethyl-barbituric acid produces in intact animals a state of hyperactivity of the central nervous system. Its lethal dose can be raised three times by the previous administration of a depressant barbiturate, but the reverse antagonism is not marked. It augments the respiratory minute volume when this is reduced by barbital or morphine. It augments the flexion and crossed-extension reflexes of decapitated, decerebrate and anesthetized animals. The knee-jerk of the intact anesthetized dog is reduced by small doses and increased by larger doses. All related compounds studied, where other alkyl groups were substituted for the 1,3-dimethylbutyl group, had a purely depressant action on the spinal-flexion reflex. In comparing the stimulant and depressant properties of barbiturates, use of thiobarbiturate instead of barbiturate may develop central-nervous-stimulant reactions, but if these are already present they may be reduced. Introduction of a double bond may develop stimulant properties. Presence of a 5-benzyl group, but not a phenyl or phenethyl group, favors the presence of stimulant properties. In several instances a change in chemical structure which increases the potency of a stimulant compound also increases the potency of a depressant compound. The spinal-flexion reflex may be augmented or reduced by the same compound, depending on the dose. Phenomena of central-nervous stimulation may be produced in the intact animal by compounds which are purely depressant to the spinal-flexion reflex.
L. E. GILSON (Chem. Abstr.).

Local Action of Penicillin and Sulfamethazine and a Penicillin-sulfamethazine Mixture on Rabbit Brain. Russell, Dorothy S., and Beck, Diana J. K. [*Lancet*, **1**, 497-8 (1945); cf. *C. A.*, **35**, 7653¹.]

Local applications of Na penicillin had an irritating effect on the brain. Powdered sulfamethazine had no damaging action. Mixtures of Ca penicillin and sulfamethazine were less irritating than penicillin but more irritating than sulfamethazine alone. The injurious action of penicillin may be caused by the impurities known to form a considerable part of the best samples available.

E. R. MAIN (Chem. Abstr.).

Modification of the Vascular Effects of Papaverine by Certain Poisons of the Autonomus Nervous System. Bariéty, Maurice, and Kohler, Denyse. [*Compt. rend. soc. biol.*, **135**, 706-8 (1941).]

In dogs the hypotensive effect of small doses of papaverine-HCl (1-2 mgm./kgm. intravenously) is notably increased by pre-administration of sympathomimetic compounds (adrenaline, ephedrine, norephedrine) in doses ordinarily sufficient to produce hypertension. After cocaine (5-8 mgm./kgm.) or β,β -diphenoxyethylamine (JL 408) (10-20 mgm./kgm.) the hypotensive action of small doses of papaverine is slightly increased. After atropine (2 mgm./kgm.) the hypotensive action is also increased and the subsequent injection of adrenaline or ephedrine causes a further drop in pressure. After sympathicolitics, such as yohimbine (2 mgm./kgm.) or piperidinomethylbenzodioxan (5-10 mgm./kgm.) the hypotensive action of papaverine is moderately increased, and here ephedrine causes a further drop, but adrenaline does not.

L. E. GILSON (Chem. Abstr.).

The Nature of the Action of Benzedrine. Gubar, V. L. [Byull. Eksptl. Biol. Med., 18, Nos. 1-2, 51-4 (1944).]

Experimental data are presented to show that benzedrine (I) stimulates the brain centers to quicken the heart, but does not have a primary action on the heart and blood vessels. In its effect on the peripherae of the brain in the region of the cross-shaped bend, (I) increases the tonus of vasoconstriction. Other effects are described.
S. GOTTLIEB (Chem. Abstr.).

(Action of) Amphetamine (Benzedrine) Sulfate Upon Higher Nervous Activity Compared with Alcohol. II. Human Experiments. Finkelstein, Nathaniel, Alpern, E. Bryce, and Gantt, W. Horsley. [Johns Hopkins Hosp Bull., 76, 61-74 (1945).]

Amphetamine sulfate, 10-15 and 20-30 mgm. orally in healthy young subjects, increased the systolic and diastolic blood pressures, did not alter pulse rate, increased respiratory rate, caused slight improvement in differentiation between positive and negative conditional reflex stimuli, had no effect on the threshold of sensation to electric shock, auditory acuity, or performance in problem tests. A respiratory *cr* (conditioned reflex) was observed. Alcohol (1.5 c.c./kgm.) had a pronounced effect on motor *crs* as compared with amphetamine. Alcohol tends to convert inhibitory to excitatory reactions, interferes with inhibition, favors excitatory reactions, impairs the respiratory *cr*, and markedly increases the threshold for perception and pain. The *cr* test was better for detecting changes in higher nervous function than the verbal tests used. Cf. C. A., 38, 584^a.

A. EDELMANN (Chem. Abstr.).



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JULY, 1946.

VOL. XCII

Part I.—Original Articles.

CLINICAL SURVEY AND RESULTS OF 200 CASES OF PREFRONTAL LEUCOTOMY.*

By JAN FRANK, M.D.,
Graylingwell Hospital, Chichester.

SINCE the introduction of leucotomy by Lima and Moniz in 1936 numerous authors have reported their experiences with this form of treatment in mental disorders (Freeman and Watts, Fleming, Mayer-Gross, Hemphill *et al.*). Although leucotomy has stood the test of time well, and all workers agree that in selected cases its application is well justified, so that it has become an established form of treatment, there are many obscure clinical aspects which require elucidation. It is obvious that the collection of observations from as many angles as possible is necessary in order to further research in this promising field. It is hoped that a report on the results of leucotomies performed in this Hospital will be a contribution to that end.

Before going into detailed analysis of the case-material, one has to meet one or two methodological objections to the present-day customary clinical psychiatric research. These are: first, that the intangible complexities and imponderabilia of a personality, the all-important developmental and individually unique psycho-drama on the psychological plane, get lost in the maze of clinical descriptive terms, mass observations and statistics. This seems to me irrefutable. It is salutary to recall, I think, that Freud, for example, arrived at his epochal discoveries by studies of *individual* patients, and was bold enough to build upon those observations a psychopathology, a psychology, and a metapsychological theory. The dynamic psychoanalytical discipline thus founded still remains an unrivalled method for disentangling symptoms psychologically, and for understanding some of the meaning of the contents of psychoses. Despite the frowning misgivings with which statisticians question the permissibility of, for them, useless terms such as emotional

* Read at a meeting of the S.E. Division of the R.M.P.A. at Graylingwell Hospital, Chichester, on May 2, 1946.

ambivalence, libidinal cathexis, and so forth, as too vague, psychoanalysis obstinately refuses to budge before the anathema of the modern number-wizards. All this has practical clinical implications too; psychiatric clinicians should not mesmerize themselves, as it were, by brandishing numbers.

The indications for leucotomy should be put forward, not only after a clinical descriptive classification of illness and assessment of chances of spontaneous recovery, but also after painstaking investigation of the *quality* of the present and past personality, and the social environmental situation into which the patient will be discharged on his eventual recovery. The possibility must be kept in mind also, that a psychosis might be the last act of a psycho-drama; meaning that a constitutional personality with its own peculiar, developmental, and instinctual response subconsciously chooses psychotic surrender as a solution for some insurmountable conflict on a different plane of psycho-biological existence.

The realization that the response of the personality to brain injuries is markedly individual and cannot be predicted by any clinical criterion or any other rule of thumb method is essential; quite apart from the apparent fact, which Alfred Meyer has demonstrated so impressively, that in almost every operation of leucotomy, topographically different fibres are cut, owing to lack of exposure of the operative field and inexactitude of skull markings.

John S. Muller, the great physiologist, once said that "every organ has its own language and a key to it." To apply this metaphor, the language of the brain expresses itself in the psychic manifestation of the whole personality which responds to the brain as a holistic entity. Both structure and function are holistic: function affects structure—as seen in the speedier disappearance of deficiency symptoms after brain damage by appropriate psychological reablement—and structural changes influence, of course, function. Such principles of a holistic neuropathology, as propounded especially by Goldstein and his school, should put a stop to the futile and confusing "revivalist" tendency to find the seat of the soul in some localized cell or fibre constellation of a particular part of the brain. That is why, I think, the projecting of psychological conceptions, such as the super-ego, into neuropathological mechanisms is fraught with the danger of confusion, even if it is suggested as a heuristic assumption only.

The next fundamental difficulty of psychiatric mass observation and assessment of results is the almost hopeless "Tower of Babel" confusion of descriptive psychiatric nosology. (Alienists seem to be very zealous pupils of their patients in finding neologisms for the naming of diseases and in creating autistic systems of clinical classification of their own, which they foster with great narcissistic pride.) A basic standardized psychiatric terminology is imperatively needed if clinical psychiatrists are ever to achieve common ground.

The enumeration of possible fallacies in this type of paper, unfortunately, does not eliminate them or render the investigator immune from them. The only excuse for its shortcomings is that during the war years the really desperate shortage of doctors and auxiliaries, such as social workers, nurses, etc., made sufficiently exhaustive collection of information wellnigh impossible.

CASE MATERIAL.

The cases are those of the chronic population in an average county mental hospital. Although their social-educational attainments range from unskilled labour to the professional classes, such as doctor, lawyer, medical student, clergyman, nurse, civil servant, etc., the majority (71 per cent.) were housewives, artisans, farmers, lower category clerks, and members of the working class (16 skilled workers among them). Only 27 out of 200 had reached matriculation standard or the equivalent. The overwhelming majority (81 per cent.) were educated in State-supported schools.

The average *duration of stay* in this hospital before operation was 4 years and 3 months, ranging from a few months up to 14 years. In all cases some form of treatment, such as suitable occupation with attempted change of environment, systematic psychotherapy for those accessible to it, both in the hospital and before admission, had been given without making the slightest difference to the clinical course of the illness or chronic invalidism. In those cases where there was no contra-indication, some form of shock treatment, such as insulin, cardiazol, or E.C.T., had been applied, but apart from transient improvement, all the cases had proved refractory or responded unfavourably to these forms of treatment.

The *age incidence* of the cases operated on ranged from 22 to 69 years. Sixteen patients were over 55. The average age at operation was 36 years.

Choice of patients: Indications.—The first 75 of this series were selected exclusively because of distressing and permanently disturbing hallucinations, unmanageable aggressiveness, unceasing melancholic agitation, constant unrelieved anxiety due to delusional experiences or organ sensations. Our rationale for the selection was the same as that of Freeman and Watts and other authors. We found, however, by further study and follow-ups, and by increasing experience, that it is impossible to indicate the probability of success of leucotomy, however tentatively and cautiously it is formulated, by any one symptom or pair of symptoms.

If the personality is colourful, and beneath the psychotic symptoms one can discern a depth of emotional response, this supports the indication for operation. We have found the Rorschach test a very great help in fixing the multifarious personality facets.

Clinically, the generally accepted prognostic criteria in psychiatry are also valid in leucotomy. The following should, in our experience, be regarded as favourable indications for the operation: sudden onset of the psychosis after some apparently justifiable psychological or physical eliciting cause; a marked plasticity of symptom production such as delusional productivity, a certain degree of cyclic tendency, an island of integrated personality preserved under the psychotic deluge.

Organic cerebral deterioration from arteriosclerosis or senility are definite contra-indications to leucotomy, for any damage to the brain will hasten the underlying dementing process. In the diagnosis of early cerebral arteriosclerosis masquerading, for example, as a refractory depressive illness, the examination of the retinal arteries serves a very useful purpose. This, and the palpation of the peripheral arteries, is of more diagnostic value than are

blood-pressure readings, which, in any case, are frequently normal in cerebral arteriosclerosis. An "organic" Rorschach, and discrepancies of the scores between vocabulary or verbal intelligence tests in comparison with those obtained in performance tests (Kohs' Blocks, Alexander's Pass-along tests) are corroborating evidence (Wechsler, Goldstein *et al.*) of an organic process, and such cases should, therefore, be excluded from leucotomy. The positive correlation of high blood urea and senile mental illness established by Richter facilitates the elimination of early senile organic states.

In psychotics who have nobody to look after them outside the hospital, or whose families during the many years of illness have lost interest and sympathy for them, or whose environmental circumstances are decidedly unfavourable emotionally or materially, leucotomy is of questionable value. If one neglects the above-mentioned factors, apparently good clinical recoveries will, in the end, be disappointing. It is, of course, a truism that leucotomy is a cerebral operation and so a major one, performed mostly under general anaesthesia, and therefore all the usual contra-indications and hazards of systemic illness, cardiac, renal, or pulmonary, have to be considered and excluded.

Time of observation after operation of cases under review: All the cases in this series were operated on more than 9 months ago; the average length of observation is 15 months, varying from 9 months to 3 years. All but 27 cases were followed up by personal interview at 2-4-monthly intervals, and were tested repeatedly for their general intelligence with different batteries of tests. Relevant information regarding the social behaviour, efficiency at work, etc., were collected from relatives, either personally or by the Social Worker, and in a few cases by correspondence.

The criteria by which the cases are classified are as follows:

Social recoveries are those in this series who are capable of independent management of their own affairs, occupy a post, have the same type of work as they had previously, or, if not the same, are earning their living or looking after their household, etc., as before the illness; at the same time, they are capable of the usual customary enjoyment of life. Insight into their previous illness is *not* included in the definition of social recoveries. All are discharged from hospital, and should not express or show manifest psychotic signs.

Improved are those who are more manageable, with diminished psychotic symptoms and have a better social adaptability, but are not considered well enough to live on their own and are not self-supporting. They may, or may not, be resident in hospital. They are usefully occupied, though sometimes with stereotyped tasks.

ANALYSIS OF RESULTS.

Schizophrenic group.—As will be seen from the Table, the numerical results are rather disappointing, although individual cases may make a startling recovery, as, for example, one catatonic who, after 8 years' uninterrupted hospitalization, socially recovered. Certain features, however, seem to be worth considering. In the first place, there is the poor response to leucotomy of those with relatively meagre delusional productivity, in whom

the so-called primary symptoms of schizophrenia (Bleuler, Gruhle *et al.*) prevail. These are psychic anergy, remoteness and incongruity of affect, and impairment of abstract conceptual thinking. In the catatonic, hebephrenic and simplex sub-groups of our series, some of these primary symptoms were predominant in the clinical picture. It is all too well known how difficult and vague classification is in psychiatry generally and in schizophrenia in particular, but as a guide these types are useful, despite the unavoidable overlapping and telescoping of nosological groups. The three above-mentioned forms of nuclear schizophrenia were represented by 52 of the total of 92 schizophrenic cases, and only 6 of them can be regarded as social recoveries, in contrast to 13 of the 40 paranoid schizophrenics. In the latter group are included those in whom delusions of persecution, influence, etc., with a bizarre fantastic undertone, but not systematized, are the dominant symptoms. Some of the primary symptoms are present too, but not always in the foreground of the clinical picture. It seems possible that the implications of clinical experiences with regard to prognosis in both insulin and in leucotomy treatment of schizophrenics may vindicate and revive again Kraepelin's classical views of dementia praecox; in which case the nosological unity of schizophrenia would, contrary to Bleuler's views, again be split into dementia praecox and paranoid groups, regarded as separate disease entities. All our schizophrenics were hallucinated at one time or another, but hallucinations do not afford a prognostic clue to the decision to operate or not. Our observations bear out the following conclusions with regard to the advisability of operating in schizophrenics: The most unfavourable cases for leucotomy are those in whom there is an inability to form concepts of an abstract kind, coupled with the typical schizophrenic language disorder (Kasanin). An insidious onset, autistic tendencies in the pre-psychotic personal history, and absence of stormy periods of psychomotor restlessness, are of aggravating significance. Schizophrenics displaying the above summary of symptoms, with a duration of manifest illness of more than 3 years, are to be regarded, in our opinion, as only problematically suitable for prefrontal leucotomy. In hebephrenics with a "giggly" hebetude affect, and also in simplex cases with marked emotional blunting, leucotomy is, in general, contra-indicated.

In the catatonic and paranoid states, if insulin fails, leucotomy is the method of choice, and should be performed with the least possible delay before the deranged function-patterns are indelibly fixated and render any treatment hopeless. The problem of leucotomy in the schizophrenic group cannot be left without mentioning one or two points of post-operative psychological management. The success of the operation is absolutely dependent on the proper handling of this. Everything must be done to make reality and its objects attractive for the thin thread of libido which has been released by the operation from its narcissistic imprisonment. The schizophrenic personality hinges on a narcissistic grievance and the insecurity of self. The uncertainty about success or failure in life which everybody has to face in normal circumstances in coping with reality demands, assumes for the patient the quality of a deadly threat. In the post-operative psychological management of schizophrenics, everything has to be arranged for many months to come, so

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	M.		F.		Total.		Social recovery.			Improved.			Not improved.			Died.	
	M.	F.	M.	F.	Total.	%	M.	F.	Total.	%	M.	F.	Total.	%			
Schizophrenic group:																	
Catatonic	8	7	15	1	2	3	20	1	2	3	20	6	3	9	60		
Hebephrenic	8	2	10	..	..	..	..	2	..	2	20	6	2	8	80		
Simplex	18	9	27	1	2	3	11.1	10	1	11	40.8	7	6	13	48.1		
Paranoid	20	20	40	7	6	13	32.5	6	6	12	30	6	8	14	35		1 (M.)
With formal thought disorder			64			6	31.6			25	89.3			32	73.3		
Without formal thought disorder			28			13	78.4			3	10.7			12	26.7		
Schizophrenic total.	54	38	92	9	10	19	20.7	19	9	28	30.4	25	19	44	48.9		1
Paraphrenic group:																	
Paraphrenia	15	23	38	7	15	22	57.9	6	5	11	28.9	2	3	5	13.2		
Paranoia	3	..	3	3	..	3	100	..	..	..	..	..	..	..	..
Paraphrenic total .	18	23	41	10	15	25	60.9	6	5	11	26.8	2	3	5	12.2		
Affective disorders:																	
Cyclothymia	6	10	16	5	7	12	75	..	2	2	12.5	1	..	1	6.25		1 (F.)
Involutional depression	13	23	36	10	14	24	66.7	3	5	8	22.2	..	1	1	2.7		3 (F.)
Affective total . . .	19	33	52	15	21	36	69.2	3	7	10	19.2	1	1	2	3.8		4 (F.)
Aggressive and oligophrenic psychopathies																	
Chronic obsessional neurosis	6	5	11	1	..	1	9.1	4	3	7	63.6	1	2	3	27.2		..
GRAND TOTAL	100	100	200	37	47	84	42	33	24	57	28.5	29	25	54	27		5 (M. 1) (F. 4)

that there is no possibility of their experiencing the alternative of *failure*, but only success in anything which one suggests they should do. This, of course, applies also to emotional attachment and strain, and the inevitable near-complex environment of family. As such a setting outside the hospital is rarely available, the schizophrenic patient should be treated in the hospital for as long as possible. Complicated occupational tasks should be avoided—one is frequently tempted to the contrary owing to the sometimes excellent clinical condition—for the catastrophic reaction (Goldstein) of brain failure means in schizophrenics withdrawal and narcissistic regression, with eventual complete relapse in the psychotic condition. The exposure of post-leucotomy schizophrenics to the full blast, as it were, of reality must be done gradually and expertly. Under no circumstances should they be pushed in any way. W+F

The discussion of *leucotomy effects in paraphrenia* must begin with clarification of the term itself—or at any rate in what arbitrary meaning it is used here. Notwithstanding the differences of opinion of many psychiatric schools, in this report we mean by paraphrenia a chronic psychotic condition characterized by delusions of various contents which are either systematized or semi-systematized, but may be rather bizarre occasionally. A considerable part of the personality is preserved; there are no primary schizophrenic symptoms present. Hallucinations are more frequently of a pseudo-hallucinatory type, but true hallucinations do occur also and are not a rare symptom. An emotional element is often very marked; the affect is, however, congruous to the delusional content. The pre-morbid personality, to mention salient features only, is marked by an unsolved oedipus complex (only daughters or sons fixated on love-demanding parents, or intense rivalry amongst siblings, some brother or sister favoured by parents, and so on). The patients remain fixated on such childhood bonds, often never marry, or if they do, are instinctually frustrated, disillusioned. Childhood experiences and *constitutional* factors probably are responsible for a particularly strong bi-sexual “anlage,” the suppressed homosexual part of which is often projected in the delusion formation (Freud). But the most characteristic anomaly of their personality is the tendency to project and introject, using this psychological mechanism as a defence from pressing, but conflicting, instinctual demands. The cases of paraphrenic hypochondriasis—patients who rationalize delusional organ sensations into some illness, and those with obsessional tendencies—are especially tormented in this way. The male patient presented for demonstration to-day, for example, has been called an anxiety neurotic, depressive, obsessional, mild paranoid schizophrenic, during the different phases of his Calvary. In spite of these differences, however, I am absolutely convinced that all of us here would have regarded him as incurable by psychological means alone, and after the failure of convulsion treatment, which was given because of the depressive element in the clinical picture, we should all have given up hope of ever being able to help him. In fact despite the prevailing confusion of psychiatric nosology, clinical sense and experience does enable us to estimate fairly accurately the gravity of a given mental illness. Cases showing chronic hypochondriasis with peculiar organ sensations and a tendency to project these into paranoid delusions in narcissistic premorbid personalities were,

before the advent of leucotomy, a hopeless therapeutic proposition. Whether, as Professor Pötzl of Vienna thought, some sub-threshold somatic parasensations combine with specific psychological conflicts in determining the choice of symptoms, is as yet unknown. It is certainly remarkable that some patients with cancer-phobias, for example, who are miserable semi-invalids obsessed for almost a lifetime with the dread of cancer, finally die of it. I cannot go into the discussion of clairvoyance, as it were, of subconscious self-awareness, but the fact remains that disabling hypochondriacal organ-sensations, in our experience, are most amenable to treatment by leucotomy. The continuous sub-threshold discharge of sensory modalities from the periphery, sensory impulses which are absorbed and distributed via the thalamus and its cortical radiations, must have something to do with the intensity of the psychic experience of self.

The cases in this review went through all the usual treatments of innumerable bottles of medicine, previous hospitalization, psychoanalysis; and suicidal attempts or assaults on others also punctuated their sad life until they became chronics or invalids. The length of manifest illness, which varied from 3-14 years, had no significant correlation with the chances of recovery in this group. Their premorbid personality, history and endowments with regard to school, work record, social adjustment, was very much more satisfactory than in the schizophrenic group. It is amazing to see how magnificently leucotomy helped our paraphrenics. The natural caution which one has to exercise, due to the relatively short period of follow-up, is offset by the consideration that even if all relapsed, which is most improbable, the years of lucidity gained by the operation would fully justify it in any case.

Paranoia.—Two of our patients were classical paranoiacs in the sense of Kraepelin's description, with systematized delusions of persecution and reference; they showed pseudo-hallucinations, and were querulous and grandiose. The third displayed marked psychopathic trends in his personality and symptomatology, at the basis of which, however, there were systematized delusions of reference and annoyance.

Cyclothymics.—These were manic-depressives who had suffered from psychotic mood swings practically all their lives, but for the last few years had had to be continuously in hospital, as the intervals between the psychotic episodes had become too short, or practically non-existent. The follow-up period is still too short, and the number is too small to state any definite opinion which would be statistically significant, but one cannot help gaining the clinical impression that leucotomy possesses a curative effect for endogenous psychotic alternations of mood. If the spontaneous remissions are long lasting, however, despite the very great risks of eventual suicide in a depressive attack, leucotomy is not justified, considering the social efficiency and relative happiness of these patients without treatment. The consideration has also to be kept in mind that only the extensive form of incision (posterior cut) seems to achieve the arrest of mood swings. This causes some impairment of initiative and spontaneity and a bleaching of varying degree in the emotional sphere.

Involitional melancholia (4 agitated melancholics).—The patients of this

category were all refractory to E.C.T., or else there were strong contra-indications which prohibited the use of convulsive treatment. It is particularly gratifying to see these intensely suffering patients recover, who, if not heavily sedated, clamour for death in order to escape the intolerable mental anguish caused by their lowered vitality and state of delusional self-accusation. The desensitization of the ability for symbolic emotional experience effected by leucotomy is in these cases comparable to the relief obtained by tractotomy for some incurable neuralgic pain. One has to reckon, however (in patients over 55, with a precipitation of senescence of the personality as a concomitant effect of leucotomy, and warn the relatives of the social consequences of a happy dotage). The length of hospitalization before the operation varied from $3\frac{1}{2}$ to 6 years: 7 patients were over 60 years of age at the time of operation: 2 agitated melancholics were 69 and 67 respectively.

Aggressive oligophrenic psychopathy.—These were, with but one exception, mental defectives whose behaviour disorder was characterized either by very frequent episodes of blind aggressiveness, threatening other patients or actually causing them grievous harm, or by destructive tantrums which made their social adjustment impossible and necessitated hospitalization. Attempted conservative remedial measure had been unsuccessful. Two were imbeciles: 8 had an I.Q. ranging from 50 to 75 (Raven's Progressive Matrices, Herring, Modified Stanford-Binet). The results are rather disappointing. In 7 some amelioration of aggressiveness was noticeable; 2, however, after 8 months and a year respectively of freedom from attacks, and after having been discharged and successfully employed, relapsed and had to be admitted to other mental hospitals. The only social recovery of this group has been a man of good general intelligence. The impulsive murderous episodes with some reactive schizophrenic colouring from which he suffered for 4 years at frequent intervals have ceased since the operation 14 months ago. To state whether leucotomy would be a suitable treatment for unmanageable aggressive psychopaths with average general intelligence needs, of course, much more experience than we have in this hospital.

Chronic obsessional neurotics.—Four cases, who all requested the operation on outside advice, were disabled by obsessional ceremonials, ruminations, compulsory doubts, or hypochondriacal preoccupation. Three made an excellent social recovery. All of them had had previous outside treatment by systematic psychotherapy, which had no effect on their symptoms.

PHYSICAL AND NEUROLOGICAL COMPLICATIONS OF LEUCOTOMY.

Neurological signs which were observed in the days, weeks, and sometimes months, after the operation in about 35 per cent. of our cases were as follows: transient pyramidal signs—the first 2 days only; cortical irritability—motor restlessness and delirious confusion of the organic type, with hyperaesthesia, hyperalgesia, patchy amnesic aphasia or perseveration—occurred in less than one-third of our total, and did not last longer than 2–4 days after the operation. In 9 patients, however, all of whom were over 50 and up to 67 years, a more chronic confusional state, also of the organic type, was seen, which lasted over 2 months. They were restless at nights and disorientated for time and person,

spatially perplexed, and inclined to mistake the strange for the familiar. These complications were more frequent when the incision was performed posteriorly, i.e. according to Freeman and Watts' instruction, 9.5 centimetres from the midline. Urinary incontinence lasting more than 2 months, the incidence of which in our series was 15 per cent., is also decidedly more frequent after the posterior operative approach; but in no case of ours did it remain as a permanent symptom—in fact it invariably disappeared within 6 months.

Eighteen patients had major epileptiform convulsions, usually 1 or 2 fits—in two cases 4–6 fits—at short intervals. All responded readily to anti-convulsive drugs administered for two months, and no recurrence of convulsions was observed later than 8 months after the operation. Fifteen of these patients had a posterior cut and 3 an anterior cut (7 centimetres from the midline).

Late neurological sequelae.—Some in the early group of 75 patients had for a time a peculiar sagging posture, lacking in tonus as it were, but this was no longer noticeable after 6 months had elapsed. Only one patient has a permanent neurological disability, which he gradually developed after the operation. It is a choreiform jerking of the limbs and involuntary grimacing, rather similar to that seen in Huntington's chorea. He is a paranoid schizophrenic, unchanged mentally by the operation performed more than 2 years ago. His mother died of some form of chorea.

A slight flabbiness of the innervation of the facial muscles—rendering the play of expression less distinct than before—is in a few cases a lasting sequel. Bulimia is a relatively frequent post-leucotomy symptom in our patients, but it also disappears within 6–12 months. The ravenous appetite may also be responsible for some unusually rapid gains in weight. Some of our female patients showed hirsute changes; this was seen in 7 cases: 4 of them had previously had a pronounced facial growth of hair, but after leucotomy they developed a veritable beard which needs trimming. Nothing definite emerged about their menstrual cycle; some patients did report amenorrhoea following the operation.

Intelligence.—The impairment of simultaneous grasp, and of discriminative conceptual thinking, which we observed by psychometric testing, and from reports from the patients themselves, also a tendency to perseveration, was not noticeable after the follow-up 10 months later. In fact, apart from the age-group over 55, we could not detect any impairment of cognition or any intellectual deficit after 1 year had elapsed. We tested 96 cases with the Herring, Modified Stanford-Binet, Raven's Matrices, Kohs' Blocks, and Pass-along tests, but could not find any significant difference in their general intelligence, except that in the recovered cases the scores show less scatter due to less preoccupation with the psychotic experiences. Patients over 55 show a discrepancy of their vocabulary, verbal and performance scores—in some consisting of a difference of 15 points to the disadvantage of performance (10 out of 16 patients). We tested these cases also with Rorschach's blots, but we could not surmount the difficulty of familiarity with the blots when shown before and after operation, so we found it impossible to utilize these in our findings with regard to post-operative personality changes.

Mental state after operation entirely depends on the type of illness, and on

the previous personality—and to some extent, probably, on which and how many fibres have been cut. The days immediately following operation were by many dominated by disinhibition phenomena of frontal brain damage. If hostile and remote before, as in schizophrenics, the negativistic attitude changed over into hypomaniacal familiarity, into a "hobnobbing" chit-chat with crude, facile jocularity, and so one was able to contact the patient for the first time, perhaps, for many years. The stilted language, neologisms, the spheric type of associations (Kleist's intrapsychic ataxia) was in the background for some hours only, to return a few days later, unfortunately. Some patients become irritable and rude in this first phase of frontal hypomania, and one is surprised to hear obscenities blared out by a self-belittling, unworthy, retarded depressive. This frontal release phase does not, however, last longer than a few days; in a majority of patients it does not appear at all; only in about 40 per cent. of the cases is it present. The attitude of the majority is only friendly, but sparing with words and punctuating many sentences with an obliging "Thank you very much." This over-politeness disappears very gradually; in most cases there remains a trace of it after a year or more. In whatever mental or organic state the patient may be in the first 6 months after operation, it has, according to our observations, no prognostic significance for the final result of the original mental illness. It was most dramatic to hear, for instance, a patient operated on under local anaesthesia (6 have been done so) to say, after the last lower cut had been performed, "The megaphones are quiet; I do not hear them any more; how peaceful it is now," meaning, of course, the auditory hallucinations which she thought came from small megaphones put behind her ears by some malicious plotters. Unfortunately the hallucinations returned 20 days later, and she remains hallucinated, although perhaps with less intensity.

The process of recovery in the successful cases, to whatever clinical group they belong, is gradual. Delusions once established have an inertia, so to speak, and it takes many months, if not years, until they fade. True auditory hallucinations in the few successfully treated schizophrenics persist as long as delusions; the patient in the meantime expresses his disinterestedness in them, and in his behaviour loses the characteristic schizophrenic fascination for the voices. The emotional incongruity which prevails in such a sinister way in the schizophrenic scene changes to a somewhat flat affect.

In affective disorders the process of re-integration is very much quicker; paraphrenics with well-preserved personality first successfully dissimulate, and after 6 months or so genuinely report spontaneously that the delusional ideas or hypochondriacal organ sensations do not cause them to be preoccupied any more. None of the patients regained true insight in the full sense of the word, or is really able to appreciate what the operation was for, or its importance. There is a tendency to displace their interest, when asked about the operation, on to the hair, scar, etc., and although they sometimes reproduce, "gramophone-like," that they had a brain operation, it is without emotional emphasis. The most intelligent patients are utterly unable to ascribe any significance to the operation, apart from stereotyped phrases about it, heard or read, which they repeat faithfully, but as if it had not happened to them.

The direct effects of the operation on psychic life are those on the personality. The specific change which was verified in the surveyed cases was a poverty or entire lack of dreams, and a thinning, or disappearance of dereistic experience—they cannot daydream about their wishes, or be abstractly angry in a sustained fashion. They become, owing to this emotional asymbolia, more plain, matter-of-fact like. In many ways this has a resemblance to slight senile personality changes. Owing to the emotional desensitization the passions and conflicts which are expressed in their psychosis gradually shift out of focus, very much as old men can look serenely upon the follies of their youth. Again, as in senile personality changes, post-leucotomy patients do not like adventure, but want to remain in a more or less stereotyped routine of activities. The learning ability for new knowledge is, as some patients complain, reduced. In the old involuntional melancholic the paradox occurs that the desperate loneliness of oncoming senility is alleviated by reaching sooner the state of a happy dotage. This is borne out, not only in the personality changes, but in the neurological symptoms too; for example, if they had a tremor of the hands, it gets worse after leucotomy; their gait, also, becomes less steady.

The fundamental personality pattern remains unchanged after leucotomy; it has less legend only. The emotional short-circuiting in a previously colourful personality certainly is preferable to an incurable psychotic misery. We had no patient in this series who was worse after the operation. Three of the improved cases after more than a year still manifest frontal disinhibition and are unrestrained, selfish family tyrants; whether this is due to more extensively damaged frontal areas owing to anomalous placing of the cut, or to some secondary changes, is impossible to say. The topographical variability of the incision, decisively proved by Alfred Meyer, is with the present technique unavoidable, and a grave drawback. In our series there was no clinical disadvantage accruing from the more anterior incision, but certainly much less asponaneity and loss of initiative.

Mortality.—We lost 5 patients whose death was directly attributable to leucotomy: 4 died of cerebral haemorrhage, 1 of staphylococcal meningitis. The percentage is 2.5. Three died of intercurrent illness more than a year after the operation.

Relapses.—Two paraphrenics classified as recovered relapsed, both a year after the operation, one as a result of harassing environmental circumstances. One schizophrenic classified as “improved” relapsed after 3 months; an improved aggressive psychopath relapsed 8 months after operation.

Before I finish this report, I have to thank most sincerely Dr. Carse, the Medical Superintendent, without whose co-operation, advice and help in every way I could not have collected these observations. My thanks are also due to my colleague and the nursing staff who, despite the difficulties of war years, never lost their admirable enthusiasm and interest for our work.

AN EXPERIMENT IN THE VOCATIONAL ADJUSTMENT OF NEUROTIC PATIENTS.

By H. HALSTEAD, M.A., AND PATRICK SLATER, M.A., Dip.Psych., Oxon.

1. Conditions obtaining at the time of the investigation.
2. The subjects observed.
3. Test scores, etc.
4. Answers to the questionnaire.
5. The instructors' gradings.
6. The associations between the test scores, etc., and the gradings.
7. Possible use of the information collected.
8. Implications of the results.
9. Suggestions for future enquiries.
10. Summary.

(I) *Conditions Obtaining at the Time of Investigation.*

It is well known that occupational therapy plays an essential part in the rehabilitation of psychoneurotic service patients. The usual occupations are carpentry, arts and crafts, gardening, and the like. At Mill Hill E.M.S. Neurosis Centre, marked success attended a supplementary scheme wherein selected patients underwent four-week courses at a nearby technical institute in mechanical and commercial subjects.

After the course had been in operation for some months a series of tests were given to a sample of patients selected for the course, to see if any of the tests had predictive value for the kind of work involved. The criterion was the degree of success achieved in the course as judged by a committee of the instructors.

Before giving the results of the investigation a few remarks about the course and the way in which patients were selected may not be out of place. These refer to the conditions obtaining at the time of the investigation. The work of the course was both theoretical and practical, and included machine drawing, lectures on the general principles of engineering, and practical work at the bench, lathe and smithy. Each instructor rated his men on a scale from 0 to 10 for each job completed, with a further rating of ability, educability, and general behaviour. The final grading of each man was done jointly at the end of the course by the instructors. In this final assessment four grades were used, viz.:

Grade A : Very suitable for training, or little further training required.

Grade B : Suitable for training.

Grade C : Suitable only for prolonged training.

Grade D : Unsuitable.

The top 50 per cent. of the men were graded A or B ; the remainder C or D. Grades B and C were subdivided into B+ and B-, C+ and C- respectively.

Men who were considered suitable by the instructors were often further recommended as specially suited for particular types of work, e.g. as semi-skilled bench fitter, or assembler, storekeeper, machine operator, precision engineer, draughtsman, etc.

Shortly after admission each patient filled in a questionnaire relating to

vocational experience and interests, and was afterwards seen by an interviewer, who recorded additional facts. The scores on the two group tests—given to all patients on admission—were entered on the forms. The complete data were scrutinized each week by the doctor in charge of occupations, assisted by a psychologist and the interviewer, and candidates were classified as “Yes,” “No” or “Doubtful.” The quota of trainees was made up just before the end of the current course. Before the commencement of a fresh course each medical officer had a final option of removing the names of any of his patients on psychiatric grounds or of recommending others not chosen.

(2) *The Subjects Observed.*

Ninety-four successive selectees for the mechanical course were given five tests, viz. :

1. Shipley Vocabulary Test,
2. Progressive Matrices,
3. Bellevue Verbal Scale,
4. Carl Hollow Square,
5. Minnesota Spatial Relations Test,

in addition to the questionnaire and interview.

Tests 1 and 2 were the routine group tests for the hospital at the time. The remaining three tests were given individually. Of these only the Minnesota Test had any tradition as a vocational test for mechanical work.

Analyses were made of the results of 84 of the subjects who completed the course ; of the remaining 10 cases, 3 were ungraded and 7 did not attend the course.

(3) *Test Scores, etc.*

Table I shows the mean and standard deviation of their ages and their scores on the five tests :

TABLE I.

Variable.	Mean.	S.D.
Age	27.40	5.090
Test 1 : Shipley	25.14	7.200
Test 2 : Matrix	43.35	9.732
Test 3 : Bellevue	107.02	13.334
Test 4 : Carl Hollow Square	105.00	17.868
Test 5 : Minnesota	56.31	32.405

As a group the subjects compare favourably with normal samples on all five tests ; they are a selected sample from the hospital population. Men below the average on Tests 1 and 2 were not recommended for the course unless there were favourable contraindications. As will be shown, scores on all the tests are positively correlated, so direct selection on two of them implies indirect selection on the others.

Scores on Tests 3 and 4 are expressed as I.Qs. The difference between the two standard deviations is disturbing ; it probably reveals differences in the methods used for standardizing these two tests. I.Qs. obtained from

different tests should have the same range of variation—otherwise the probability of finding a given I.Q. (say, 70) will vary from test to test (1).

(4) *Answers to the Questionnaire.*

As the questionnaire formed an essential part of the selection process it was decided to compare replies to certain questions with degree of success at the course. Replies to the following questions were divided into "Yes" and "No," and χ^2 was applied to test whether the grades obtained by patients who gave affirmative answers differed significantly from those obtained by others. The results were:

TABLE II.

	χ^2 (for 5 d.f.).	P.
1. Do you consider yourself handy at doing odd jobs and repairs?	3.07	0.70
2. Do you consider yourself mechanically-minded?	2.19	0.83
3. Have you ever done engineering or similar work?	9.74	0.09
4. If you have, did you like it?	2.68	0.75
5. If not, have you ever wanted to do it?	1.27	0.93

The above figures show that only one question, that relating to previous engineering experience, yielded a difference approaching significance. The patient's own estimate of his abilities bore little or no relationship to success on the course. Similarly, the outcome of the course had little to do with whether a man liked his previous engineering work or not, or with his desire to do the work in question. Thus, the answer to question 3, which deals with facts, may be given some weight in recommending a person for a course of training, but the replies to the other questions, which depend upon the person's own judgment of his abilities and feelings, should be regarded with caution.

(5) *The Instructors' Gradings.*

The distribution of instructors' gradings was:

TABLE III.

Grade.	Description of grade.	Number of cases.	Centroid.
A	Very suitable for training, or little further training required	4	+ 2.1
B+	Suitable for training	6	+ 1.4
B-		32	+ .5
C+	Suitable for prolonged training	18	- .3
C-		19	- 1.0
D	Unsuitable	5	- 2.0
Total		84	

The proportion of definitely unsuitable men recommended is satisfactorily small.*

* Instructors' gradings of a much larger sample, i.e. all patients over a period of two years who attended the mechanical course, were collected by Lewis and Goodyear (2). In their sample the distribution of grades was A, 5 per cent.; B, 33 per cent.; C, 55 per cent.; D, 7 per cent. The 84 men in our sample include a higher proportion of A's and B's and a lower proportion of C's and D's.

In order to calculate product-moment correlations between the grades and the tests, and to analyse the variance of the grades, centroids were calculated using the procedure given by Pearson (*Tables for Statisticians and Biometricians*, Part II, p. xxii). Working approximations to the exact centroids are given in Table III.

(6) *The Associations Between the Test Scores, etc., and the Gradings.*

In view of the results of the questionnaire, the subjects were separated into two groups, those who had had no previous experience of engineering work being treated as a separate group. Table IV gives figures for comparing the two groups :

TABLE IV.

Variable.	Arithmetic mean of—		Ratio of mean square variances (F).	Probability.
	Group 1 (with experience). <i>n</i> = 67.	Group 2 (without experience). <i>n</i> = 17.		
Age	27.52	26.94	5.73†	>.05
Test 1	25.90	22.18	3.74	>.05
Test 2	44.33	39.47	3.48	>.05
Test 3	106.87	107.65	21.72†	>.05
Test 4	104.48	101.18	1.02†	>.05
Test 5	57.61	51.18	1.88†	>.05
Grade	+1.10	-.48	5.11	<.05

† 1 degree of freedom for lesser mean square.

The figures in the last two columns of this table show that the men without experience do not do appreciably worse on the tests, but obtain significantly poorer gradings.

The correlations between the variables (calculated from variances and covariances within groups) are :

TABLE V.

Variable.	Tests.					Grade.
	1.	2.	3.	4.	5.	
Age	-.006	-.108	-.034	-.002	-.102	.128
Test 1, Shipley . . . . .		.465	.598	.268	.387	.200
Test 2, Matrix			5.32	.398	.296	.042
Test 3, Bellevue . . . . .				.321	.427	.184
Test 4, Carl Hollow Square . . . . .					.419	.223
Test 5, Minnesota Spatial Relations . . . . .						.116

The multiple regression equation appropriate for predicting grades from age and scores on all the tests was calculated, but is not given here. The Carl Hollow Square is the only test which contributes significantly to the accuracy with which grades can be predicted ; the contribution of the next most valuable test, Shipley Vocabulary, is too small to be significant. The extent to which

errors of prediction can be reduced by making use of information concerning experience and scores on these two tests is shown in the following analysis :

TABLE VI.

Source of variance.	Sum of squares.	Degrees of freedom.	Mean square.
1. Total variance of grades	77.99	83	—
2. Accounted for by differentiating experienced from inexperienced subjects	4.58	1	4.58 (a)
3. Variance (in excess of 2) accounted for by regression of grades on scores in Test 4	3.65	1	3.65 (b)
4. Variance (in excess of 2 and 3) accounted for by regression of grades on scores in Test 1	1.55	1	1.55 (c)
5. Residual variance (error)	68.21	80	.85

(a) $F = 5.37$ P. $< .05$.

(b) $F = 4.28$ P. $< .05$.

(c) $F = 1.82$ P. $> .05$.

Taking experience and score on the Carl Hollow Square test into account, errors of prediction can be reduced by just over 10 per cent. The multiple correlation between grades and these two variables is .325.

(7) *Possible Use of the Information Collected.*

We may take it as a working hypothesis that a man's expected grade should be C+ or better if he is to be recommended for the training course ; and we may consider what score a man should obtain on the Carl Hollow Square test, in order to warrant an expectation that he will be so graded. This can be computed from data already given. If he has had experience, his score should be 70 or better ; if not, 120 or better.

Tabulating the results, we find that 14 men fail to meet these requirements. The distribution of their grades is :

TABLE VII.

Grade.	Number of cases.
A	0
B+	0
B-	3
C+	3
C-	5
D	3
	—
	14

This result is as good as the expectation warrants.

In making the above analyses, we have not been able to apply corrections

for homogeneity because of lacunæ in the data. The results, therefore, only show what helpful *additions*, made to the procedure followed at the time the observations were collected, might have reduced the proportion of relatively unsuitable men recommended. We have not been able to consider helpful *amendments* to that procedure (e.g. changes in the use made of tests 1 and 2), which might lead to the recommendation of suitable men who were in fact not recommended.

(8) *Implications of the Results.*

The selection procedure outlined above was for a specific purpose, and the battery of tests used was purely experimental. The statistical analysis has led to an administratively clear and simple definition (Sec. 7, par. 1) of acceptable qualifications of candidates for the training course. The usefulness of the definition and the extent to which it may give rise to erroneous selection have been assessed in terms which can be experimentally verified. From among the available sources of information about the men, i.e. five tests and five questionnaire items, only a small number, viz. one test and one item, have proved useful. The definition provided is thus economical of both test and interview time; besides excluding irrelevant information, it also assigns a definite weight to the information used; there has been no need to consider what kind of traits are measured by the tests or are important for success. The main terms of the project have been made clear and simple, viz. the definition of the class of men from whom selection was to be made, the description of the qualifications possessed by members of that class, the purpose for which the men were to be selected, and the terms in which success was to be judged. The reasoning proceeds from premises about observed and verifiable characteristics of the subjects to conclusions about verifiable expectations of their future behaviour.

(9) *Suggestions for Future Inquiries.*

Of further avenues that might be explored with a view to improving the selection procedure, three seem to be worthy of particular attention, viz. :

- (a) The possibility of using clearer and more objective criteria of success.
- (b) The possibility of expressing the relevant previous experience of the candidates in more precise and graduated terms.
- (c) The effect of lowering or neglecting the initial standards on Tests 1 and 2.

(10) *Summary.*

Eighty-four patients interviewed and tested at Mill Hill E.M.S. Hospital during the early part of the war—part of a larger group recommended for a special course in engineering—were graded by their instructors according to their suitability for this type of work. On the whole the results appear to be satisfactory. Only five patients were graded unsuitable.

The records of all patients, including age, scores on five tests, and answers to a questionnaire, were related to their grades. It was found that by taking previous engineering experience and scores on the Carl Hollow Square Scale

into account, further improvements might be made in the selection, reducing the errors of prediction by 10 per cent. The implications of the results and methods that might be tried for improving the procedure are discussed.

Our thanks are due to the Medical Superintendent of the Mill Hill Neurosis Centre, to Lt.-Col. Trist, who initiated the investigation, to Miss P. J. Wilson for her considerable help in the testing programme, and to Mr. Walls, Principal of the Hendon Technical Institute.

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GENERALIZED XANTHOMA, WITH A CASE PRESENTING LESION OF THE CENTRAL NERVOUS SYSTEM.*

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GENERALIZED xanthoma is a cholesterol disturbance of the cells, coincident with a normal lipid content of the blood serum.

The case described involves the skull, dura mater, brain, pleura and gall-bladder.

I propose to deal with the subject as follows :

- A. Description of generalized xanthoma and allied conditions, with special reference to the central nervous system.
- B. Clinical record, detailed morbid anatomy and discussion of a case which involves the central nervous system.
- C. Differential diagnosis.
- D. Conclusion.
- E. Bibliography.

A. DESCRIPTION OF GENERALIZED XANTHOMA AND ALLIED CONDITIONS, WITH SPECIAL REFERENCE TO THE CENTRAL NERVOUS SYSTEM.

LIPID DISEASES.—A disturbance of lipid metabolism is protean in its manifestations, and the lesions are extremely variable both macroscopically and microscopically.

Generalized xanthoma is one of many lipid disorders, which include gall-stones, atheroma, xanthomatous lesions of the skin, muscles and bones, xanthomatous lesions in the lungs, lipid nephrosis, the intestinal lipodystrophy of Whipple, Gaucher's splenomegaly, xanthomatous lesions of lymph glands and von Gierke's disease.

Certain of these lipid disorders affect the central nervous system ; such are amaurotic familial idiocy, Niemann-Pick's disease and the Schüller-Christian syndrome. In Gaucher's disease, too, the main symptoms may be cerebral (Pick, 1933).

HISTORY.—Rayer first described a xanthomatous lesion in 1836. Addison and Gull in 1851 recognized the characteristic large pale cells, and the systemic character of xanthomatous manifestations. Panzer in 1906 first discovered a lipid content of the cells, and Pick and Pinkus, in 1908, identified cholesterol.

The first to be described of the three diseases which affect the central nervous system and are now known to be lipoidal diseases was amaurotic familial idiocy. Waren Tay in 1881 and Sachs in 1887 described this syndrome, now known as cerebromacular degeneration, and with which is associated Niemann-Pick's disease.

* Awarded the Bronze Medal of the Royal Medico-Psychological Association, 1943.

Hand in 1893, Schüller in 1915 and Christian in 1919 described the syndrome known as the Schüller-Christian syndrome. Rowland, in 1928, renamed it xanthomatosis, and recognized it as a disturbance of lipid metabolism. Seventy cases of the disease had been reported by 1940 (Jelsma, 1940).

AETIOLOGY.—*Age.*—Lipoid diseases occur at all ages. Lesions in the skin, for example, occur in young children (xanthoma multiplex) and in adults (xanthelasma palpebrarum). General visceral xanthomatosis is found at all ages. In the central nervous system amaurotic familial idiocy occurs in Hebrew children, and there is an adult type of Kufs and Schob. Niemann-Pick's disease is found in infants. Although Gaucher's disease occurs usually in children, it has been found at all ages, even up to 65 (Bloem, Groen, and Postma, 1936).

Schüller's original case was five years old, and most of the early cases described of the Schüller-Christian syndrome were in children, but cases have now been described in adults. Thannhauser (1940) mentions a case which was observed from the age of 35 to 51.

As a general rule it is said that the lesions in children are diffuse, and in adults nodular.

Trauma.—Trauma and friction are regarded as precipitating factors, where there is already a predisposition. Nodules in the skin, for example, may occur at the sites of hypodermic injections or of mosquito bites.

Sepsis and infection.—It is known that the blood cholesterol is altered in febrile diseases. Weber (1924) believes that, following an influenza-like infection, a symptomless hypercholesterolaemia may give rise to lipid deposits.

Sepsis is obviously an aetiological factor when xanthoma forms in an old abscess. In these cases polymorphonuclear cells, lymphocytes and plasma cells may be seen in the lesions.

Abscess of the scalp, gingivitis, tonsillitis, otitis media and mastoiditis have been described in association with the Schüller-Christian syndrome. It is possible, however, that conditions so described may actually be not infection, but part of the xanthomatous process. Xanthomatous tissue may soften and a milky fluid containing cholesterol be found. A viscid brownish-red discharge from the middle ear in a case of the Schüller-Christian syndrome may not be a primary infection, but a degenerating xanthomatous lesion, which can be demonstrated by operation on the mastoid (Thannhauser, 1940).

Hyperlipaemia.—Xanthoma may be secondary to hyperlipaemia in diabetes mellitus, von Gierke's disease, chronic pancreatitis and lipid nephrosis.

PATHOLOGY.—*Macroscopical appearances.*—The characteristic xanthomatous lesion is nodular or in plaques in whatever organ of the body it is found. The nodules may be solitary, but they are usually multiple.

In Niemann-Pick's disease the nodules are found in several viscera. In the Schüller-Christian syndrome they are found as yellow masses growing from the dura mater and periosteum of the cranium and pelvis with erosion of bone. The masses are also found at the base of the brain and in the lungs, liver, spleen and lymph nodes. Soft pearly-coloured, translucent masses have been described by Berman (1938) in xanthomatosis of the spine.

Xanthomatous lesions may be diffuse. Diffuse lesions may be coexistent

with nodular lesions, which is well shown in Niemann-Pick's disease and the Schüller-Christian syndrome.

Amaurotic familial idiocy presents a diffuse lesion of the brain, which is found to be enlarged, hard and firm. The cerebellum in the late infantile type is very atrophied.

Microscopical appearances.—The sections in the early stages are usually vascular, but the microscopical picture is dominated by the presence of lipid. It is usually cholesterol, and is stained orange by Sudan III and by Sharlach R. Sphingomyelin is present in amaurotic familial idiocy and Niemann-Pick's disease and stains a dull brick red with Sudan III (Scheidegger, quoted by Thannhauser, 1940).

The lipid may be seen free in the blood vessels, in the adventitia, in the perivascular spaces and in intercellular spaces. It is sometimes found in the parenchyma and always in the connective tissue, giving a foamy appearance to the cells. In so far as the lipid does not stain with many dyes, the cells are termed pale and, as they transmit light well, they are bright.

There is a special type of "foam cell," regarded as a product of the reticulo-endothelial system. Rowland (1928) marshalled considerable evidence to show that lipoidosis is essentially a disease of the reticulo-endothelial system. This systemic conception has been very generally accepted, and has given impetus and direction to much subsequent research. Exceptions to the rule are, however, claimed. Pick (1933) states that in the varied lesions of Niemann-Pick's disease all the body tissue elements take part in the storage of lipid and production of foam cells. The importance of the reticulo-endothelial system is accepted, but it is safer to say that the single common factor in all these diseases is the disturbance of lipid metabolism.

"Foam cells" are described as being in sheets, columns, collections or fused to form a multi-lobular mass, often around the blood vessels. These cells vary in size and shape, but are usually large and distended by fine granules of lipid. The nucleus is small, dark staining and eccentric. Foam cells may be absent, especially in old lesions. They have sometimes been found to be absent (Jelsma, 1940) in the central nervous system in the Schüller-Christian syndrome, but Davison (1936) has confirmed the findings of Chiari that typical foam cells may be found in demyelinated plaques in this disease.

The cells of the parenchyma may or may not be affected by the disturbed lipid metabolism. A lipid disturbance and degeneration of the ganglion cells is present throughout the brain in amaurotic familial idiocy, Niemann-Pick's disease and the Schüller-Christian syndrome. The changes are similar, except that differing areas of the brain are specially involved in each. The nucleus becomes displaced to the periphery of the cell and granules appear at the opposite pole. At first the axon may be increased in size and tortuous, but later the cell processes disappear as the cell swells in size and becomes globular. Normal protoplasm becomes confined to around the nucleus, and later there is disintegration of the tigroid bodies and chromatolysis. The nucleus retains its nucleolus. Finally the nucleus disappears and the cell dies and disappears.

There is always a connective-tissue hyperplasia, the histiocytes of Aschoff

being filled with lipoid granules. Pollitzer and Wile (1912) have described the ultimate predominance of fibrous connective tissue over the true xanthomatous elements in xanthoma tuberosum multiplex. In the central nervous system the neuroglia is increased. Compound granular corpuscles (gitter cells) derived from the microglia are numerous, and act as phagocytes and scavenger cells. Their appearance very much resembles "foam cells" proper and the distended ganglion cells, but the nucleus of the compound granular corpuscle is smaller and darker (Hassin, 1940). Astrocytes are increased and contain lipoid, for they stain with the lipoid stains, but granules are not seen in them. The oligodendroglial cells proliferate and form perineuronal satellites, whose function is metabolic. The gliosis is very marked in the advanced and chronic cases.

Lipoid.—The lipoid present in the liver and spleen in a case of Niemann-Pick's disease has been estimated by MacFate (1928). He found 61.29 gm. per cent. total lipoids in the spleen, the normal figure given by Bloom and Kern being 22.851 gm. per cent.

Deposits of lipoid in the cells of the body may or may not be accompanied by excess of lipoid in the blood serum. In some cases the nodules follow hyperlipoidaemia and, in the case of xanthoma diabeticorum, have disappeared with treatment and improvement of the diabetes. In such cases the local conditions are clearly secondary to the increase of blood lipoids.

Excess of lipoid in the blood is, not always followed by infiltration of the cells and lipoid deposits.

In most cases the blood cholesterol is not raised above normal and there appears to be a primary lipoidal degeneration of the cells.

Lipoids are unsaturated fatty substances. Phosphatides, cerebrosides and sterols are among the most frequently found in diseases of lipoid metabolism. Sphingomyelin is present in amaurotic familial idiocy and in Niemann-Pick's disease. Of the sterols, cholesterol is of outstanding importance and is the lipoid present in most lipoid diseases, including the Schüller-Christian syndrome and the case described in this paper.

Cholesterol is absorbed from the digestion of animal but not vegetable foods, and it is also synthesized in the liver.

Cholesterol as a free alcohol or as an ester of palmitic, stearic or oleic acids is believed to be present throughout the body. Vitamin D, the bile acids and the hormones of the suprarenal cortex are derived from sterols, to which the male and female sex hormones, androsterone and oestrin, are related chemically. Indeed, Cook, Dodds, Hewett and Lawson (1933-1934) consider the assumption justifiable that there is a biological relationship between the oestrogenic hormones and the sterols and bile acids.

Cholesterol is excreted in the bile and by the intestines.

SYMPTOMS AND SIGNS.—Nodules which are not in the skin are often unsuspected, for there is a remarkable absence of subjective symptoms. There are sometimes no symptoms in the mild diffuse lipoidal degenerations of the parenchyma, but as the degeneration proceeds the effects are devastating. Normal healthy babies are reduced by amaurotic familial idiocy to paralysis, blindness and progressive dementia and die before they are two years old.

Niemann-Pick's disease also causes mental symptoms and death before the age of two.

The Schüller-Christian syndrome comprises defects of the bones, especially of the cranium, exophthalmos and diabetes insipidus. Atypical cases are described in the literature, and those which involve the central nervous system are included in this review of symptoms.

The defects in the skull are characterized by their multiplicity, great size and sharp outlines (Schüller, 1926). Reynolds (quoted by Rowlands, 1928) demonstrated the usual cranial lesions of such a case by X-ray examination, and 20 months later a second X-ray examination showed complete bony regeneration. A second case had resolved after an interval of three years.

Rowland's review of 14 cases of the Schüller-Christian syndrome showed that tumour of the brain was often vaguely suspected (Rowland, 1928), but there has been no report of definite signs of cerebral tumour (Thannhauser, 1940).

Hemiplegia has been found due to the Schüller-Christian syndrome in a girl, aged 10 (Thannhauser, 1940). She was still hemiplegic when examined again at the age of eighteen.

The nodules which arise from the dura mater and periosteum of the cranium are generally reported not to cause signs of cerebral pressure. Berman (1938) has, however, described a case, occurring in the spine but entirely extradural, which caused spastic paresis by pressure and not by invasion of the spinal cord by xanthomatous tissue. The patient was an unmarried coloured woman, aged 18.

In the case now to be described there were definite signs of cerebral tumour.

B. CLINICAL RECORD, DETAILED MORBID ANATOMY, AND DISCUSSION OF A CASE WHICH INVOLVES THE CENTRAL NERVOUS SYSTEM.

CLINICAL RECORD.—W. S— was born in 1883 and had a normal childhood and upbringing. He went to school until he was 13, was able to read and write, and was considered to be a "bright boy." He was left-handed, and had the full use of all his limbs. He became a file-grinder and earned £3 a week.

At the age of 30 he developed "epileptic fits." He started to wander away from home and get lost, and he admitted this. He commenced to laugh when questions were put to him, and he came to be considered childish and simple minded, and was certified (17. x. 13) as an insane person.

On admission to hospital his teeth were in bad order, his lips were dry and his pulse was 75. The report on his nervous system reads: "Station and gait normal. Knee-jerks present and similar. No ankle clonus. Plantar reflexes (flexor), cremasteric and abdominal reflexes, all present. Pupils approximately equal; slight corectopia inwards. Outline of each uneven. They react to light (direct and consensual) and with near vision. Movements of unrest present. Speech—some difficulty in articulation of difficult phrases—slight slurring."

He was at first in fair general health, but 18 days after admission he was sent to bed as he had become dull, listless, in poor health and had had two fits. He continued in poor health for seven months. His condition then became fair, but he complained of malaise in association with his fits, and he was still dull, listless and variable. Nine months later he was able to assist in the ward.

During the first part of his stay in hospital it was noticed that there was an appreciable latent period before he replied to questions. He was amnesic and "in the morning he forgets where he has put his clothes the night before." He was repeatedly described as confused.

In 1919, six years after admission, there was the first record made of a paralysis of the left leg and arm. Two years later he had a discharge from beneath the right eyebrow, which continued irregularly for four years. During this period his health was fair. He was described as having little facial expression. He had occasional fits, about once in three months. It was stated that he could not tell his name, and he had "gross deficiency of power of attention." It was noted that his condition resembled general paralysis of the insane.

His condition then remained stationary till his death another 12 years later. During this time he had infrequent fits, in which he did not lose consciousness or fall to the ground. The convulsions were confined to the hemiplegic side and caused the patient much distress, so that from the start to the finish of the attack he would repeat, "I wish I were ——— well dead." After a succession of fits he eventually died in coma, when he was noticed to have skew deviation of the eyes.

He died 24 years after admission to hospital.

Discussion of clinical record of patient.—The typical xanthomatous feature is the discharge lasting irregularly for some years from below the right eyebrow. Irritation has often been described as an etiological factor in xanthomatous conditions, and it is inviting to speculate whether inhalation of dust from the patient's occupation of file-grinder caused irritation to the frontal air sinus and localized the primary lesion in this site.

The teeth are described as being in bad order. This may be irrelevant, but it is remarkable how often disorders of the teeth and gums have been described in the Schüller-Christian syndrome.

The patient's condition on admission was suggestive of a lesion of the frontal lobe of the cerebrum.

Sachs (1930), in his paper on lesions of the frontal lobe, gives among other symptoms and signs disturbance of speech, convulsions, nystagmus and mental changes. In the case under discussion the slurring of speech and convulsions were present on admission. Sachs describes the nystagmus as being irregular twitchings, not so regular as in cerebellar nystagmus, and the notes on this case describe movements of unrest in the eyes. Among the mental changes he describes loss of memory for recent events, lack of concern about disease and its outcome, depression and emotional instability. In this case the patient was dull, listless and in poor health and was definitely amnesic, for "in the morning he forgets where he has put his clothes the night before," and he would laugh when questions were put to him.

Kolodny (1929), referring to tumour of the frontal lobe, described personality changes, mental confusion (marked in this case), fits, speech disturbance and pupillary changes. The pupils, he said, varied in size and shape, and in this case the pupils were only approximately equal and the outline of each was uneven.

The clinical record described an appreciable latent period before the patient replied to questions. Jefferson (1937) has recorded this sign in a young woman suffering from a frontal lobe tumour, who showed a hesitation and a brief pause before answering questions. Strauss and Keschner (1935) found that mental symptoms were present at some time in 90 per cent. of cases of tumour of the frontal lobe, and that mental symptoms were the earliest manifestation in 43 per cent.

"Variable" was a description given of the patient W. S—, and in this connection Macewen (1893) described a case of cerebral abscess in the left

frontal lobe coming under observation ten weeks after injury. Of his case he said, "It was hard to convince those who saw him only during the blinks of sunshine that he was suffering from an abscess of the brain." Macewen recorded that three minutes after a fit had passed off the patient was able to speak intelligently. Macewen also described the reflexes as being normal on admission, as in this case.

It is reasonable, therefore, to presume that this patient had, on admission to hospital, a profound disturbance of a frontal lobe of the cerebrum, and it is believed that definite symptoms and signs of this have been demonstrated in a case of xanthomatosis.

MORBID ANATOMY ; MACROSCOPICAL REPORT.

General.—The body is well nourished. The right pupil is smaller than the left. The visceral pleura are studded with cream coloured, firm nodules, 5–7 mm. in diameter. There is oedema and congestion of the lungs, a dilated heart and congestion of the liver. The gall-bladder contains three stones, each 25 mm. in diameter.

Cranium and central nervous system—inspection.—There is an old scar and a sinus 12 mm. deep under the right eyebrow. The cranium is of solid bone and there is no separation of the tables. The bone is roughened for an area 25 mm. in diameter behind the right frontal air sinus and opposite the frontal lobe of the right cerebral hemisphere. In this roughened area of bone are several large perforations for blood vessels.

The dura mater immediately adjacent is grossly thickened, being 5 mm. thick, and adherent here to the pia arachnoid. The pia mater strips easily from the brain, except from the right frontal lobe, where it is thickened, dull, and shows evidence of having been vascularized, but at death is gelatinous and fibrotic.

There is atrophy of the whole of the right cerebral hemisphere, but this is especially apparent to inspection in Brodman's areas 1, 2, 3 and 4 in their lower portions, most of 6, all of 8, 9 and 10, most of 11 (but excluding that part of 11 which lies on the orbital plate of the frontal bone), all of 43, 44, 45, 46 and 47, and the anterior portion of 40. In these areas of the right frontal lobe the convolutions are shrunken and gelatinous. The convolutions of the right parietal and occipital lobes are somewhat flattened and appear to have "fallen in."

Opposite the air sinus of the frontal bone and lying in the superior right frontal sulcus is a depressed scar 8 mm. in diameter, extending deeply as far as the ventricle, and 22 mm. along the sulcus forwards and backwards.

Section of brain.—The brain was divided by a medial sagittal section, and the hemispheres were divided by three coronal sections into four parts, which were then examined before further section was made for histological examination.

The first coronal section passed through the head of the caudate nucleus and through the scar in the right superior frontal sulcus. The part of the right hemisphere anterior to this section shows that the anterior horn of the right frontal lobe is lined by a gelatinous and irregular ependyma. The frontal lobe is extremely atrophied. The white matter is sparse, structureless and gelatinous, except for a narrow subsulcine strip. There is almost no compensatory hydrocephalus of this anterior horn, for the frontal lobe is "fallen in" and shrunken.

The second part of the hemisphere extends from the head of the caudate nucleus to the middle of the optic thalamus. The foramina of Monro are patent and dilated. The ependyma of the right ventricle appears dull, tough and grossly thickened, except over the head of the caudate nucleus, where it is roughened and gelatinous. The head of the caudate nucleus on the right side is 4 mm. less in breadth than on the left side, is flattened, and has dropped below the normal level of the floor of the lateral ventricle. The anterior limb of the internal capsule is scarcely discernible. The external capsule is replaced by two cysts, which measure vertically 24 mm. and 12 mm., and are situated between the putamen and the orbital part of the inferior frontal gyrus. The rest of the white matter of the right hemisphere seen in this section is gelatinous except for the white matter of the tip of the temporal lobe, which is reduced in size.

The third part contains the posterior half of the optic thalamus and most of the corpus striatum. The cortex of the right parietal lobe is pale and the sulci are shallow. The white matter of the right parietal lobe is seen to be almost completely replaced by cysts which do not communicate with the lateral ventricle. The minimum thickness of the brain between the surface of the cortex and the ventricle is, at the site of section, 6 mm., but posterior to this is an area where the diminished cortex of the parietal lobe is adjacent to the lateral ventricle and the resulting shell of tissue is translucent. The right optic thalamus is represented by an extremely thin strip of disorganized tissue, and the internal capsule is equally atrophied. The hypothalamus, corpus striatum and body of the caudate nucleus are comparable in dimensions with the left side. The right caudate nucleus has flattened out on the extended floor of the dilated ventricle.

The fourth part of the cerebral hemisphere includes the occipital lobes. The diminished, cystic and gelatinous white matter of the centrum semiovale is still apparent, and there is compensatory hydrocephalus. The right optic radiation can be traced as a band projecting into the right ventricle from below upwards, outwards and backwards. At the posterior portion of the band the narrowing ventricle (posterior horn) bifurcates around it. Moderate atrophy of the right hippocampus, fascia dentata and hippocampal gyrus is present. The minimum thickness of the right cortex and centrum semiovale on the surface of this coronal section is superiorly 9 mm., laterally 3 mm. and inferiorly 9 mm.

All sections of the brain stem are deformed, due to atrophy of the pyramidal fibres from the right motor cortex. The right crus is atrophied, and there is a flattening and atrophy of the right pyramid.

Cerebellum.—There is obvious atrophy of the left cerebellar hemisphere and of its folia. The irregular pattern of the dentate nucleus is absent on the left side. The centre of its nucleus appears partly gelatinous. The respective weights of the cerebral and cerebellar hemispheres demonstrate the contralateral cerebellar atrophy.

L. cerebral, 560 gm. R. cerebral, 355 gm.

L. cerebellar, 50 gm. R. cerebellar, 70 gm.

Cerebral arteries.—There is a little atheroma of the circle of Willis. The right anterior cerebral artery appears healthy at its origin but later is atrophied, and trace of it is lost in the gelatinous pia arachnoid over the convexity of the right frontal lobe.

Discussion of macroscopic report.—It is characteristic of xanthoma that the lesion of the visceral pleura is nodular. Small cavities and fibrosis of the lungs themselves have also been described (Rowland, 1929) in post-mortems of the Schüller-Christian syndrome.

The stones in the gall-bladder are interesting, for xanthoma is a disturbance of cholesterol metabolism and cholesterol is excreted normally in the bile.

One large granulomatous mass was probably the acute phase of the process, which is represented in its chronic state by the condition described post-mortem of the frontal air sinus, cranium, dura mater, pia arachnoid and scar in the frontal lobe. It should be remembered that this post-mortem is on a patient who died 24 years after the onset of the acute process, and fibrotic changes are characteristic of the chronic process.

The condition of the frontal air sinus was inactive at death, but the large perforations in its posterior wall speak of an earlier vascularity, which is typical of xanthomatous lesions in their acute phase.

There is no separation of the tables of the membranous bones of the cranium, the marrow being absent completely. It is known that resolution may occur after a few years of the multiple sharply outlined defects in the skull associated with the granulomatous masses which arise from the periosteum and dura in

the Schüller-Christian syndrome. Pick (1933) refers to a type of lipoid disease in which there is dense osteosclerosis of the long bones.

The fibrotic process is seen in the dura and in the scar in the frontal lobe.

The exceptional atrophy of areas of the frontal cortex which are underlying the gelatinous pia arachnoid and thickened dura mater may be the result of pressure by a granulomatous mass in the acute phase, or the result of ischaemia from fibrotic changes in the pia arachnoid membrane.

Demyelination has been exceptionally severe in this case, and by cutting off the thalamus from the cortex has contributed to the almost complete atrophy of the thalamus, with which is associated the crossed cerebellar atrophy.

MORBID ANATOMY ; MICROSCOPICAL REPORT.

Areas of sections and stains used.—The brain was hardened in 10 per cent. formalin saline, and sections were made from the following areas: Thickened dura mater opposite right frontal air sinus; scar tissue of right frontal lobe; motor area of right hemisphere; left frontal lobe; right and left parieto-occipital areas; right and left angular gyri; right and left hippocampi; coronal section at level of infundibulum, anterior commissure and head of caudate nucleus from both sides; coronal section at level of tuber cinereum, middle commissure and optic thalamus from both sides, coronal sections slanting upwards and backwards from corpora mammillaria through the central median nucleus; right optic radiation; midbrain to include right and left crura; medulla at level of inferior olive and restiform bodies; lower medulla; and right and left cerebellar hemispheres to include dentate nucleus and part of cortex. Some of these were frozen sections, others were paraffin to obviate disintegration of necrotic tissue, and some sections which were irregular in shape were embedded in celloidin.

The stains used were Nissl's; haemalum and eosin; haemalum and van Gieson; haemalum, van Gieson and Weigert's elastic; Weigert Pal; Holzer and Anderson's stains for neuroglia; Gram; Perl; iron alum; stain for amyloid; and Scharlach R.

Microscopic report.—The fibrous structure of the thickened dura mater opposite the right frontal air sinus stains red with haemalum and van Gieson. The same stain on the scar in the right frontal lobe shows both red and yellow fibres in sheaves, some fibres having spindle-shaped nuclei. Scharlach R shows irregular lines of extra cellular granules of lipoid in the scar, which contains no foam cells and no pyramidal cells. No bacteria are present, but there are a few scattered polymorphonuclear cells and twice their number of small lymphocytes in the scar. These inflammatory cells are not found elsewhere in the brain.

The pyramidal cells of the remainder of the cortex of the right frontal lobe are in the last stages of lipoidal degeneration. The cells are oval or round, the nucleus, with the nucleolus present, is extremely eccentric, and the cytoplasm is replaced by granules of lipoid, which stain orange with Scharlach R in frozen sections, but in paraffin sections the lipoid is removed and clear spaces are seen in the cells. Extra cellular granules of cholesterol are also found, in frozen sections, stained by Scharlach R.

The cortex of the right frontal lobe stained by haematoxylin and eosin shows numerous neuroglial nuclei, 7-12 μ in diameter. The larger nuclei, astrocytes, stain lightly and are stippled with granules of chromatin, and are without nuclei. The smaller oligodendroglial nuclei are darker. There are no compound granular corpuscles.

The cortex of the left frontal and parietal lobes, though normal macroscopically, shows lipoidal degeneration. The degeneration has not advanced as far as in the cortex of the right cerebral hemisphere, but the quantity of cholesterol present appears greater. Many pyramidal cells still retain some of their processes, but the nucleus is becoming eccentric and deposits of cholesterol are forming in the cytoplasm. The cells which have become globular contain a large crescent of lipoid at the opposite pole of the cell from the nucleus, but intervening cytoplasm around the nucleus is still present. Astrocytes are increased, but not so much as on the right side, and there is a marked perineuronal oligodendroglial satellitosis. The cortex of this hemisphere is more vascular than the right. The cortex of the occipital

lobes was not examined. The cortex of the left hippocampal gyrus shows deposits of cholesterol in normally shaped pyramidal cells which have oligodendroglial satellites. A few pyramidal cells in these gyri are becoming globular. The cholesterol shows as a brown pigment in Nissl sections. In the right hippocampal gyrus chromatolysis is more advanced and cholesterol deposits are less. Several subpial corpora amylacea may be seen in sections of all parts of the cortex.

The subcortical white matter of the right cerebral hemisphere is far less degenerated than the centrum ovale, the fibres of which, where present at all, are few and broken, with bulbous ends. "Spider cell" astrocytes are stained orange by Scharlach R, and there is a marked increase of interfascicular oligodendroglia shown by Holzer's stain.

Weigert Pal sections of the left frontal and parietal lobes appear normal. Scharlach R stains the fibrous "spider cells" orange and they are increased in number.

There are no compound granular corpuscles in the white matter of either hemisphere.

The basal ganglia on the right side are extremely disorganized and degenerated. A few shadowy remnants of cells of the optic thalamus are all that is left of that body. A few ganglion cells are left in the caudate nucleus and corpus striatum and hypothalamus, but there is much cellular debris. Among the neurons of the hypothalamus are a few truncated, vacuolated cells in which the nuclei are not recognizable. Weigert Pal sections of this area stain very poorly. A few plump astrocytes are present in the head of the caudate nucleus, and there is a gliosis of the putamen and globus pallidus and in the hypothalamus. These sections are very vascular, especially at the anterior perforated substance.

All stages of cholesterol lipoidal degeneration are to be seen in the ganglion cells of the left basal ganglia, the process being most marked in the thalamus, and less in the corpus striatum and hypothalamus. Some cells still retain their processes, but the nucleus is displaced and granules of lipid are present at the opposite pole of the cell from the nucleus. In other cells the lipoidal degeneration has progressed and the cells are globoid, swollen and devoid of processes. There are also irregular pale ghosts of cells without nuclei and surrounded and invaded by two to five oligodendroglial cells. The ependyma over the left basal ganglia is in places four or more cells deep, and has lost its columnar appearance. In some areas the ependyma is missing.

There is a bilateral subependymal gliosis with deposits of corpora amylacea. Corpora amylacea are also found scattered and in groups, often around blood vessels, throughout the basal ganglia. The corpora amylacea do not stain for amyloid or lipid, but are blue in haematoxylin sections. Cholesterol globules may be seen in and around the blood vessels, especially of the corpus striatum, and granules of lipid are present between its fibres.

The red nuclei of the midbrain show the same globoid swelling, cholesterol deposits and satellitosis. Gliosis is not marked except for a little in the tegmental decussation. The left crus is normal. The inner half of the right crus is almost devoid of nerve fibres, which are replaced by a thick neuroglial felting and there is a moderate gliosis of the outer half too. The white fibres of the outer half of the right crus appear smaller than the fibres of the left crus.

Occasional cells of the medullary cranial nuclei have lipid deposits, but the cells have their processes and normal Nissl bodies are present around the nucleus. Chromatolysis of the cells of the olives is worse in the right olive and pigment is present between the cells. There is an absence of fibres in the right pyramid. Increased neuroglia is present in the right pyramid and in the right restiform body.

The cortex of the left cerebellar hemisphere is two-thirds the depth, and contains fewer fibres than are found in the folia of the opposite hemisphere. There is an almost complete absence of Purkinjé cells in both cerebellar hemispheres, occasional folia being less severely affected. There is slight narrowing of the depth of the granular layer, and the cells are reduced in number. The cells of the dentate nucleus, particularly the left, stain poorly, show chromatolysis, and are intermingled with globules of dark pigment. There is severe demyelination of the white fibres in this nucleus, very few fibres remaining. Neuroglia is increased in the cortex, medulla, and especially in the dentate nucleus. There is no ferrugination of the brain cells.

Comment on microscopical report.—The special feature of the microscopical report is the presence of cholesterol granules, which stain brown with Nissl's stain and orange with Scharlach R. The cells tend to lose their processes and become globular. The nucleus becomes eccentric. Hassin (1933), in describing lipoidal degeneration of the central nervous system, says the importance is "not so much in the structure as in the microchemical properties of the ganglion cells."

The degree of lipoidal degeneration found throughout this brain is at first surprising. It is characteristic, however, of xanthomatous lesions in all parts of the body that deposits of lipid in the cells do not appear necessarily to destroy the function of the cells.

The fibrous and neuroglial scarring of the dura mater and small portion of the right frontal lobe constitute a localized process, differing from the generalized degeneration of the brain.

Fibrosis is often found in chronic xanthomatous lesions to have followed an acute phase in which collections of "foam cells" and compound granular corpuscles are associated with increased vascularization. Similarly it is probable that the localized sclerotic lesion of this brain was the original acute lesion composed of foam cells and compound granular corpuscles, as is found in the nodules of the Schüller-Christian syndrome. Evidence of the original vascular character of the lesion is to be found in the large perforations in the posterior wall of the right frontal air sinus.

No bacteria were found in this localized area of the right frontal lobe, but some small lymphocytes and polymorphonuclear cells are present. Focal sepsis is often associated with xanthomatous lesions, either as a precipitating or as a complicating factor.

Generalized xanthomatous degeneration of the brain is found in amaurotic familial idiocy, Niemann-Pick's disease and in the Schüller-Christian syndrome.

The generalized degeneration present in this brain has not progressed so far as the localized lesion, although many ganglion cells are in advanced stages of cholesterol degeneration. The connective-tissue hyperplasia is present in the form of oligodendroglia and astrocytes, but the latter are protoplasmic and not fibrotic in type, as in the scar of the localized lesion.

The change from cellular to sclerotic structure is in different stages in the two cerebral hemispheres. There are more cholesterol deposits and less gliosis in the left hemisphere than in the more severely affected right hemisphere, in which there is less lipid and more gliosis.

Numbers of oligodendroglial cells are present around the degenerating cells. These glial cells, though present in other chronic conditions, are metabolic, not scavenger in function, and their presence confirms the view that the case here described is essentially a metabolic disturbance in the cells.

Compound granular corpuscles are not present, and this absence of scavenger cells may point to an arrested process.

The demyelination of the right cerebral hemisphere suggests that hyperlipidaemia was not a primary factor in this case.

Two anatomical anomalies of the case are explained by the widely spread lipoidal degeneration of the central nervous system. These are the degenera-

tion of the right centre median nucleus of the optic thalamus, and secondly the crossed cerebellar atrophy.

Le Gros Clark and Russell (1940) described a case of acquired atrophy of the optic thalamus, associated with diffuse porencephaly and sclerosis of the left cerebral hemisphere. The history was of the onset of hemiplegia in a girl, aged 13, who died five years later. The only undegenerated elements in the thalamic atrophy were the lateral geniculate body, the centre median nucleus and a narrow subependymal zone of cells. There were no undegenerated cells in the optic thalamus described in the case of W. S—. The few cells which were not dead showed lipoidal degeneration.

Crossed cerebellar atrophy is found in some congenital hemiplegics, and is generally only expected when the cerebral lesion occurs in a very young person (Hassin, 1935). Von Monakow (1885) observed atrophy of the cerebellar hemisphere after ablation of the contralateral cerebral hemisphere in newborn dogs and cats. Mott and Tredgold (1900) emphasized the importance of the basal ganglia, and pointed out that the changes in the cerebellum and fillet only occur in hemiplegia when the lesion is primarily basal. Claude and Loyez (1912) reported a case of crossed atrophy of the cerebellum from a traumatic lesion of the internal capsule. The unusual occurrence described in this paper of crossed cerebellar atrophy in the adult may be due to the effect of porencephaly and thalamic atrophy superimposed on a cerebellum already affected by lipoidal degeneration.

It is unfortunate that the lungs and pleura were discarded before their significance was appreciated. There might have been excess of lipid found in other organs had they been kept, for xanthoma was not suspected in the left cerebral hemisphere until a microscopical examination was made.

C. DIFFERENTIAL DIAGNOSIS.

Congenital.—The atrophied convolutions of the right frontal lobe are distinguished from congenital microgyria by the normal pattern of the convolutions.

Crossed cerebellar atrophy is usually congenital, but in this case the history of the patient and the clinical examination on his admission to hospital are quite inconsistent with a congenital lesion. The relatives give the history that far from having his left side paralysed as a boy, he was actually left-handed and he was considered a bright boy. He learnt to read and write at school, and later earned his living as a file-grinder. He was 30 years of age when the thorough neurological examination already described found no paralysis, and finally there is the photograph of the patient when he was admitted to hospital. Both his hands are in the picture, and that there was no hemiplegia then is quite evident.

Industrial: Chronic manganese poisoning.—The nervous system is particularly affected in chronic manganese poisoning by inhalation of dust in manganese mines and in the manufacture of manganese preparations. Manganese damages all areas of the nervous system, particularly the pallidum (O. Bumke and E. Krapf, 1936). M. Canavan, St. Cobb and K. Drinker (1934) reported the post-mortem examination of the brain of a man who had developed

chronic manganese poisoning. They found atrophy of the parietal lobe, enlargement of the lateral ventricles and shrinkage of the basal ganglia. H. Stadler (1935) described a disappearance of ganglion cells replaced by glial tissue in multiple areas of the brain. Similar cases have often been described since 1901, and especially in the last ten years. The perivascular changes described are similar to those of lead poisoning. These degenerative changes are similar to those found by post-mortem in W. S.—, but are distinguished by the absence of intracellular cholesterol deposits in the brain and other organs. The symptoms of chronic manganese poisoning are essentially those of Parkinsonism—mask-like features, flexion of the trunk, pro- and retro-pulsion, monotonous speech, and tremors. Our case differed from this in resembling general paralysis of the insane. It is unlikely also that dust from file-grinding could cause chronic manganese poisoning, for the manganese content of the tool steel used by file manufacturers in 1912 was from 0.30 per cent. to not more than 0.40 per cent. (personal communication from Sheffield Chamber of Commerce).

Dietetic.—Diffuse pigmentary atrophy of the ganglion cells is found in pellagra. Pigment-laden macrophages are found in the perivascular spaces. Pellagra does injure the central nervous system, but there is no other evidence that pellagra was present in this patient, nor, if it had been present, would it explain the pathological findings in the cranium, dura, brain and pleura of this case.

Circulatory.—The microscopical findings of dissolution of a large part of the right cerebral hemisphere suggest a circulatory disturbance in the areas supplied by the right frontal and middle cerebral arteries. An intrauterine or infantile process has already been shown to be absent in this case, and it is established that the hemiplegia arose between the ages of 30 and 35. An embolism might have lodged in the cerebral arteries, but there is no evidence post-mortem of a primary lesion, such as ulcerative endocarditis. Haemorrhage appears unlikely, for the patient would not have survived a haemorrhage of that magnitude. There is no trace of a congenital aneurysm, and arteriosclerosis is not a factor in a young man, and there was very little arteriosclerosis of the circle of Willis, even at post-mortem 20 years later. The heart and kidneys are not suggestive of hyperpiesia; nor would haemorrhage account for the microscopical findings in the left cerebral hemisphere and brain stem.

Inflammatory.—Dural lesions following sinusitis are limited as in this case. Pickworth (1935) believes that a symptomless infection of an air sinus of long duration may cause thickening of the adjacent dura, but in this patient the process had advanced to hemiplegia before the frontal air sinus showed symptoms and discharged. It is doubtful whether that discharge was purely inflammatory, and of all the air sinuses subject to infection frontal sinusitis is uncommon.

If there was a primary inflammation of the frontal air sinus the probable spread of infection would have been infection of frontal air sinus, infective venous thrombosis, pachymeningitis, subdural infection, leptomeningitis (Turner and Reynolds, 1931). Retrograde extension of septic thrombosis along the arteries causing infarction or along the veins, usually the superior

cerebral veins, may pave the way for an abscess, solitary or multiple, of the frontal lobe. A superior longitudinal sinus thrombosis, however, would have caused equal damage in both hemispheres. Courville (1937) states that abscess of the frontal lobe secondary to frontal sinusitis is rare. The connective-tissue scar in the superior frontal sulcus of the right cerebral hemisphere is not a characteristic end-result of a cerebral abscess, although the inflammatory cells present may indicate an infection either precipitating or secondary to another process. The pencephaly is of such dimensions that if due to an abscess it would be expected that the latter would, by spread of infection and rupture into decadent tissues, have burst into the anterior horn of the lateral ventricle, with consequent death from ependymitis and meningitis. Yet in this brain the cysts in the right hemisphere do not communicate with the ventricle, and the patient lived for 20 years after the onset of hemiplegia.

Diffuse encephalitis may follow otitis media, but is unusual secondary to frontal sinusitis. Diffuse suppurative encephalitis due to an assumed anaerobic organism is very rare.

Infection by a neurotropic virus causes damage to the central nervous system, including destruction of Purkinjé cells in the encephalomyelitis complicating chickenpox and in louping ill. Parker and Kernohan (1933) say that it is not impossible that parenchymatous cortical cerebellar atrophy is in some instances at least due to a virus disease.

Infection by a virus may occur at all ages, in children (encephalomyelitis complicating chickenpox) and in elderly people (encephalitis in St. Louis). Neurotropic infection should therefore be considered. Against the diagnosis in this case is the path of infection, which was not by the olfactory nerve or other nervous tissue, but, if there were a primary infectious process at all, by infective thrombosis.

The degenerative changes in this brain were probably not a toxic encephalitis due to a diffusion of toxins from a bacterial infection of the frontal air sinus. Pickworth (1932) discusses the effects of naso-pharyngeal sepsis on the calibre of small brain vessels, through the sympathetic system. A circulatory disturbance in the brain might thus have been linked with frontal sinusitis. This would be in accordance with the theory of apoplexy that severe vascular spasm produces necrosis of vessels and brain. When the spasm relaxes the weakened vessels break, and the blood leaks into tissues which are already dead or dying. A toxic process might thus result in haemorrhage, but the diagnosis of haemorrhage has been excluded above.

The diagnosis of a primary infectious process cannot explain all the findings in the central nervous system, in the cranium and pleura. An infection may, however, have precipitated or been secondary to a xanthomatous process.

Disseminated sclerosis.—This relatively common and usually chronic disease is found in persons of the age of this patient, and often causes spastic paralysis. There is histological evidence of an inflammatory origin, and in the demyelinated plaques fat-containing cells, which stain by Scharlach R, replace the normal brain structure. Disseminated sclerosis, however, shows very few changes in the ganglion cells, and the other viscera are not affected as in this case.

Schilder's disease.—Schilder's disease causes a demyelination of the axis cylinders of the centrum ovale, sparing the subcortical fibres. Compound granular corpuscles phagocytize the free fat, perineuronal oligodendroglial satellitosis is present, and overgrowth of neuroglia is found around the blood-vessels.

The frontal lobe is seldom involved, and the pons and cerebellum are unaffected in Schilder's disease. There are no generalized visceral changes.

Hereditary cerebellar ataxias.—Atrophy of the cerebellum is characteristic of this disease, and the Purkinjé cells are often severely affected. The cerebrum is not affected as in this case, in which there is no family history suggestive of hereditary cerebellar ataxia.

Senility.—Yellow granules are frequently deposited in the nerve cells of older persons. The age of this patient excludes the diagnosis of senility.

Hepato-lenticular degeneration.—Bilateral degenerative changes in the lenticular nuclei may also extend to the internal capsule, basal ganglia, motor cortex and pyramidal tracts. There is a symptomless cirrhosis of the liver. The combination of degeneration in the central nervous system and a symptomless visceral lesion is suggestive of xanthoma, but this interpretation has not been given to hepato-lenticular degeneration.

D. CONCLUSION.

The case here described is an atypical example of the Schüller-Christian syndrome, or, as Rowland calls it, xanthomatosis. In Thannhauser's classification it is an example of "generalized xanthoma of the normocholesteremic type," which is a subdivision of his "primary essential xanthomatosis of the normocholesteremic type."

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SOCIAL MATURITY TEST.*

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It has been said that when a psychiatrist is appointed to a general hospital the staff only by stages come to make use of his services. The first phase is that in which he is called upon to dispose of those patients suffering from severe mental illnesses, whose behaviour is disturbing to the rest of the ward. In the next phase he may be called upon to deal with psychotics and severe psycho-neurotics. The third phase comes when surgeons and physicians refer to him all those patients they have investigated for whose symptoms no organic basis can be found. A fourth phase is when the psychiatrist is asked to co-operate in the treatment of such psychosomatic cases as asthma, colitis and migraine—and in the last phase, when the psychiatrist has proved his worth, he may be asked to advise on the handling of patients suffering from “wear and tear diseases,” frank organic diseases, such as gastric ulcer and hyperpiesia (1).

A parallel sequence of events can be observed in the natural history of child guidance clinics. When these are first established there is a tendency for schoolmasters to drag out from the back rows of their classes those unascertained defectives who have vegetated there—or worse still, disturbed the rest of the class by their bizarre behaviour and responses. The completeness of ascertainment varies of course from county to county, but it is significant that Miss Dunsdon and I found that of 23 defectives appearing before the Bristol Juvenile Court in 1941, only one had been attending a special school (2). The numbers of defectives passing into the Army past the medical officers of Recruiting Boards are also significant (3). If this stream of defectives referred to the Child Guidance Clinic becomes a flood there is a danger of the Clinic being labelled in the popular mind as the “daft and silly” clinic, and parents hesitate to bring their normally intelligent but maladjusted children for advice, as they fear they will be “put away” (4).

A campaign of re-education of the teaching profession in the city or county is required therefore, and this may need to be backed by a survey to ascertain the distribution of defectives in the area to convince the administrators and local authority committees concerned of the need for action.

Having coped with this aspect of the problem, a new class of case tends to swamp the clinic facilities, the juvenile delinquent; if the proportion of juvenile delinquents to the total referrals becomes too large, the clinic now acquires the reputation of the “bad boys” clinic, and again parents of more normal children are deterred from bringing their neurotic children in case they should be contaminated by “evil communications” in the waiting room. Such a situation became fairly acute in the Bristol Clinic in the second year of the war, and Miss Dunsdon and I investigated the problem first by studying the distribution of intelligence amongst children brought before the Court (2).

* A Paper read at the Child Psychiatry Sub-committee meeting held at The Retreat, York, on May 16, 1946.

and demonstrated the high incidence of dull and backward children among the young delinquents (4). At the same time there were a large number of children of normal, and some few of superior intelligence who came before the courts, and in a high proportion of these children we found evidence of disruptive influences in the home: parents dead, divorced, separated, both parents at work, alcoholic or psychotic parents. Arrangements were therefore made with the support of the Chief Education Officer that every child remanded by the Bristol Juvenile Court for investigation, whether on bail or to a remand home, should have an intelligence test. If the psychologist felt that a further psychiatric examination was required in addition, this was requested in her report to the magistrates (5).

While, therefore, in the case of the defectives and the dull and backward we were able to assist the magistrates with a fairly accurate assessment of the intellectual limitations of the child before the court, in the case of the normal and the bright children, other factors which so far did not lend themselves to quantitative measurement required more attention.

At that time I was also interested in some of the handicaps of the child brought up in institutions, and was casting about for some method of assessing the differences in adjustment to the school-leaving situation and the commencement of work between the child brought up in a normal home and the child who had spent his early life in an institution. I found Goldfarb's account (6) of a small sample survey on these lines which was carried out in America, and noticed his use of the Vineland Social Maturity Scale (7). Miss Mackinlay, of Mill Hill Hospital, kindly put at my disposal a collection of reprints on this test, and through the kind offices of a friend in the American Consulate, I was able to obtain a copy of the test, and the manual of directions, together with the scoring table.

Investigation of social adaptation entails a study of how the growing child reacts to his human environment, and how he achieves a state of relative independence, having entered the world in a condition of complete dependence.

The capacity of the child to adapt himself will depend on a variety of factors, some of which are inherent in the child, while others will depend on the chances and changes in his surroundings.

Of those factors which are inherent in the child, an important one will be the child's general intelligence—the reliable memory, the capacity to learn from experience, the mastery of general principles, the perception of the relation between cause and effect, the exercise of common foresight, are all associated with a developed intelligence, and should be mobilized in successful adaptation to other human beings.

But it does not necessarily follow that high intelligence and good social adaptation go together. It is easy to think of examples of the clever adolescent who is out of adjustment with his environment. On the other hand, some mental defectives make excellent social adjustments, provided the people in their environment do not make demands beyond their capacities.

While, therefore, a measurement of intelligence is valuable in such an investigation, it cannot be relied on as a complete guide to the social adaptability of the subject.

In America a good deal of work has been done in the last ten years on working out a scale of social adaptability, which should measure this capacity much as the Terman Merrill scale measures intelligence.

Doll, working at the Vineland Institute, has now standardized (7) his Social Maturity scale on 620 subjects, rechecked the scale on 250 subjects, and further rechecked it on 196.

He has worked out maturation curves on specific items in the scale, as illustrated in his 1942 article (8).

The test is not a scale of emotional maturity—or a measurement of personality, conduct or occupational success. It is devised to estimate the degree of self-help and self-direction, the initiative shown in independent locomotion, communication and socialization. The degree to which the individual is independent from the assistance and supervision of others and the extent to which the individual can contribute to the well-being of those around him.

His test is devised as independent of sex factors (9)—that is, it is applicable to both boys and girls. Originally the test was designed to be applied to informants about the testee. He has later found it accurate when the testee provides the information down to a social age of only 4 (10).

He found that when informants, wardens, attendants, matrons, parents, welfare officers, were asked opinions and impressions of the social adaptability of children and young persons, they were apt to be wildly inaccurate about children over 12. Their estimates tended to be based in terms of usefulness rather than social capacity. The Vineland Scale constitutes a useful check on such a tendency.

After seven years' experience with this test Doll maintains that there are probably limits to the unfolding of the social personality (11), just as there are limits to the development of intelligence. While intellectual capacity reaches its maximum development at 14, in the great majority of cases social capacity goes on developing until the 25th year.

The influence of training and environment is principally effective, he believes, during the period of development. It is ineffective after social maturation is complete. This, if true, has important bearings on the institutionalization of children, particularly defectives, as Doll found that the rate of maturation in the feeble-minded slows down after 15 and stops at 18 (12) as compared with 25 years in the normal subject. He finds that a social age of 18 seems to be the borderline between the normal adult and the defective, and that a Social Quotient (S.Q.) of under 70 indicates social deficiency.

Doll has investigated a series of families using his social maturity test, and has demonstrated that social maturity appears to be distributed in a similar fashion to intelligence. He prints genealogical trees of four generations, showing that in some families the social maturity never reaches a normal level, while in other families the social maturity is always above average. He states, "to be socially feeble-minded is just as fatal to successful integration in human society as to be mentally feeble-minded."

Doll tended to believe that social capacity was very largely an innate factor and was only slightly modified by environment (11), though he admitted

that foster-home placement capitalizes social competence to better advantage than does institutional care in some directions (12).

To illustrate the usefulness of this test I have taken 70 consecutive cases from the Bristol Child Guidance Clinic files, and made up the numbers to 100 with cases from the Somerset County files and my private case-file over the same period. Thus, both urban and rural children have been examined, and from all economic levels of society. It must of course be remembered that all these children were referred as child guidance problems, and that so far, owing to pressure of work, I have had no opportunity of examining controls—though I may add that Miss Mackinlay, working for the Nuffield Research Foundation, is at present building up some control figures.

In parenthesis, I would like to comment on the difficulty of establishing "controls" in psychiatry and social medicine. The variables are so many that the hunt for normal controls often proves the most difficult part of a research plan. Richardson (1) has practically stated that controls are impossible in certain fields of social medicine. Margaret Mead (14), the anthropologist, has also commented on the difficulty, and contented herself with those clinical studies recommended by Prof. Aubrey Lewis at the last annual meeting of this Society (15).

To return to the clinical material of this study—how far does social competence correlate with intelligence as measured by the Terman Merrill test? Doll claimed that the correlation worked out at 0.8, but my material might be expected to show a smaller correlation, as all the cases had been referred to me for some maladjustment or other. I decided rather arbitrarily to narrow the correlation down to a difference of 5 points plus or minus between the intelligence quotient and the social quotient ($\frac{\text{social age}}{\text{chronological age}}$). Social ages and mental ages were not comparable, as the maturation ages were different.

Twenty-eight children had social quotients within 5 points of their intelligence quotients—the I.Q. range being from 61-130.

TABLE I.

	Number.	%.		Number.	%.
I.Q. under 70	2	7.1	S.Q. under 70	2	7.1
Between 70-84	6	21.3	Between 70-84	7	28.4
„ 85-115	16	57.8	„ 85-115	14	56.8
Over 116	4	14.2	Over 116	5	17.7

Of these 28 children, whose I.Qs. and S.Qs. were nearly identical, 20 children (71 per cent.) came from broken homes.

TABLE II.

Step parents	1	Illegitimate	2
Evacuated	4	Parent alcoholic	1
Father in Services	4	Father killed on service	3
Parent in prison	2	Parents separated	2
Both parents at work	1		

Although nearly 75 per cent. of this group had average to very good social quotients, in more than 70 per cent. the environmental circumstances were, or had been unsatisfactory. This finding for what it is worth seems to support Doll's contention, referred to above, that social capacity is an innate factor.

The group of children in which there is a disparity of more than 5 points between the S.Q. and the I.Q. can be divided into two parts. First the group in which the S.Q. is more than 5 points higher than the I.Q. There were 25 of these—if the discrepancy is 10 points or over, the group is one of 18)—the I.Q. range being from 35-109. (See Table III.)

TABLE III.

	Number.	%.		Number.	%.
I.Q. under 70	8	32	S.Q. under 70	5	20
70-84	5	20	70-84	4	16
85-115	12	48	85-115	10	40
116 and over	0	0	116 and over	6	24

In this group in which S.Qs. are higher than I.Qs., more than half the children are either mentally defective or mentally dull and backward. Nearly one-third are defective, and there are no children of superior intelligence.

Of the eight defectives none had been officially ascertained and neither parents, teachers or employers were aware of their special limitations. The consequence was that pressure had been put on them to maintain average standards of work and behaviour, and a considerable number, 69 per cent. of both the defective children and the dull and backward, had broken down under the strain of maintaining standards beyond their capacity and showed either social symptoms, such as delinquency, or conversion symptoms, such as hysterical paraplegia.

TABLE IV.

Symptom.		Symptom.	
Depression	1	Phobias	2
Stealing	2	Aggressive, spiteful	1
Sex abnormalities	2	Hysterical conversion	1

Of the 12 children of average intelligence, whose social capacity was abnormally developed, 10 were showing signs of the pressure put on them.

TABLE V.

Stealing	3	Tics	2
Lying	1	Enuresis	4

It is interesting to note that in these more intelligent children conversion symptoms were not observed, but psychosomatic symptoms were preponderant—and stealing is the commonest social symptom of maladjustment.

One boy—Case No. 2967—in this group illustrates the type of situation. He was aged 11½, had a mental age of 10 (I.Q. 88), a social age of 12·9 (S.Q. 113). He was referred by the Juvenile Court for stealing. He was the sixth child in a family

of 9. His father suffered from fits and was of very dull intelligence. His mother appeared to be mentally defective according to the social worker's report. An older brother was in a colony for defectives. It was clear from the social history that this boy was the brightest member of the family, although his I.Q. was only 88, and that the rest of the family had learnt to rely on him. It is not surprising that he developed a "social breakdown" and became delinquent.

The other group of children where a disparity is found between the I.Q. and the S.Q. is that group of children in which the S.Q. is lower than the I.Q. by more than 5 points. There were 47 of these; I.Q. range from 54-144. (If the discrepancy is 10 points or over, there were 41.)

TABLE VI.

I.Q.		Number.	%.	S.Q.		Number.	%.
under 70	.	1	2	under 70	.	2	4
Between 70-84	.	2	4	Between 70-84	.	14	29
„ 85-115	.	28	60	„ 85-115	.	30	64
Over 116	.	16	34	Over 116	.	1	2

In contrast with the group of children whose S.Qs. were greater than the I.Qs., there is a big proportion of children (over a third of the total) who are of superior intelligence, but there are very many fewer mental defective and mentally backward (6 per cent. compared with 52 per cent.). A very much smaller number of children have exceptionally good S.Qs. After all this is to be expected. A child of 10 may have a mental age of 14, but we do not expect him to behave like a 14-year-old; in fact we should tend to discourage such precociousness.

The home environment in this group of children was unsatisfactory in 25 (53 per cent.).

TABLE VII.

Step-parents	.	.	1	Parent alcoholic	.	.	1
Evacuated	.	.	7	Parent died (mothers (3))	.	.	4
Father in Services	.	.	5	Parents separated	.	.	3
Parent in prison	.	.	0	Both parents at work	.	.	0
Illegitimate	.	.	4				

It is perhaps significant that this is the only group examined in which motherless children were found.

Of the remaining 22 children in this group, whose family circles were intact, 6 children had mothers who were noted as grossly over-protective, 4 had one or more parents who were under treatment for neurosis. Their social training, therefore, was likely to be deficient as far as adult example and encouragement were concerned.

Social training is also brought about by brothers, sisters and school-mates. In this group of children whose social capacity was not as good as their intelligence, and who had normal parental care (12 cases), 4 were only children and 8 were the youngest members of the family. Only children lack the example of older brothers and sisters, and the stimulus of younger sibs, while the youngest child is treated often as the family pet, rather than as an individual with rights of doing things for himself.

Perhaps the chief interest in this group is in those children whose intelligence is normal, but whose social capacity is to be ranked as backward (under 84) or defective (under 70).

Of the social defectives (S.Q. under 70) there were 2. One a girl of 20, with a mental age of 9 and a S.Q. of 54. Her over-protective mother had spent a lot of money training her as a shorthand typist, and was indignant because nobody would employ her for longer than a week. Quite obviously this girl would never be able to earn her own living.

The other was a girl of 9+, with a mental age of 7.0 (I.Q. 72) and a social quotient of 57. Obviously, though this child was above the usual borderline for a special school, her limitations were too great for her to profit by education in the ordinary junior class.

There were 14 children who were socially dull and backward in this group of children with S.Qs. lower than I.Qs. Only one of them was intellectually dull and backward. The remaining 13 had average or superior intelligence—2 with I.Qs. of 115 or over (see Table VIII).

TABLE VIII.

S.Q.	I.Q.	Symptoms.	Social history.
81	92	Aggressive	Illegitimate; only child in hostel; mother refused to take it home.
82	96	Enuresis	Only child; mother invalid in hospital; father in Army since child was 2.
79	97	Stealing	Second child in family of four.
83	98	Educational failure	Has been at boarding school for five years since age of 8.
74	101	Stealing	Father dead; mother's remarriage; youngest of three brought up by grandmother.
84	104	Phobias	Over-anxious mother; father in Services since child was 3; hospitalized 2; younger of two children.
72	96	Sex play	Youngest of three children; sleeps with sister and two girl cousins.
84	110	Phobias	Middle child of three; alcoholic father; over-protective mother.
80	113	Apathy	Parents separating; has been fostered in four different homes.
79	115	Depression	Father in Services; evacuated; boarding school for seven years.
79	118	Inability to keep job	Typical psychopath.
83	90	Tempers	Oldest of three children; father in Services since child was 4.

The study of this sample survey of social capacity appears to show that there is, on the whole, less variation, a smaller range of differentiation, compared with the spread of intellectual capacity. Perhaps this is to be expected when we bear in mind the very powerful social pressures brought to bear on

the child, as Margaret Mead has demonstrated in her Chapter, "The Child's Dependence on Tradition" (14).

However powerful the external forces, there would appear to be an innate factor concerned, probably an inherited one. I have not had time to investigate S.Qs. throughout families. It would be interesting to make comparable studies to those of Dr. Savage, who investigated the I.Qs. of the mothers of problem families in Herefordshire (16). I have only notes of a brother and sister with S.Qs. of 125 and 111.

But I think I have demonstrated that social capacity may be precociously stimulated and developed with resulting breakdown, either social, neurotic or physical. It is interesting to note that in many defectives the S.Q. is higher than the I.Q., and I have recently begun to investigate the social capacity of school-leavers from special schools. Here I have found in the small number so far tested that the children who have been recognized early, and have had adequate training in a curriculum suited to their limitations, leave with S.Qs. considerably higher than 70, and are fit to take up work in an occupation suited to their intelligence, but that a certain number of these school-leavers have S.Qs. under 70, and it is doubtful if they should be exposed unsheltered to the normal hazards of the labour market.

This compactness of social capacity leads us to expect that children of superior intelligence would have, on the whole, relatively lower social quotients, and that if the S.Q. is lower than 85, difficulties in behaviour, neurotic symptoms or psychosomatic symptoms are likely. The child with an S.Q. below 70, even if the I.Q. is higher, is so handicapped that he should be treated as a defective. This is a practical point of some importance, and should help to clear up those difficult borderline cases which give such headaches to the Justices on the Juvenile Bench and the magistrates' clerks.

It is relevant to ask here, can S.Qs. change, or are they fixed irrevocably for life? Wechsler has marshalled the arguments which led to some very disturbing conclusions about the constancy of the I.Q. (17), and if the constancy of the I.Q. is no longer sacred, one would still less expect the S.Q., depending on a scale whose items involve a range of opportunities, to be constant. In fact, I have used this scale to measure improvement after treatment and give two examples:

One boy of nearly 13, with an I.Q. of 115, who was referred to me for apathy; when I first saw him he had a S.Q. of 79 and in appearance resembled a typical melancholia. He was unhappy at his Boarding School, and worrying over his father, who was a captain in the Merchant Service. I took him on for weekly interviews, kept him at home—the social worker found him "occupational therapy" in a garage, which he enjoyed; at the end of three months his father was due home for leave, we had arranged his transfer to a technical school, and his social quotient on retest was 107.

By way of contrast, a boy, aged 8, with an I.Q. of 101, had a S.Q. of 87. He was an only boy, whose mother had died when he was a year old and had been brought up by a grandmother and two spinster aunts. He was referred for backwardness in reading. He had a year's treatment of combined remedial coaching and play therapy, and though he had made $1\frac{1}{4}$ year's progress in reading, his social quotient was practically the same—86.

I hope that this analysis of a sample of children tested may stimulate your interest in this test. A great deal of work remains to be done. I am at present

trying to standardize the test for English children. The test has been worked out for an American culture, which differs in some respects from our own ; for example, the availability of telephones, and the prevalence of the mail order system in the Middle West. (Example in the film, "Our Vines have Tender Grapes.") I am therefore plotting maturation curves for each item, but so far my total numbers (about 400) only allow of smooth curves in a few items. When this standardization has been done it will be possible to be more precise about the correlation of social maturity with intelligence. How much of social adaptation is due to nurture—how much to nature ?

Another correlation to be worked out is that between social maturity and educational attainments. In about 45 cases the educational attainments had been recorded, and I find that of 40 children the reading age approximates to the social age in 18, as compared with 22 where it approximates to the mental age. The discrepancy is even more marked in number work. Of 43 children tested, 24 arithmetical ages corresponded to the social age, as compared with 19 to the mental age. This corroborates Fleming's dictum that persistence (in learning) is closely related to an atmosphere of social acceptance (18).

A useful avenue to explore would be the range of improvement possible by various forms of treatment, i.e. environmental adjustment, play therapy, individual or group treatment. More work, too, could be done to correlate particular types of test failure—failure in self help, or failures in self direction, self occupation, communication, locomotion, socialization with particular—with certain types of environment or defects of environment. What are the failures of the institution child—the foster child—the displaced person—the only child ? What are the handicaps of the child in the isolated rural community ? Is anti-social behaviour more common in metropolitan areas ? Apparently it is more common in the larger colonies of social birds, such as gulls (19). Do social quotients tend to be lower in cities with populations of over a quarter of a million ? Mumford says robberies occur seven times as often in cities of 250,000 populations as in cities of 10,000 (20).

Will it be possible to give a social prognosis for the individual by a scattergram analysis of the pattern of scoring in the test, analogous to the scatter analysis of the Bellevue Scale worked out by Rapaport ? (21).

Can we detect the potential psychopath at an early age ? I consider that this American maturity scale has great potentialities, as one of the tools of social medicine. No doubt it will be improved, sharpened, made more precise ; but it is also incumbent upon us to master its use, and develop the skills required to employ it to the best advantage.

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LASTING LESSONS OF OVERSEAS MILITARY PSYCHIATRY.*

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MILITARY psychiatry is a large subject with widespread ramifications. The general scope of the work at home has been well reviewed in J. R. Rees's paper, "Three Years of Military Psychiatry in the United Kingdom"; I need not, therefore, try to describe what he has described so well. Even in the overseas field, I must unwillingly avoid the fascinations of detailed discussion of the aetiology and treatment of "battle neurosis" in forward troops; there is already a wealth of papers on this subject, including the valuable symposium at the Section of Psychiatry of the Royal Society of Medicine last November, in which Palmer, Kenton, Craigie and Main took part. Kenton's contribution, being based on work in North Africa and Italy, outlines some of the experience on which my remarks to-day are based.

The overall incidence of psychiatric illness in the Army is possibly not very different from the incidence in civil life; but when we come to consider such things as the nature of the population at risk, the types of stress undergone, the priorities obtaining, and the administrative powers available, we find that almost everything is radically different from the conditions of peace-time civilian psychiatry; in fact so much so that it might well be thought that there could not possibly be any lessons for us to learn from military psychiatry!

It is important to enumerate some of the outstanding differences. Military psychiatry deals with a population which is predominantly male, and whose age-range is from 17 to, say, 50 or 55. And a fair proportion of the grosser mental defectives and the more severe chronic neurotics have been weeded out by the civilian medical boards.

Among the special stresses of military life which are relevant to psychiatry may be mentioned lack of privacy, discomfort, a hustled and regimented life, boredom in leisure time, interruption of the chosen career, less congenial employment, and a mode of life which produces special strain in certain men with homosexual tendencies.

For the overseas soldier specially we must, of course, add to the list the tendency to "separation anxiety" and all the manifold stresses of battle. In this connection it is well to emphasize that, though the psychotherapists of 1914-18 bequeathed to us an important struggle more than half won and a valuable fund of understanding and experience, we found their concepts in a sense too simple for the purposes of this war and seemingly lopsided; human nature had not changed, but almost all the circumstances had!

Returning to our comparison between war-time military, and peace-time civilian, psychiatry, the next important difference to note is in the field of morale. In a force overseas the morale structure builds itself on clear-cut,

* Read at a Meeting of the S.E. Division of the R.M.P.A., at Graylingwell Hospital, Chichester, on May 2, 1946.

traditional, hierarchical lines, affording, for short-term purposes, great internal strength, resiliency in the face of communal misfortune, and considerable support to the individual officers and men who make up the force. If it were not for the "immunizing effect" in the psychiatric field of this well-braced morale structure, half the expeditionary force would become psychiatric casualties, or desert, however harsh the disciplinary regime might be; and the psychiatrist's job would be impossible.

The values and policy priorities, too, of war-time military psychiatry differ radically from those of peace-time civilian psychiatry. The short-term view is dominant. As Main has said, "If a sergeant can recover his poise for one month, it can be regarded as a satisfactory therapeutic result in an army fighting for its very life, though such a result would not be worth having in civilian life." The overriding objective of battle-winning subordinates the individual's interests completely to those of the army as a whole. The soldier's reaction to, and effect on, the group of which he forms a part becomes a matter of primary importance.

If we turn now to the question of the administrative powers and resources of the psychiatrist, the difference from the conditions of civilian psychiatry is still immense. A soldier who seems to be concealing a serious neurosis can be ordered to attend a military psychiatric out-patient department. A psychotic soldier can, without certification, be taken to a military psychiatric hospital against his will. A man who does not realize that his psychiatric symptoms are mostly due to unsuitable army employment can be instructed to go to a personnel selection centre for testing and interview, and can then be posted summarily to the sort of job for which he has been found to be naturally suited.

Moreover, if the patient's psychiatric problem is insoluble, or not soluble within the short time-limits which the Army sets itself, the military psychiatrist can always produce his "trump card"—discharge from the Army for medical reasons. Although with all psychotics, and with many neurotics who are unfit for service, the Army does its best to give adequate treatment on modern lines before discharge, it yet remains true that this "trump card" relieves the military psychiatric machine of many very difficult cases, which sooner or later fall to the lot of the unfortunate civilian psychiatrist.

One other great advantage the war-time military psychiatrist has over his peace-time civilian colleague; the general urgency of fighting a war, and, in particular, the stringencies of man-power, enable him to exert on the army administrators an effective influence in the direction of necessary administrative and policy reforms. But for this fact, it would not have been possible to get the army to introduce even a quarter of the innovations which, in fact, it did carry out during the War.

Random examples of this which might be quoted include the formation of special companies of the Pioneer Corps, the introduction of intelligence-testing at recruiting centres, the starting of personnel selection, and the institution of the General Service Corps recruit intake procedure.

My own psychiatry has been considerably influenced and modified by my time in the R.A.M.C.—not just in spite of the differences which we have been

discussing, but partly because of them. Standing back from one's painting for awhile, anyhow, often helps one to see one's picture with fresh eyes ; and a period of work in a different medium can be very stimulating.

Moreover, for all the differences that we have been considering, military psychiatry can point to certain general principles and trends which its experience has revealed or emphasized, and which may serve to enrich in a direct way the main stream of peace-time civilian psychiatry.

In an expeditionary force, as in the Army at home, neurosis as a problem quite overshadows psychosis. When I went out to North Africa in May, 1943, I learnt that this had been the finding there. The medical authorities had made no psychiatric plan for the landing in North Africa, and had sent out no psychiatric hospitals. Throughout the North African campaign there had been no psychiatric adviser at medical headquarters, and the specialist resources of the force amounted to two psychiatrists, with two general duty officers whose help they had enlisted. Of these two psychiatrists, one, Wishart, did valuable experimental work in the forward areas—but largely in the teeth of opposition from a high medical quarter. The other, Kenton, with opportunism, skill and immense industry, built up an unofficial rear psychiatric centre at Algiers, where he did his best under difficult conditions to get the psychotics handled suitably, and, in the treatment of the enormous numbers of neurosis cases, brilliantly employed narcotic, abreactive and psychotherapeutic techniques.

Unfortunately, his work was greatly hampered by two factors. The first of these was the fact that his patients took a long time to reach him. They travelled, without sedation, by slow stages along the winding valley routes from the front. In turn they were bullied, ignored, and mollycoddled ; only when they reached Kenton were they understood. Many of the cases, therefore, had become much more complicated, with emotional deterioration, fixation of their original symptoms, formation of new symptoms, and the development of much "secondary gain." Some of them regressed to states of hysterical stupor very difficult to distinguish from psychosis. It will be understood that the duty to which he returned three-quarters of his cases was usually not a fighting role.

The other disadvantage under which he laboured was that, owing to ignorance at headquarters and the lack of personnel selection facilities, most of his well-considered recommendations for changes of employment were never carried out.

Fortunately, when I arrived, as Psychiatric Adviser to Allied Headquarters, a personnel selection organizer arrived with me. Personnel selection centres were rapidly organized, and an efficient administrative procedure worked out ; in particular, a special routine was devised for "translating" the psychiatric disabilities of a down-graded man into a form understandable by a layman, and expressed in terms of limitations of his military employability.

Meanwhile, proper rear psychiatric centres were set up, more specialists were obtained, and the out-patient services organized.

By the time that the campaign in Italy was under way, we had built up a

pretty effective psychiatric organization. In the forward areas, regimental medical officers had been taught when to evacuate psychiatric cases, how to sedate them for their journey, and how to "label" them so as to ensure that they got to the corps psychiatrist at the corps exhaustion centre. At the corps exhaustion centre a third of the cases—those with a good quick prognosis—were held for a five-day period of simple treatment and then returned to their units, the remaining two-thirds of the cases being evacuated to the advance psychiatric centre in the Lines of Communication Area behind Army Headquarters.

Of these cases, a small minority were sent on almost at once to a rear psychiatric centre at Naples or Bari in the base area; this minority included all the psychotics, the gross psychopaths, and those neurosis cases likely to need to be sent home to England, or, at least, to require a long period of treatment. The remainder—rather more than half the total cases coming back from the forward area—were retained for treatment at the Advance Psychiatric Centre, our second treatment "level." They were given, on an average, ten days of specialized hospital treatment, followed by some weeks of rehabilitation at a re-allocation camp. There most of them, having been medically downgraded, were tested and interviewed by the personnel selection staff, with a view to their prompt nomination for new and non-combatant duties in the Lines of Communication Area.

For a long period this Advance Psychiatric Centre functioned at Assisi. The contrast between our clinical findings there, and our findings at Algiers during the North African campaign, was immense. Thanks to earlier evacuation, sedation for their journey, and contact with a psychiatrist (in the corps exhaustion centre) at an early stage, practically none of the patients were severely "regressed." The psychiatric syndromes they displayed were much milder and more "embryonic" in type; there was less fixation of symptoms, no new symptom formation, little general deterioration, and amazingly little "secondary gain." Continuous narcosis was less frequently needed, and abreaction much less often employed. Treatment was, in general, much less specialized.

I have described the psychiatric syndromes seen at the Advance Psychiatric Centre at Assisi as being more "embryonic." I mean that they were much simpler in psychopathological structure—and much more malleable by treatment. One seemed to be seeing in these patients the essence of the breakdown before there had been time, opportunity, or stimulus, for the nuclear disease-process to aggregate around itself the various specific psychopathological weaknesses of the individual soldier, and before there had formed the husk of "secondary gain."

All this gave us a wonderful therapeutic opportunity, and we tried to take full advantage of it. To ensure that, during his brief ten days in hospital, the Advance Psychiatric Centre patient would get something like real intensive treatment, and a sense that his case was being well understood and swiftly and skilfully handled, I allotted to this one hospital unit far more than its numerically fair share of the twenty-odd psychiatrists in Italy. On this firm medical basis was built up a dynamic hospital routine, the patients being kept busy

with physical training, games, competitions, and all kinds of recreation; they were also responsible for almost all the work of the hospital except treatment and nursing. Both in their work and in their play much use was made of a simple form of the "leaderless group" technique, the onus being thrown on to the patients themselves of choosing their leaders, of organizing themselves, and of seeking ways and means and supplies. At this Advance Psychiatric Centre hardly any occupational therapy in the ordinary sense was done. (With the psychotics at the rear psychiatric centres in the base area, the position was, of course, quite different.)

The response to this general therapeutic plan was quite remarkable. "Secondary gain" hardly developed in the patients at all, even towards the end of their time in hospital; and their original psychiatric symptoms responded very well to treatment in a high proportion of the cases. Very few, of course, were returned from this "level" to combatant duty; most of them were destined for fresh employment in the lines of communication area. But their degree of mental recovery and general spirits were remarkable, and augured well for their keenness and effectiveness in their new Army jobs.

The results, then, achieved at this advance psychiatric centre seemed to me quite remarkable, even allowing for the fact that the cases were arriving there in much better shape. On the other hand, the psychiatrists working at the hospital, though very able, and possessed of special experience of work of this kind, were not using any dramatically new methods in their handling of individual cases; they were using abreaction, prolonged narcosis, modified insulin, and a few psychiatric interviews for each patient. It was therefore clear that the immense superiority of the results over those achieved at Algiers must be due to something in the setting, general atmosphere, and routine of the place. This beneficent general atmosphere one sensed at once as one went round the hospital. There was a general feeling in the air of optimism, liveliness, activity, interest and helpfulness—of "team spirit" in the best and widest sense. The whole hospital seemed like one big family, embracing the medical officers, the nursing sisters, the nursing orderlies, and the patients; even the Italians who were employed about the place on various menial duties seemed to "belong." That this atmosphere should have grown to such a degree is a great tribute to Kenton and his colleagues.

They were, in fact, using group treatment. Now, group treatment in different hands has developed along very different lines. In their practice some workers emphasize exhortation, some the use of lectures about the patients' symptoms, and some social clubs; all these fall into the "repressive—inspirational—informative" class of the method.

At home, at Northfield Military Psychiatric Hospital, the trend of group treatment has been in the "dynamic—analytical" direction. There, as Torrie says, the therapist is passive and catalytic. The group lives, works, and abreacts as a family, and as a team. It displays a remarkable power of collective free association which eventually leads to a greater degree of insight. This particular method has been found immensely valuable in the handling of repatriated prisoners of war. The methods used at the Advance Psychiatric Centre at Assisi involved a mixture of both techniques.

This experiment at Assisi, though conducted, as we know, on psychiatric cases of a special type and in a special setting, may perhaps give us a few pointers for our civilian practice. Perhaps, even in civilian life, if we established a better understanding with general practitioners (and the increasingly important industrial medical officers), and made it easier for them to give patients contact with a psychiatrist at a really early stage of their breakdown, we should get our neurosis cases for treatment in a milder, less complicated, and much more malleable form. To achieve this, however, we must do a lot of spade work. In particular, some of us must go out into factories and offices to learn what they are really like—the special stresses and the early signs of breakdown. Army experience suggests that one of the most profitable types of case to look for will be the “willing horse” who is beginning to break down—the man (often a foreman) whose integrity and conscientiousness have made him in the past one of the mainstays of his workshop, but who, more recently, has displayed a gradual deterioration in his spirits, his temper, and his efficiency. Such a man, when he finally breaks down, breaks down badly, developing, say, an involuntional melancholia or a severe anxiety state.

Another type of case which is likely to repay well our, so to speak, going to look for him is the injured workman whose convalescent stage is going awry, and who stands in danger of developing a severe “compensation neurosis” with a general paranoid flavour.

In so far as the psychiatric organization in Italy was able to do an effective job, this depended, I am sure, in a considerable degree on the strict limitation of each of the three types (or “levels”) of psychiatric treatment unit (exhaustion centre, advanced psychiatric centre, and rear psychiatric centre) to a prognostically selected group of cases. This leads me to think that, in the different field of civilian psychiatry, specialization by the various psychiatric hospitals in a large centre of population may well be found to have overwhelming advantages—especially, of course, if we are seeking to create a strongly therapeutic group atmosphere. By the same token, I am not an enthusiast for psychiatric beds in general medical wards. One freely admits the advantages of easy consultation with surgeons and physicians, and the greater willingness of certain patients to come in; but, if we develop them on a large scale, we shall, I think, lose more by the unsuitable general hospital atmosphere than we gain in other ways.

When I turn my attention back to our experience in Italy during the war, and ponder the things which my colleagues and I learnt about the differential incidence of psychiatric casualties in different units, and about the general prophylaxis of psychiatric breakdown there—it at once becomes clear that in these fields, which are fields of morale, the group is again of primary importance.

Different front-line battalions, made up, apparently, of similar human material, and fighting under similar conditions, produced startling differences in their numbers of psychiatric breakdowns, and parallel differences in the frequency among their soldiers of petty disciplinary troubles—and of venereal disease. In almost every case of a contrast of this sort between two similar units we found, not a striking difference in the standard of physical fitness between the two lots of men, and not an obviously higher average degree of

psychiatric instability among the men in the more troublesome unit, but some, or all, of the following—poor leadership, poor team-spirit, and poor training in the past, with consequently a much less strong feeling of professional soldierly competence. To these were sometimes added a protracted experience of the passive role in warfare, or perhaps the recent memory of a sudden military disaster involving a large element of surprise.

As in the pathology, so in the prophylaxis of breakdown in all its forms, the positive factors of morale were of predominant importance. The negative use of discipline in the narrow sense could exert only a limited, and very short-term, effect.

When, in rare instances, individual officers tried to inculcate hate and blood-lust into their men, the attempts recoiled upon them, and the last state of morale was worse than the first. The effective ingredients of good morale were—a high state of real battle-training, good leadership, good comradeship, some acquaintance (however slight) with the objects and progress of the engagement, and some conviction (however vague) of the rightness of the Allied cause.

Lest I should seem to be painting the British soldier, who, after all, was once an ordinary civilian, as too reasonable a being, I hasten to admit that many of his mental mechanisms were quite irrational. Though he maintained for the Germans opposite him a considerable professional admiration and not a little affection, he had a most intemperate bitterness about all “base-wallahs” such as myself, and about all civilians at home (except his own relatives) and the continuous good time that they were allegedly having.

In the field of morale, and of certain topics allied to it, it is specially tempting to draw from military experience tentative lessons for the peace-time civilian situation. Psychiatrists and sociologists in this country have as yet hardly started on the study of peace-time civilian morale, whether in its more general and its more specialized aspects. In Italy we derived considerable assistance, in our studies of the morale of the troops, from the services of a trained Opinion Survey team, led by a sociologist. That technique is, of course, only one of many methods available to the modern investigator. It might be illuminating, and even useful practically, if a serious attempt were made to study with these methods the history of the miners of Great Britain during the last fifty years, and the complicated structure and origins of their present frame of mind.

Other possibilities spring to one's mind. Even if we do not contemplate large-scale personnel selection throughout industry, might it not be worth while, on the basis of all the experience and research of the War Office Selection Boards for Officers, to devise some method of selecting our industrial leaders, likely to be less lop-sided in its effect than the system which now obtains? Could not similar methods be applied in the Civil Service, in the teaching profession—and even in the choice of the psychiatrists of the future?

Under this same heading of morale many topics claim our attention. Why was the symptomatology of battle neurosis in this last war so different from that found in 1914-18? Was it a greater awareness, on the part of the doctors, of the importance of psychological factors, that made the incidence

of "D.A.H." or (as we now call it) "effort syndrome," less heavy? Why were hysterical campotocormias, paralyses, and anaesthesias less common among British soldiers this time? Was it because of a higher average level of general education, or a better understanding of physiology, or a wider recognition of the nature of neurosis, or the growth of a system of moral values less simple and clear-cut? Why, incidentally, in Italy, did the South Africans and Poles produce a higher incidence of crude hysterical syndromes than the British; and the Indians a lower proportion of frank anxiety states, but a higher incidence of functional deafness and of self-inflicted injuries?

Time does not permit me to examine all these problems in detail—and, if it did, you might not agree with my tentative interpretations. What I wish to emphasize at the moment is, that the issues raised by these war-time questions are probably relevant to civilian problems too.

There is another question which, in my opinion, merits careful study by the members of this Association. To what extent, and in what manner, should modern personnel selection methods, worked out so thoroughly in the general service recruit intake procedure and other routines of the Army, be employed for peace-time civilian purposes in Britain?

As I mentioned earlier in this paper we found ourselves compelled considerably to modify and extend the concepts of the aetiology of "shellshock," which we had inherited from the psychotherapists of the 1914-18 war. One thing, for instance, which they hardly mentioned is the importance in the aetiology of "shellshock" of dullness and backwardness. Feeble-minded soldiers never last long in the combat zone; and even those who are merely dull are very much more liable to battle neurosis, which in them often takes a crudely hysterical form. Fortunately few of them get to the front line now.

But, quite apart from the question of battle neurosis, the minor degrees of mental defect (backwardness, dullness, and feeble-mindedness) presented the Army in 1940 with a serious problem at home. Dull men had been uprooted from their civilian environment, where their relatives protected them and their employers and neighbours were sympathetic; they had been torn from the suitable peace-time jobs which they had with difficulty found and with difficulty learnt. In the Army they became bewildered and anxious, and less able than ever to cope with their difficulties. Some reacted by constant invalidism with minor physical ailments, some developed frank neurosis, and some, through repeated absences without leave, or other offences, found their way to the military prison. In addition, these dull men were much more liable than the average soldier to get scabies or a venereal disease.

After 1940 the situation was gradually brought under control. Three effective steps were taken in turn. First, Army medical boards had to be persuaded by psychiatrists that a low-grade feeble-minded man, however well-built physically, is of no use to a modern Army and should be discharged without further ado.

Secondly, special companies of the Pioneer Corps were formed, so that dullards might do simple garrison duty, and selected high-grade feeble-minded soldiers do manual labour without ever using firearms. These companies were a great success. The men worked well at their allotted tasks. They

became contented, self-respecting, and well-behaved; and the incidence among them of disciplinary troubles, neurosis, and sick parade attendance, fell dramatically.

Finally, in 1942, the general service recruit intake procedure was instituted, whereby every recruit during his first six weeks of training is tested, interviewed, and allotted a job really suitable for him. This system has prevented even slightly dull men from being assigned to work too difficult for them.

The Army's experience in this field gives us some useful pointers for the planning of the future attack on the vast and important problem of minor mental defect in this country. MacCalman, in an illuminating article in the *Practitioner* of July, 1942—an article to which not nearly enough attention has so far been given—stresses the enormous size of this problem (as compared with, say, that of imbecility and idiocy), stresses its immense social importance, and outlines the great opportunities it presents for an effective reduction of ill-health, delinquency, unemployment, and man-power wastage. Here, surely, is an aspect of social psychiatry to which the R.M.P.A. as a body might profitably devote its organized attention.

The experience of Army psychiatrists during the war has emphasized some administrative points which are very relevant at this time, when the National Health Service is being planned. Every Command psychiatrist, for instance, found it essential to have direct access to the D.D.M.S. of the Command, and to make frequent use of that right; even the most able consulting general physician or deputy director of hygiene was unable completely to grasp the psychiatric problems in all their complexity, or adequately to plan the optimum line of attack on them. Clearly, in the new Health Service, psychiatry must be adequately represented at the higher administrative levels.

In the end, of course, a doctor's enjoyment of working in a service depends, not only on his formal rights and the nature of the administrative set-up, but also, and at least equally, on his relations with his colleagues and the general "atmosphere" of the service. In this respect, to work in Army psychiatry was a great pleasure. All the psychiatrists worked together as a band of brothers, with a strong team spirit, great enthusiasm, and a justifiable pride in the considerable achievements of their very happy family. This, like so much else in Army psychiatry, and in British psychiatry generally, we owe to the friendliness, vision, energy, and infectious enthusiasm of J. R. Rees. I do not think that the full magnitude of his work for the R.A.M.C.—and for the national war effort—has been fully realized.

MENTAL DISORDER IN THE ADULT DEFECTIVE.*

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THIS paper deals with the presence of insanity and allied mental disorders only in so far as found in adult defectives. The subject of psychotic states in defectives during infancy and childhood seems to demand a separate treatment.

While there is no clear evidence that the defective mind is specially prone to display peculiarity, apart from simplicity, of behaviour it is, nevertheless, true that mental abnormality or disease may contribute appreciably to create conditions, e.g. social failure and intellectual dullness, which lead to certification under the Mental Deficiency Acts. In some of our admissions it is legitimate to question whether one is not dealing with unbalanced, rather than with subnormal minds. Others appear to represent the results of insidious psychotic, especially schizophrenic, illnesses, in short to be "dements" rather than "aments." Cases are not rare in our institutions in which it is clear that eccentricity and not weak-mindedness is the major factor in preventing a return to life in the community.

The certified institutions receive also their quota of patients who are, even in early life, already beginning to degenerate mentally, some of whom, e.g. epileptics, will, in the course of their decline, develop frankly psychotic states. The increasing tendency to certify under the M.D. Acts persons who are already well on in years is responsible for the admission of not a few demented and very odd folk. A domestic, who has shown an increasing failure to maintain herself and has become dependent upon her relatives, is certified to be defective for the first time at the age of 55. She is exceedingly simple and clouded in her judgment, garrulous, expansive and subject to states of anxiety. There is no record of defect having been noticed in early life, but there is a history of her mother having died in a mental hospital. A male epileptic, who has hitherto lived at home, becomes too burdensome for his relatives at the age of 40. On admission he is heavily demented and somewhat paranoid in his attitude. An ex-soldier remains outside on his disability pension and on casual labour until he is 44. Cases are transferred from mental hospitals where they have been already from ten to twenty years who retain more than a trace of their previous mental disorders. These demented and middle-aged admissions fit very badly into the ordinary life of the institution. They cannot benefit from its training facilities, they are unhappy, and they have an irritating effect on the general run of patients. There would be much advantage in making provision for their care otherwise than by sending them into a colony of young, active persons. The aim of this paper, however, is not to strike any controversial note, but rather to indicate that a problem does exist in our certified institutions of dealing with those who are at once of defective and of unsound mind.

* A paper read at the Autumn Meeting of the Northern and Midland Division of the R.M.P.A. held at York on October 26, 1945.

In the institution for defectives, schizophrenic personalities and behaviour traits are by no means uncommon. Some defectives of this type are recognizable on admission to be definitely peculiar ; in a number, who have already been some years in the colony, the condition is known to have developed insidiously. The defective, in the latter instance, increasingly fails to keep up with the ordinary institutional community life and becomes solitary, muddled, inefficient and strange in his manner. Attacks of grimacing and moping in corners, with difficulties of feeding, faulty and destructive habits, etc., may also occur, which cease after many months, leaving the patient demented.

The hall-marks of the schizophrenic group are emotional withdrawal and oddities of behaviour. It is sometimes very difficult to conjecture what the original intelligence might have been if the schizophrenic state had not supervened. It has probably affected every level of defect from the barely subnormal to the imbecile group. Schizophrenics are commonly mute and apathetic ; they may attend to themselves, and for the rest of the time remain inert and vacant ; they respond to advances with a smile and a muttered "yes." The less retarded ones can be taught to carry on the simpler processes of domestic cleaning, brush making, dish-cloth knitting, etc. They are usually slovenly, and regardless of their personal appearances. They mix passively with the other patients, of whom they are often the butts or dupes. It is not an easy matter to know where to place these patients, as their liability to phases of disorderly excitement, to impulsive striking out and to repeated absconding precludes them from being kept with the quieter or lower grade patients to whom they more naturally belong. Others are manneristic in various ways.

Sidney, aged 22, is quite a high-grade patient who goes out of his way to address one in an exaggeratedly affected and boisterous manner with much laughter. He soon becomes disconnected, jerky and embarrassed in his speech. He is really unsettled and anxious, and confesses that he never feels at ease with his fellow patients.

Marjorie, aged 28, who is very demented, remains with mouth pursed and frequently with limbs crossed and has constant bouts of vigorously rubbing her hair.

Edgar, aged 20, was one of the vacant "yes" men, who are profoundly anergic in normal ways. He had phases of persistently knocking his head on the walls, and had cracked many panes of glass in the process.

Spells of noisy excitement are not uncommon in these schizophrenic dements, and these may last at intervals for weeks. They are very characteristic of—

Marjorie ; her silence is replaced by loud chuckling and the monotonous repetition of short meaningless phrases. She radiates broad smiles but is, of course, as inaccessible as ever to attempts to get into touch with her. She is destructive to her clothing, etc., at such times.

The more chronic excitements tend to become unmanageable.

Doris, aged 27, who had been at home in a mentally debilitated state for several years, was fond of scribbling and of making grotesque drawings on books and on scraps of paper. She was also given to grimacing and to most mournful wailing, e.g. "I don't want to be here, etc." Worse still she had the habit of noisy bangings for long spells upon the walls and furniture (and occasionally upon any patients who happened to be near her.) She had raised prominent hard masses on her fists in the course of time, and was a great trial to the nerves and tempers of her fellow patients.

These patients in general live the dependent and unproductive lives of low-grade defectives and are sometimes difficult to distinguish from them. Pointers to the correct diagnosis are given by—

(1) the poor and unreal emotional responsiveness. Even the low-grade defective is usually more friendly.

Molly, for instance, welcomes a remark with a beaming smile, somewhat spoilt by the exaggeration of the downcast eyes and the facial rigidity. Her replies consist almost entirely of an echo of what is said to her ; she agrees to everything in an unqualified way and laughs immoderately.

(2) The mannerisms, stereotypies and mechanical excitements of the schizophrenic which indicate the working of morbid mental processes.

(3) Lastly, the psychotic frequently reveals at some time or another, if only through the most irrelevant of utterances, the remnants of a range of vocabulary or a conceptual expression which the defective has never had. Some break silence, in phrases of excitement, to express momentarily pertinent and even witty opinions, however inappropriate to their own situations, e.g. criticism or advice to others.

Some schizoid natures express their chief difficulties in adaptation in an extreme " touchiness " which far exceeds that of the mere extroverted, irascible patient, whose frequent complaint is that others are " leading her a life." I have found this condition almost exclusively confined to the female sex. It involves, even in the milder form, an ever-present tendency to be insulted or upset by others, to distrust and misinterpret almost everything said or done about them, and a thorough-going lack of humour. Some work out this disposition in a whole-hearted disbelief in the good faith of everybody ; others in frequent clashes with the environment, leading to impulsive destruction or scoldings. This condition may occur, too, in more obviously abnormal persons.

Ivy, aged 35, is a thin introverted, apprehensive-looking woman, whose whole life is a series of imagined slights and anticipated unfairnesses. But Ivy has also masochistic-erotic tendencies, which are barely repressed and which frequently control her. She is intensely jealous of other girls, whose rivalry she sees everywhere. She cannot detach her interests from the male patients. She has a curious compound of attachment and fear of her father. At times under the stress of fancied rebuff she becomes intensely depressed. She has nothing to live for and readily turns to thoughts of suicide. Her judgment, never strong, becomes clouded and paranoid. She has been " let down " by everyone ; slandered everywhere. Then she reactivates reminiscences or phantasies of cruelty and sexual ill-usage at the hands of her father in the past. She becomes acutely apprehensive of what he may do in the future. On occasion, with sedatives and persuasion, the mental upset subsides. More than once, however, the anxiety and suspicion has gained the mastery. Hallucinations have set in ; Ivy has heard her father's voice beneath her window and apprehended sexual assault. Suicidal semi-attempts (yet with a somewhat dramatic element of the string needle, etc., half concealed, half revealed) and threats to murder a supposedly hostile member of the staff have led to her certification under the Lunacy Acts.

Gladys, aged 37, when certified, has a more robust spirit. She has lived at home with a very eccentric mother until she wandered into a shop and stole something. On admission she believes that her " will is dead," that she is controlled by some outside agency through her feet, that her thoughts go " blank with a thud." During her stay in the Colony she is frigidly aloof ; her speech, never volunteered, is affected, brief and staccato. She is tidy, and an excellent woollen

worker. Yet her record is punctuated by violent explosions of temper in which, in a moment, she is turned into a human wild-cat, with a most obscene vocabulary. The attacks increase in frequency and, if possible, in intensity. She ceases her very limited co-operation, refuses to eat, is savagely resistive and is perforce certified under the Lunacy Acts.

Much the same story can be told of several others whose active resistance to the need for a minimum co-operation in the institutional regime and consequent dangerous outbursts eventually compelled their transfer to a mental hospital.

Not all schizoid types have the same melancholy story. Successful workers on daily licence, trustworthy parole patients, have developed out of rigid shut-in types, who have originally been stormy petrels and most difficult problems. The taciturnity, the distant manner and the shrinking from close contact remain. Such patients need, at all times, great tact in management and the avoidance of all unnecessary interference with their invincible reserves. They seem to experience in time an increased inner security. If never sociable "to all the rout" some form close single associations and develop relationships of good will and confidence, if not of demonstrative affection, with authority. The importance, as a means to the socialization of a patient of this type, of the timely provision of employment in which he or she can take a legitimate pride cannot be overestimated, though failure may occur, readily enough, at the onset.

Wandering in the shapes of either drifting aimlessly till something interesting is met with or escaping without plan of where to go is, of course, of common occurrence among restless and emotionally disturbed defectives. Some admissions to the institution are, however, already confirmed roamers.

Harry, aged 32, is a very simple type. Before certification he regularly wanders from his home and wife, and walks to Walsall, Coventry, etc., putting up in Poor Law and Salvation Hostels, etc. He cannot give reasons for this and is quite ready to admit that his wife has, as he puts it, to "live anyhow" in the meantime. Later he absconds from the institution and lives quite contentedly in a workhouse for some weeks without disclosing that he is an absconder.

Lilian, aged 24, is moody, irascible, grossly hypochondriacal and altogether difficult. She has already been found destitute on several occasions in Hampshire and other distant places.

A few very dreamy subjects apparently owed their wandering proclivities to all-engrossing phantasies.

Elsie, aged 26, a high-grade girl, has alarmed her mother greatly by repeatedly slipping out of the house in the late evening to walk, often for miles, without any fixed direction. She had been molested on one occasion. It transpired, however, from what she told us, that she was hearing the voices of male fellow-workers inviting her to parties. Later on, in the institution, they kept talking to her about marriage, so that she "could scream." In her early days with us she was entirely preoccupied with her inner experiences and, to avoid external distraction, hid behind doors and in deserted corridors. She was often observed to be muttering. It is still very difficult to get her attention so as to pay heed to what was said to her, and harder still for her to fashion a reply.

Joseph, aged 26, was mute and mechanical to a degree. He was entirely unconcerned over his arrival with us, asked no questions, volunteered no statements. Nevertheless the educational attainments were quite good. He had been previously stigmatized in certificate for "mind wandering, forgetfulness and no sense

of responsibility." The police had also much trouble with him as a wanderer who broke into unoccupied houses and left stolen goods behind in the next premises into which he intruded. He continued his exploits after admission to our Colony, and fifty miles away stole and left behind valuable property. He gave as a reason that he was looking for a camera worth £100 which, with the vaguest of details, he believed someone had left for him somewhere near Worcester.

It is of interest to note that Elsie and Joseph have lost most of their delusions, though remaining essentially solitary and absent-minded. They are, as it were, "in" but not "of" the Institutional Community.

Geoffrey, aged 16, combines a restless desire to wander about with an obsessive urge to play tricks, especially with telephones. He cannot resist a telephone, and loves to disguise his voice and to send false messages. Before certification he is in trouble for causing public mischief, sending calls of imaginary fires to the Fire Station. He plays many such pranks in the Colony. He frequently hides away and spends a whole night and day, until discovered, under the Institution stage. He swallows coins, etc., and repeatedly scratches open an abdominal scar. He is particularly tense and tremulous when he has done this. He has peculiar mannerisms, such as glancing from side to side apprehensively whenever he talks to one. He is extraordinarily jerky. He seems impelled to thrust himself suddenly into one's presence, but is most shy and awkward when he has done so. When an idea is in his head he must express it whenever he meets one, even if it amounts to half a dozen times in a morning. This is undoubtedly an obsessive state occurring in a very childish intelligence.

As an example of colourful eccentricity, again probably with an underlying schizoid disposition, is a woman in the forties, but of juvenile appearance and size, who is a daily reader of the papers and a worker of cross-word puzzles. Nevertheless she dresses (with the active co-operation of her relatives) in the fashion of a 10-year-old girl of at least a generation ago, with excessively short clothes, frills and socks. She has gathered around her a family of dolls, and plays with a large rubber ball. Her speech is lisping and plaintive. Persistently over the years she has refused contact with anyone over the rank of her ward charge nurse, and runs away when approached. She is difficult over her bath, and vigorously resists the periodic physical examination.

Diagnosis.—The difficulties in diagnosis depend largely upon the grade of the subject. The forms which insanity takes among the higher types resemble closely those found in non-defectives. Advanced schizophrenic admissions tend to present problems in diagnosis which are solved by recognition of the signs of the disease process, and the evidence which is given either by history or on examination of a higher degree of intelligence than appears to be the case at first sight. The certified institution also, like the outer world, contains many odd characters, psychopathic and borderline cases, upon whose sanity, or the reverse, it is not always easy to make up one's mind. The more prolonged behaviour disorders of unstable defectives occasionally furnish difficulties owing to such factors as the apparent senselessness of acts committed, extreme excitements or depressions or a temporary paranoid attitude. The characteristic exaggeration and make-belief of the defective, e.g. vivid suicidal threats, may also work in the same way.

With low-grade defectives schizophrenia must be considered when characteristic pictures of severe behaviour disorders are shown. Those patients are typically withdrawn and hostile in demeanour. They remain in corners, sometimes with their faces hidden in their hands or sit huddled upon the floor. They are often, but not all the time, resistive to attention. They are subject

to frequent periods of unprovoked excitement, with screaming, stamping, throwing over or breaking furniture, and are specially prone then to assault their fellow-patients. They may also abruptly interrupt their habitual quietude by walking up to and striking or kicking another, or show a certain shyness in doing this. They give the impression at times of watchfulness. When questioned upon their actions some hold the head down and grin, others pull angrily away. Little is said, but occasionally they make unfounded complaints that the patients that they have assaulted had abused or struck them first.

Where, in the course of time, a well-marked deterioration in behaviour has occurred, the evidence of the onset of mental illness becomes clearer. The previous adaptability becomes impaired or lost and is replaced by irrational and disorderly action. This change may be seen even in quite low-grade defectives.

William, though handicapped by a pronounced dysarthria, was once a Boy Scout in the institution and went on parole. He is now entirely asocial and very wild looking, constantly shouting in angry, unintelligible fashion. He also calls out obscenely and threateningly after passers-by, calls them Jews, doubles his fists at them, etc.

Where the evidences of a mind akin to ours are almost negligible, as in the restless and destructive idiot, the question of insanity being present can hardly arise. Indeed, in the very low imbecile, incapable of expressing in words the underlying motive forces, which we can but dimly grasp, the decision is hard to make with any confidence. If we diagnose insanity in a case of this type with marked behaviour disorders, it is on the grounds that his actions, even for his mental level, are abnormally perverse, excessive or discordant, and from the practical view-point anti-social and obnoxious. The persistent hyper-excitability, which is the main source of such severe abnormalities of conduct, springs, however, from an intrinsic personality defect and dates from birth.

From a survey of 39 cases which were actually certified under the Lunacy Acts in a space of seven years the following table is constructed. The diagnosis may not, of course, correspond with those affixed later in the mental hospital.

Epileptic insanity	7 cases.
Post-encephalitic insanity	3 "
Schizophrenic group	16 "
Manic-depressive	4 "
Melancholia	2 "
Presenile dementia	1 "
Psychopathic affective states	6 "

There was but a solitary recovery among the seven epileptic patients. This occurred in a feeble-minded woman, aged 36, who after severe physical stresses—pneumonia following upon a *status epilepticus*—developed an acute confusional (or toxic delirious) state. She was returned to us after six months and has not had a second attack. The other cases represented progressive deterioration into confused states with excitement and hostile tendencies,

leading to frequent outbursts of assault and destructiveness. The post-encephalitics were high-grade subjects, who displayed with increasing frequency uncontrollable rages resulting in savage assault, and in one case also in suicidal attempts.

Seven of the sixteen schizophrenics had remissions in mental hospital which allowed them to return to us after stays varying from a few months to more than two years. In three instances the patients were still very abnormal, though improved in behaviour. The other four made a fair adaptation to their institutional life and were able to go on accompanied leave, but were solitary and rather vacant. Relapses occurred later in five of the seven returned patients, and the sixth is very demented. Of the nine cases which did not return, seven were of very slow onset.

The schizophrenic illnesses were of varied but familiar type. They have many features of interest, but limitations of time prevent me from presenting the case-material which I have collected. This embraces catatonic stupors and excitements and a number of hallucinatory-delusional states, some of rapid, others of very slow onset.

Bertram, aged 19, a deserter from the Army, who presented no traits of mental illness on admission, on the eighth day became acutely excited, hearing the voice of God telling him "the whole world was upside down and that he (Bertram) was the Saviour." He attempted to get out of the windows at night to save the souls dying outside.

A buffoon syndrome was displayed by George, aged 18, in his third attack, whose excitement found vent in extraordinary clowning and exact mimicking of the speech and actions of his fellows.

MANIC-DEPRESSIVE STATES.

Two of the four cases were transferred to us from mental hospital, where they had been for many years.

Harold, now aged 32, a high-grade patient, who has never been under the Lunacy Acts, is the most interesting cyclothyme. Normally a model, a somewhat mechanical person, of the type which is seen but not heard, for many years he has had recurring attacks, when he is impelled by a pressure activity and an urge to assert himself into a restlessness and an extravagance of behaviour which is difficult to contend with and which may last for months.

PSYCHOPATHIC PERSONALITY DISORDERS.

Six women certified, in various stabs of affective illness or with persecutory ideas, appear to have been essentially severe psychopaths, though some had traits of schizophrenia also. The family history showed a record of insanity in four cases. One woman had already been for several years in a mental hospital, another at Borstal and Rampton. The record of—

Blodwen, aged 38, a married woman, is illuminating. Reported already to have attacked her husband and neglected her home, she had cast aside her responsibilities, moved to Birmingham and, under an assumed name, led an immoral life, from which resulted two illegitimate children, whom she had ill-treated.

A high range of fluctuation of mood, impulsiveness and uncontrollable emotional display marked the behaviour in these cases. They were all readily prone to active violence to a degree which surprised those who made their

acquaintanceship first in their quieter phases. More characteristic still was the tendency to prolonged moodiness, of days' or weeks' duration, quite unlike that of the ordinary unstable girl, who is always readily passing in and out of trouble. A protracted ill-humour had perhaps its origin in the mere transfer to the institution, as in Blodwen's case, the rejection of some request, an abortive escape, a disciplinary measure, a quarrel, etc., and continued to feed and augment itself upon any available pretext. The more aggressive types become rather elated at first. The poor mental stamina of the psychopath is responsible for the predominance of depressions. As might be expected, they go to extreme lengths to display this depression by refusals to eat, lurid threats or half attempts at suicide. Food is often surreptitiously taken and serious attempts at suicide are not common. Suspiciousness, hostility to their companions, ideas of reference may be features in the attack. They allege that they hear slanderous or threatening remarks made about them, as in the case of Agnes, who discovered that her dormitory was full of spies and even professed to fear for her life at night-time. Certification under the Lunacy Acts, which is by no means inevitable, is usually enforced by the risks they constitute to themselves or the dangers and discomforts to others. Clouding of judgment, extreme breakdown in behaviour or intense affective disturbances lend justification to this step. Nevertheless they are, at most, borderline insanities, for they retain some measure of control over their conduct, which they can disown or justify, by word or letter, in a very plausible way. A cure is sometimes dramatically affected by a timely alteration in the external conditions, such as a transfer from their existing surroundings. One woman with an I.Q. of 90 had a dreadful record of self-mutilation; another was given to compulsive outbreaks of great violence.

Psychopathic defectives reveal themselves to be "problem" patients, whether they are in or out of the institution, owing to their uncertain tempers, unreliability and weak ethical sentiments. They inevitably project the entire blame for their failures and misfortunes upon their environment.

Harry F—, aged 28, is a very high-grade type of presentable appearance, a ready and even witty speaker, who is also very useful with his hands, e.g. at carpentry. Inability to remain at any occupation for long, an almost manic mood and a fantastic attitude to reality are the main features of his make-up. He claims to be a man who can make money readily at whatever he turns his hand to. Electrical devices especially fascinate him. He has undertaken to execute electrical repairs in private houses without any expert knowledge, which might have led to serious consequences. When away from institutional control he moves rapidly from job to job between London and the Midlands, but cannot resist the temptation to gain money by illegal bye-ways, such as purloining and disposing of tools and other equipment from his work-place. He even hired a furnished flat and arranged to sell the entire furniture in the owner's absence. To unravel the thread of his adventures at such times constitutes a bewildering task. He has strong traits of mischievousness, especially where his favourite electrical appliances are concerned, dismantling them slyly. His accounts of his actions are delivered without hesitation, very plausible and almost complete fabrications. He is often aggrieved at the way in which, he alleges, the police and others have dealt with him; he never expresses any regrets for what he has done, and he seems to be incapable of experiencing any shame. He has his periods of depression, however, when he will say that he has nothing to live for and has staged short-lived hunger-strikes more than once.

INCIDENCE OF PSYCHOSIS.

4.4 per cent. of all admissions of sixteen years and over, during a sample span of six years, viz. October, 1937, to October, 1943, have since been certified under the Lunacy Acts. This figure will doubtless prove to be an underestimate of the ultimate load of certifiable psychosis for the period in question, owing to the long time which elapses in many cases before mental hospital treatment is sought. For example, admissions from October, 1937, to date have furnished only 54 per cent. of the total certifications, the remaining 46 per cent. being obtained from patients already in the institution in 1937.

PROGNOSIS.

The general outcome of these certified mental illnesses has been unfavourable, though naturally varying with this type of case. Uniformly bad in the degenerative states of slow occurrence, it has been more favourable with those of acute onset, and especially in the affective-reaction cases. Almost everywhere, however, the personality has remained unsound, and relapses in patients returned from mental hospital were common. Nevertheless, the prospects of, as well as the speed of, at least a temporary recovery are undoubtedly greatly helped by removal to mental hospital, with the change of environment and the hospital atmosphere, and surprising improvements are made in very unpromising cases.

DISCUSSION.

It would be helpful if we could discover whether the defective mind differed in any marked way from the normal in its tendency to severe mental breakdown, or if insanity took a different shape in the weak-minded. It may be held that the relative freedom from personal responsibility of the institutional defective provides a safeguard against mental stress. This is true to the additional extent also that the defective, wherever he is, learns to fall back upon his institution in times of trouble. Nevertheless, the Colony has its own problems of adaptation to be faced, its restraints and heart burnings. Moreover, the modern high-grade defective has his interests orientated in the outer world, from which he is only partly withdrawn and which he hopes to rejoin.

From the theoretical aspect the subnormal mind, with (1) its weaker grasp of logical thought and reality and consequent increased tendency to self-deception; (2) its impaired stamina to withstand toil, monotony, sudden shocks or prolonged strain of any sort, might appear easily prone to mental breakdown. Strong counter balancing factors exist, however, in (1) the readiness in which the defective can avoid the path of duty and banish thoughts of obligation from his mind; (2) the supreme optimism of his temperament, itself the product of intellectual shallowness, of an inveterate egotism and of an effective fickleness. With the defective the past can be said to be "truly dead and gone."

In actual fact the emotional life of the high-grade defective is probably more tempestuous than that of the ordinary man and woman, but the storms

seldom leave behind any permanent traces. The certified institution is a good place for the study of primitive reactions, crude hysterical demonstrations and the various shades of feigning. The emotional needs or advantages of the illnesses are seldom far below the surface. Deeper distresses are not infrequent and are, perhaps, never better met with than in the cases of patients whose licences have come abruptly and unceremoniously to grief, from one cause or another. Resentment, despondency, self-reproach, to an intense degree, may be present, often accompanied too by the shock of an unexpectedly sudden transfer back to the Institution. Many of these patients become unsettled for an appreciable period, and may regress to previous unsatisfactory modes of behaviour. Some are depressed and anxious; others develop what may be styled a spite neurosis against the institution. Their capacity to work, to enjoy themselves, and indeed their general adaptability is for the moment broken down. I have, however, never known insanity to result or a permanent change to occur in the personality. Sooner or later the defectives' buoyancy of temperament reasserts itself.

In only two of my instances of severe mental disorder, with the exception of the epileptic woman, could I attribute considerable significance to the effects of external factors. Both occurred in very simple-minded men.

Frederick, aged 40, is a high-grade imbecile, who has been since childhood in various institutions. He is a rather morose type, deaf in addition, who once severely lacerated his thighs with a razor blade in a fit of temper. A married sister takes charge of him on licence and he lives with her for 13 months. Quite happy at first, he gets good reports from his place of employment, as a builder's labourer. Then misunderstandings arise between him and his relatives, he has an unhappy secret association with a woman, and finally a severe attack of influenza. On his recovery he has become irritable and quarrelsome, so that he frightens his sister. He is overactive to the extent that he cannot rest, and even walked the road in his pyjamas at night. He proposes marriage to a nurse who is attending a minor accident to his fingers in an out-patient department of a hospital. He visits another hospital, but cannot state the reason and is detained on suspicion of mental disorder. Sent back to the institution, his excitement is very great. He talks incessantly in loud scolding tones; everyone has "let him down." He makes lurid threats of harming both his relatives and the institution staff. At the same time he harps on an impending marriage, but gives no details of to whom or where. He escapes, visits his home and strikes his sister, calls on his workplace and attacks a fellow employee. Certified under the Lunacy Acts, he has not returned.

Leslie was a normally sociable and cheerful daily licence worker who, through a prolonged incapacity resulting from a broken leg, was deprived of his employment and most of his outside pleasures for several months and became depressed, morose and resentful in consequence. A state of acute excitement followed, which produced a disorderly series of persecutory and expansive delusions. One morning he escaped out of a window and walked for miles on his crutches, alleging afterwards that he had overheard a remark made, "Let's finish him off." He appealed for his life to be spared. Later on he was sending verbal messages to a neighbouring airport, directing all Red bombers, of which he said he was in command, to attack Germany. His excitements and delusions left him after several weeks, but he is henceforth dull, unable to concentrate or to resume daily licence when his leg unites.

On our present evidence, therefore, it seems wiser to conclude that to whatever factors of heredity and of constitution are attributable the insanities of non-defectives, in the absence of any special exciting causes, must also be assigned those which develop in defectives. The strength of the hereditary

element may be gathered from the following table, constructed out of the very scanty information given of the family histories of our 38 psychotic defectives. (In the 39th instance no relatives could be traced.)

Insanity in father . . .	1
„ in mother . . .	4
„ in brother . . .	3
„ in grandparent . . .	3

—
11, i.e. 29% approx.

In the 28 non-epileptic and non-encephalitic patients the figure rises to 35.7 per cent. The percentage of familial insanity in the last 100 consecutive admissions was 6 per cent. (In arriving at these percentages I have, for the purpose of comparison, considered only hereditary insanity to the exclusion of factors such as family epilepsy, intemperance, deficiency, etc.)

In the sphere of personality, 4 of the 39 patients had already been in mental hospitals, and 6 others were noted as having traits of mental aberration when admitted.

This observation of certified insanity in institutional defectives failed to reveal any material respects in which it differed from that found in non-defectives, which is perhaps not surprising when the infinite variety of its display among the latter is considered. The predominance of schizophrenias is presumably due to the facility with which earlier or less obtrusive cases of this disorder-group pass under the M.D. Acts. In view of the high emotional lability of the defective the amount of manic-depressive psychosis appears to be small. Doubtless the constitutional factors necessary for the production of an endogenous cyclothymic illness are not the same as those which make up the ordinary unstable personality. Another reason is that many cases of recurring insanity are nursed in the institutions because they are naturally expected to recover in time.

THE PROBLEM OF TREATMENT.

The problem of the psychotic defective is not likely to diminish as long as the present heterogeneous mass of unadaptable elements continue to be admitted into the certified institution. It is obvious that a number of disguised or latent psychotics will always be caught in the net of the Mental Deficiency Acts. The different institutions will have their own ways of dealing with this class of patient, but it is probable that many receive no special attention until the mental state becomes such that it can no longer be ignored. It may well be that the delay in obtaining special treatment may affect the issue adversely in a number of cases.

The question has arisen, somewhat naturally, whether it would not be the soundest policy to keep these patients and treat them in their own institutions, to the relief of the already overburdened accommodation of the mental hospitals. Most of the certified institutions, as at present constituted and constructed,

are in a very inferior position to the mental hospitals for the treatment of psychotics. One could labour, if it were necessary, the facts of a staff unaccustomed to dealing with the insane, the very inadequate safeguards against suicidal or homicidal attempts, or the lack of provision for withholding the psychotic patient from contact with his sane fellows, whom he distresses or alarms. If insane defectives were to be treated in their own institutions it would mean the provision of a special annexe, equipped after the manner of a modern mental hospital, also a staff—medical and nursing—which has had mental hospital training. With the possibility that the physical therapy of the last ten years or more may be applied in a wider and more effective way to behaviour disorders, in general, it might seem advantageous to adopt this course. Nevertheless, there are also weighty arguments to the contrary. The training colony for defectives exists for its own special purposes, and any serious diversion of its activities to mental hospital work might well serve to lessen its efficiency. It is easy to foresee, also, a very disturbing effect on the general body of defectives and their relatives when they learned that they were associated with an institution which contained a substantial number of insane persons. Lastly, the M.D. Acts make clear provision, under Section 16, for the transfer of psychotic defectives to the mental hospital, and apparently the purpose of this clause of the Acts was that this class of patients ought not to remain in the certified institution.

Under existing conditions it is to be regretted that a closer association does not exist between the colonies for defectives and the mental hospitals to allow of mutual consultation upon the suitability of transfer of patients between the two types of institution. The guiding consideration for decision upon a patient who presented at once traits of deficiency and of mental disorder would be the possibility of benefit to be derived from special treatment in a mental hospital, and also whether he could, with safety, to himself or to others, be kept in the certified institution. It must be remembered that in many of these instances the degree of underlying intellectual deficiency is quite insufficient of itself to prevent the patient from living a normal life, perhaps with the aid of a certain amount of supervision, in the community. It is not, of course, necessary that every defective who shows traits of psychosis should be certified under the Lunacy Acts. As already indicated in the earlier parts of this paper the colony retains many chronic schizophrenics and other demented, and also cases of recurrent affective breakdown, severe psychopathics, etc. An example of this desirable co-operation was shown some years ago in one of our cases in which a young woman was admitted to the mental hospital as a voluntary patient to have treatment and was returned to us in an improved state after six months. It would be interesting to know if there were other instances in which a certified defective was able to make use of the provisions for voluntary treatment contained in the Act of 1930.

SUMMARY.

The liability to the admission of abnormal personalities to institutions for defectives is indicated.

Schizophrenic and allied types are described.

A survey is made of the varieties of insanity exhibited by 39 patients certified under the Mental Treatment Acts. The relative frequency and the prognosis of insanity are discussed.

The causal factors of mental breakdown in the defective are debated.

The problem of treatment is dealt with.

I wish to express my thanks to Dr. H. Frieze Stephens, Medical Superintendent of Coleshill Hall Certified Institution, Birmingham, for much helpful encouragement and advice upon this paper and for granting permission to publish the case material.

QUAKER CONTRIBUTION TO PSYCHIATRIC THOUGHT AND PRACTICE.*

By GWENDOLINE D. KNIGHT, M.R.C.S., L.R.C.P., D.P.M.,

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THE Retreat is now 150 years old. Some of you, perhaps, come from hospitals older still. Bethlem, looking back over 5½ centuries, might well wonder, "Why such a fuss about a mere 150?" But it is quite a respectable age, and all old people are fond of reminiscing, so will you indulgently allow this elderly gentleman, through me, to talk for a few minutes about his past life and his old friends, and will you forgive him if he seems to emphasize the triumphs, and gloss over the difficulties and failures? It has all been said before, we know, but we hope you will find something of interest in it.

If you had paid a visit to The Retreat say 145 years ago, what would you have found? The same square central building and front door, with a wing on either side, looking, except for the rows of small-paned windows, like the country house of a private individual not fond of pomp and luxury. At one end were low farm buildings; in front was a flower and vegetable garden, divided by shrubberies into secluded walks, and "defended from the road by a neat common hedge." Just inside the hedge was a row of beech saplings planted by William Tuke himself, and now as you can see to-day, grown to fine trees, which give us pleasure all the year round.

Within you would have found an air of cleanliness and simplicity, almost of severity, for though the building was planned to avoid any appearance of gloom, there were no carpets on the stone floors and stairs, and no unnecessary furniture, and, in accordance with Quaker custom, colours were subdued, and there were no pictures on the walls.

Very likely William Tuke, the founder, would be there to meet you; for it was his habit to spend part of each day at The Retreat. At this time he was about 70 years old, rather under middle height, erect and portly, his countenance and bearing that of a man accustomed to act as well as to plan, and not easily daunted by opposition or the doubts of others. He would be wearing the plain sober clothes and broad hat favoured by Quakers of those days—a great contrast to you, his visitors, in your bright blue or green cut-away coats with brass buttons, gleaming top boots, elaborately folded neck cloths, and curled hair. You would perhaps be a little taken aback at first to be addressed in the "thee and thou" style of speech, and to notice that he did not remove his hat to greet you, but you would remember that these were the usual manners of the Quakers at that time.

William Tuke would introduce you to the Superintendents, George Jepson and Katharine Allen, and perhaps to Dr. Thomas Fowler, the visiting physician. Dr. Fowler gave his name to the preparation "Fowler's solution," and the managers of The Retreat were fortunate to obtain his services in those early years. He was a remarkable man, and worked in the true scientific spirit,

* A Paper read at the Quarterly Meeting of the R.M.P.A. held at The Retreat, York, on May 17, 1946.

ready to give a fair trial to remedies recommended to him, and recording the results, failures and successes alike, without bias. We still have the book in which the earliest case-notes were made, starting in 6th month, 1796, with the first admission. The records are rather sketchy, we should think nowadays. They give only a brief descriptive admission note and a word or two of the history. Subsequent entries were apparently only made when the patient was discharged, or readmitted, or died. There are a few phrases which convey very familiar pictures—one patient, readmitted after a relapse, is described as "very high and flighty," and another as "haughty and censorious." It is interesting to notice references to "nurses" even as early as 1796, especially when we remember that "keeper" was the word in common use until a much later date.

I have not been able to find out who wrote the case-records—very likely William Tuke at first, and later George Jepson.

George Jepson would express great willingness to show you all over the building, for it was the policy of the managers to welcome professional men and others interested in the work. They believed that "the interests of humanity and science alike call upon us to communicate freely the discoveries we make or the failures which happen to us, in a pursuit so intimately connected with the happiness of our species." Sometimes arrangements were made for medical men to reside in the house for a time to study more closely the methods used and the results obtained. Thus, at an early date, The Retreat could claim to be a teaching hospital, and during its first few years it was visited by distinguished men from all parts of the British Isles, from Switzerland, France, Russia, Italy, and America. They came prepared to scoff, remained to be convinced, and went home to report on what they had seen, and thus to build up a new attitude towards the treatment of the insane.

It would not take long to walk all round the building, for there were still only 40 patients, but no doubt there would be plenty to arouse your interested comment and question. You would be accustomed to see, in other hospitals, many patients in chains, manacled, or locked by the leg to their wooden bedsteads, sometimes having remained in the same chains for years—sometimes lying on filthy straw, naked, or covered by one blanket, in evil-smelling cells or long gloomy galleries. At The Retreat you would be surprised, and perhaps horrified, to find no dungeons or chains of any kind, and instead of dirty, half-naked creatures shrieking imprecations at you or begging to be freed from their miserable surroundings, you would have found a comparatively orderly scene. Those who were violent were separated from the more tranquil, and methods of mechanical restraint were only very seldom used. Nearly all were fully clothed, and many were occupied writing or sewing, or reading books and newspapers. As one visitor about this time wrote: "A person coming in without being apprised beforehand would believe himself at first among persons of sound mind, so complete is the decorum and tranquillity which the Matron knows how to preserve. Everything in the house breathes the same simplicity, cordiality, order, and quietness which reigns in private families." You would notice that the attendants spoke to the patients in gentle, rather quiet tones. You might have suggested that they were taking grave risks in mixing so

freely with the patients when so much freedom was allowed, and questioned whether order could be sufficiently maintained where corporal punishment was not allowed and threats could have no meaning. We have been taught, you would say, that only by a show of power can patients be subdued ; and some are so furious and so malevolently disposed that it is absolutely necessary, for the sake of safety, to confine them most rigorously.

William Tuke would explain that he and other Friends first planned The Retreat in the firm conviction that cruel and harsh methods were always wrong and contrary to Christian teaching. He would express himself something like this : " Though the principle of fear, when moderately and judiciously excited by the operation of just and equal laws, has a salutary effect upon society, when it becomes the chief motive of action it certainly tends to contract the understanding, to weaken the benevolent affections and to debase the mind. In our opinion the general treatment of the insane has been too frequently calculated to depress and degrade rather than to awaken the slumbering reason or correct its wild hallucination. Wise kindness, on the other hand, has a far stronger influence on all sorts and conditions of men than has been usually recognized, and we believed we should find many insane persons capable of rational and honourable inducements. We therefore determined to make every endeavour to win the respect and, if possible, the affection and gratitude of the patients, convinced that their desire to retain our esteem would prove a more powerful motive for self restraint than fear of punishment. These principles, faithfully carried out, have been followed by none of the disasters prophesied, but by results so encouraging that we can now speak with the authority of experience as well as the voice of faith, and echo the words of Dr. Haslam of Bethlem, ' I can truly declare that by gentleness of manner and kindness of treatment I have seldom failed to obtain the confidence and conciliate the esteem of insane persons ; and have succeeded by those means in procuring from them respect and obedience.' "

Nowadays " occupation therapy " and " rehabilitation " are well worn phrases in our ears and everyone recognizes their importance, but George Jepson was making discoveries when he encouraged his patients in all kinds of innocent recreations and pastimes, because he had found that " of all the modes by which the patients might be induced to restrain themselves, regular employment was perhaps the most efficacious," and we can see the beginnings of rehabilitation in his attempts to find, whenever possible, a useful occupation for his patients, so that each could feel he had to some extent earned his place in the family. His wife, too, used to hold tea parties attended by patients and by visitors from York, and was gratified to find that as a general rule the patients behaved with politeness and propriety.

Some of the patients were allowed to go into the city and the neighbouring countryside. In order to compensate the less orderly patients for their narrower confinement, the airing courts were each supplied with a number of animals, such as rabbits, seagulls, hawks and poultry, and Samuel Tuke says, " These creatures are generally very familiar with the patients ; and it is believed that they are not only the means of innocent pleasure, but that the intercourse with them sometimes tends to awaken the social and benevolent feelings. "

At this date, about 1801, you probably would not meet Samuel Tuke because he was still a very young man and was engaged in the family tea business in York. A pity to miss him, because he was the most interesting of all the family. He was a grandson of William Tuke and was closely associated with The Retreat all his life, but it was not his only interest. He worked hard, too, for education and public health, and the abolition of slavery. He will, however, certainly be remembered as the author of the famous *Description of The Retreat*, which he wrote when he was 28. This book is a straightforward account of the origin of The Retreat and the first few years of its history, but it is packed with shrewd observations and comments. It is beautifully written, and a joy and inspiration to read to-day. It reveals Samuel Tuke as a widely read man with great natural insight; generous, far seeing, and extremely practical. We know from other sources that he was energetic, resourceful and bold. It was said of him that "in his bearing towards patients there was a union of tenderness and power well calculated to restrain the actions of the excited as well as to cheer the melancholy."

From his *Description* and from the reports which were published every year from 1797 onwards, we see that those old Quakers were not just idealists whose benevolent project accidentally turned out well. They were exceedingly business-like and efficient. They were not blind to the frailties of human nature, and as a precaution against possible abuses they drew up detailed rules for the management of the establishment. Regular visitors were provided for, all accounts and records were meticulously kept and inspected, and the numbers of admissions, discharges and deaths were published each year.

The choice of suitable persons to serve the establishment, and particularly of male and female superintendents, was recognized as being a matter of the greatest importance.

It was realized that "Whate'er is best administered, is best," and that however perfect a plan, its excellence depends on those who put it into practice. William Tuke and his friends planned to build a family, a "retired habitation," where each patient could feel secure; they knew that the only firm foundations were warm personal relationships. I think it was this conception which was their greatest contribution to psychiatry. The harsh usages would in any case soon have given place to milder methods—but the fundamental importance of personal relationships is only now beginning to be understood. Modern psychology expresses itself in more complicated terms, but the aim is really the same—to enable the patient to feel at one with the world and at home in it—to help him to become an accepted, esteemed member, first of his own little family circle, finally of the Family of the whole creation. The recognition that, with such an end in view, responsibility is shared by all members of the staff perhaps accounts for the "atmosphere of The Retreat," which, though it ebbs and flows, is still frequently commented upon and which we think is worth cherishing.

Samuel Tuke emphasized the need for teaching and training the nurses as to the methods they should employ, and for reminding them that their patients are really under the influence of a disease, and cannot be blamed for their actions, however unpleasant and vindictive they may be. He wisely says,

“ There is much analogy between the judicious treatment of children and of insane persons. Locke has observed that ‘ The great secret of education lies in finding the way to keep the child’s spirit easy, active and free ; and yet, at the same time, to restrain him from many things he has a mind to, and to draw him to things which are uneasy to him.’ It is highly desirable that attendants on the insane should possess this influence over their minds ; but it will never be obtained by austerity and rigour ; nor will assumed consequence and airs of importance be generally more successful. . . . I have observed that the most successful managers of the insane have been those who were the most humble and unselfish.”

And again : “ The attendant on the insane ought sedulously to endeavour to gain their confidence and esteem ; to arrest their attention, and to fix it on objects opposite to their illusions ; and to call into action, as much as possible, every remaining power and principle of the mind ; and to remember that, in the wreck of the intellect, the affections not infrequently survive.”

Samuel Tuke had a high standard, and knew he was asking a great deal. No doubt they had their difficulties with staff, even a hundred and fifty years ago, and thinking of some of the letters of resignation received from nurses from time to time, one feels a pang of sympathy with William Tuke when he records the minute in 4th month, 1797 : “ Jane King the housekeeper finding her spirits often unequal to the situation, and being desirous of leaving the House, it was agreed to leave her at her liberty.”

The appearance of the *Description of The Retreat* in 1813 was followed by an acrimonious correspondence in York newspapers concerning the conditions at the York Lunatic Asylum. Doubts and surmises arose in the public mind, and eventually the reform of this asylum, long overdue, was achieved. By this time the general concern reached Parliament itself, and in 1815 a Royal Commission heard detailed evidence as to conditions in hospitals and private houses for the care of the insane. It was clearly shown that in many ways things were very bad indeed. Legislation was urgently needed, but, as you know, nothing very substantial was achieved until the passing of the Acts of 1845, which have been called the Magna Charta of the liberties of the insane. Many names must be honourably remembered in connection with this long struggle, but I think the Retreat Quakers earned the right to be regarded as among the pioneers.

In later years much of the work of The Retreat has been done by people outside the Society of Friends, and the percentage of Friends among new patients is small ; but the Quaker Committee continues to stand behind all, guiding, serving, striving to preserve the pioneering outlook and the family spirit which were the essential features of the earliest days.

And here I must mention one of these more recent names, that of Dr. Bedford Pierce, perhaps the most greatly loved of all the Retreat servants. He was another who knew the value of good nursing, and worked constantly to raise the standard both at The Retreat and at other mental hospitals.

Let us glance back again for a brief moment at those early days. Why should it have been a Quaker institution which so powerfully influenced this branch of social medicine ? Many people were uneasy about the harsh methods

in general use, but it was left to Quakers to "demonstrate beyond contradiction" the great advantage of milder modes of treatment.

I can make one or two suggestions :

Firstly, Quakers by their religious scruples were cut off from many of the occupations and pastimes of the day. They did not own large estates whose management took up all their time ; they did not try to accumulate vast fortunes ; they were for many years excluded from public office and from the Universities. They did not dance, drink or gamble. So they had time to read and think, and to observe the world about them. Their interest in the natural sciences was strong and their pursuit of truth single-minded. It is significant that there were many Quaker physicians and scientists.

Quakerism began about 1650, and for the first 40 or 50 years it was a persecuted religion. William Tuke's great grandfather, like so many of his generation, suffered imprisonment for conscience' sake—such a heredity must have encouraged the independent and undaunted spirit that need not wait for popular support, and does not regard safety as the first essential.

Most important of all, their religious revelation was recent and vivid ; their spiritual experience personal, and a powerfully urgent spur to a new way of life. They had a burning sense of the value of each and every individual soul, so they concerned themselves with people, with those usually considered unimportant or worthless—children, slaves, prisoners, and lunatics. They esteemed it a religious duty to seek and to cherish all that was good, useful and rational in their fellows—to "walk cheerfully over the world, answering that of God in every man."

I should like to quote some sentences from the first printed announcement about The Retreat, believing that the spirit that prompted them is still alive to-day :

"Those who have embarked in this undertaking have not been influenced by interested views, nor are they requesting or desiring any favours for themselves. A malady, in many instances the most deplorable that human nature is subject to, hath excited their sympathy and attention ; and they invite such Friends as approve of their design, to co-operate with them in an Establishment which hath for its object, the mitigation of misery, and the restoration of those, who are lost to civil and religious society : in the prosecution whereof, they humbly rely on the favour of Him whose tender mercies are over all his works."

And to end, here are some appropriate words of Samuel Tuke :

"I am, however, far from imagining that this Asylum is a perfect model for others either in regard to construction or management. If several improvements have been successfully introduced, it is probable that many others remain unattempted. The managers will not, I trust, allow the approbation they have received, to induce a relaxation of their future endeavours, to combine, in a still greater degree, the comfort with the security of the insane ; but on the contrary they will be stimulated by it to further exertions, and proceed, in some degree upon the maxim, that nothing has been done whilst anything remains to be done."

INTRACRANIAL ANEURYSM WITH MINIMAL SIGNS.

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[Received May 10, 1946.]

INTRACRANIAL aneurysms are not uncommon, but those that are described are usually interesting because of the signs and symptoms associated with them. Aneurysms which have had evident leakages and yet, owing to their lack of neurological signs, are diagnosed from their symptoms as neurasthenia, effort syndrome or even malingering are fortunately rare. Correct diagnosis is important in these cases because of their medico-legal importance.

I propose to describe such a case in this paper, with observations on the pathology and the diagnostic problems. The patient was a man forty-eight years of age, who had the following relevant points in his history :

1. Complete health up to the war of 1914-18.
2. 1917: Shell burst near him. Knocked out. No wounds. Taken prisoner.
3. 1919: Awarded 20 per cent. pension for neurasthenia, when he complained of head pains, giddiness, tiredness and slight deafness. Appetite and sleep good.
4. Worked as jobbing gardener, with frequent spells of unemployment due to headaches and tiredness. Considered by neighbours to be lazy and full of hysterical pains.
5. 1942: Made to attend Psychiatric Clinics. Clinics could find no neurological signs. Normal blood pressure. Diagnosed as neurasthenia.
6. Carried on with light jobs until he had a fainting attack September, 1945. Noticed by relatives to have slight loss of power in legs and to be rather depressed. Complained that headaches were worse.
7. Admitted Sept. 22, 1945, to this Hospital as a voluntary patient. On examination, slightly depressed and complaining of head and upper back pains. Appetite and sleep good. Neurological examination negative except for slight irregularity of right pupil. Reaction of pupils to L and A normal. Fundi and fields normal. No changes in body reflexes. No sensory changes. Temperature, pulse and sedimentation rate normal. Owing to a suspicion of some brain lesion, due to slight loss of muscular tone in the limbs of the left side, a lumbar puncture was performed and the fluid was found to be at a pressure of over 400 (mm. of water) and containing much blood. Pressure came down to 290 after the tap.
8. Headache and giddiness cleared up and patient was much improved. Electroencephalographic examination revealed no abnormal tracings.
9. Oct. 10, 1945: Collapsed. Unconscious for 10 minutes. Polyuria and glycosuria. Temporary loss of memory. No gross neurological signs. Pulse 100. Lumbar puncture fluid contained blood, increased proteins and a pressure of 290.

10. Improved, but on Oct. 14, 1945, became suddenly unconscious and cyanosed. Normal reflexes, equal pupils, good pulse. Spasticity followed by flaccidity. Death in one hour from respiratory failure.

PATHOLOGICAL FINDINGS.

(a) Body—*nil* of interest. No congenital abnormalities such as cutaneous naevi, coarctation of aorta or polycystic kidneys. Some of these abnormalities are occasionally found in association with congenital aneurysms (Foster, 1943).

(b) Brain: The photographs show the condition of the brain well. One notices the partial destruction of the right frontal cortex, and the circular clots which were of varying hardness and age. The aneurysm, which was at the junction of the anterior communicating artery and the anterior cerebral artery, was of the congenital type. The ventricular clot from the final haemorrhage is also seen. It is surprising that neurological evidence of such damage was so slight.

DISCUSSION.

There are several interesting points in the history and diagnosis of this case. The story of shock from a near shell-burst, coinciding with the onset of symptoms, leads us to ask whether the aneurysm was disturbed so as to start leaking. Were other and parallel brain injuries caused by the blast, injuries which could give rise to post-concussional or traumatic neurotic syndromes? Did a war accident shorten life?—an important question in considering pension claims. His records show that his blood-pressure was normal at all times. It is known that blast can cause intracerebral haematomas without injuring the skull (Grunnagle, 1946). From the point of view of the differential diagnosis of this case before the final haemorrhage one would have to think of, among other things, neurasthenia, post-concussion syndrome, chronic haematoma and hydroma of subdural type, and consider C.S.F., X-ray and electroencephalographic evidence.

Taking an average description of neurasthenia such as found in the work of Wechsler (1939), we find the chief symptoms described as abnormal fatigability, exaggerated irritability, muscular weakness, depression, headache, dizziness, labile blood-pressure and sexual disabilities. The case under description by no means fitted in with all these symptoms. Careful inquiry revealed no sex disabilities, and the blood-pressure was stable and normal. The patient's main complaints were headaches and tiredness.

A description by Strauss (1934 and 1937) gives us an idea of the symptoms of post-concussion syndrome. He describes paroxysmal and positional headaches, dizziness, fatigability, emotional upsets, vasomotor irritability, and often vestibular-cerebellar and motor and sensory objective signs. Occasional encephalographic changes are also found. These symptoms again do not fit our case.

In cases of possible head injury we must consider chronic subdural haematoma, which can often be caused by mild injury (Putnam and Cushing, 1925; Grant, 1935). In our case we did not find the drowsiness, nausea, vomiting, confusion, paresis, pupil changes and bradycardia so often associated with

haematoma. Peet (1940) states that he has never seen either a deeply xanthochromic or bloody spinal fluid in a case of chronic subdural haematoma. Subdural hydroma due to C.S.F. in the subdural space has usually milder symptoms, but mental confusion is common and occasionally paretic signs are observed. Headaches are the chief complaint. Unilateral or bilateral Babinski signs are fairly common. The C.S.F. is usually normal but for occasional elevation of pressure.

We thus see that the case described in this paper does not have all the manifestations associated with the above syndromes.

The sudden death of the patient prevented X-ray photographs of the skull being taken. X-rays of the brain were taken after death and not a trace of calcium could be seen, so X-rays would not have helped. It must be remembered that calcium shadows suggestive of aneurysm can be caused by a tumour. On such evidence a tumour has been diagnosed as aneurysm and the carotids ligated (Grimberg, 1939). Arteriographic and encephalographic methods were not tried in this case. An electroencephalographic recording from our case did not show any abnormality. Occasionally lateralization can be obtained by EEG methods, especially with subarachnoid haemorrhage (Woodhall, 1943).

As stated, neurological signs were scarce in our case, even during the last haemorrhage. The only sign which gave a clue was the weakness on the left side, contralateral to the lesion, as was afterwards seen, and a slight ipsilateral pupil irregularity. It has been known for an aneurysm to give ipsilateral signs (Morre, 1941), especially with an intradural haematoma bringing into play the mechanism of hippocampal herniation (Sherman, 1942). Bilateral aneurysms can cause confusion, although these are often associated with tendinous areflexia and sometimes prefrontal syndromes with somnolence (Thompson, 1944). Although neurological manifestations are often confusing, before a case can be dismissed as being neurasthenia or malingering, the slightest neurological changes must be looked for and carefully considered.

We consider finally the C.S.F., which must be studied in any case of doubt. Blood in the C.S.F. (excluding bloody tap) means that there is haemorrhage from some part of the brain or cord, but of course not necessarily from a leaking aneurysm. For instance the first sign of a symptomless glioma may be cerebral haemorrhage with effused blood yielded by lumbar puncture. Still, there are many instances where an exact diagnosis of ruptured aneurysm of the circle of Willis can be made during the lifetime of the patient (Symonds, 1923). This case serves to show the importance of minute neurological study and examination of the C.S.F. in cases of long-standing headache syndromes, which can easily be misdiagnosed, often with medico-legal repercussions.

SUMMARY.

A case of intracerebral aneurysm with minimal neurological signs diagnosed as neurasthenia is described, with notes on the pathology and differential diagnosis. The importance of full neurological examination and especially of lumbar puncture is stressed.



FIG. 1.—Right hemisphere showing circular clots which were of different age and hardness.



FIG. 2.—Aneurysm dissected out. The ventricular clot is also seen.

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A STUDY OF PSYCHIATRIC ILLNESS IN COAL MINERS.

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IN recent years the mining industry as well as the miner himself have to an increasing extent become subjects for public discussion. In addition to problems of mechanization and industrial organization, the importance of the human element has found growing recognition, and an investigation into psychiatric disorders occurring in miners should form a useful contribution in this field.

The case material for this study consists of men employed in underground work in the mining industry who were treated at the Jordanburn Nerve Hospital, and a total of 100 cases is reviewed: 86 in-patients and 14 out-patients, 32 of whom have been under the writer's personal care. Many more miners were examined, but cases were included in this study only if they had been adequately investigated; even so, it is not easy to obtain sufficient information for a just assessment of cases when questions of attitude, morale or financial motive are involved. Two groups of psychiatric patients are inadequately represented: chronic and unco-operative psychotics are not as a rule treated at this department of the Royal Edinburgh Hospital for Mental and Nervous Disorders, and mild psychoneurotic and psychosomatic cases are as yet rarely referred to the psychiatrist by the practitioner. Halliday (1938) found that it was just these latter types of psychiatric disorder that accounted for a large percentage of disabling illness in the insured population, and that they were particularly prevalent among miners.

Diagnostically, the patients are distributed among the following syndromes: anxious-depressive psychoneurosis (30 patients); depressive psychosis (18); persistent psychoneurosis, including psychopaths (14); organic psychiatric syndrome (12); schizophrenic psychosis (11); conversion hysteria (10); physical disease accompanied by psychiatric symptoms (5).

EARLIER INVESTIGATIONS.

In view of the dangerous nature of underground work, the question naturally arises as to whether miners are particularly prone to psychiatric breakdowns. This question can only be answered by comparing the incidence of psychiatric disorders in miners with that of other members in the insured population. Eliot Dickson (1936), a practitioner with a lifelong experience of the "morbid miner," was struck by the growing incidence of so-called neurasthenia as well as of peptic ulceration. He wondered if the explanation might not lie in the increasing mechanization of the industry, which reduced the miner to a mere shoveller of coal from the coal face on to mechanical conveyors, and he thought that the increase of neurotic illness was due to lack of mental adaptation on

the part of the miners to these new conditions. But when the Report on Incapacitating Sickness in the Insured Population of Scotland for the year July, 1933 to June, 1934 appeared, which contained for the first and, unfortunately, only time a detailed analysis of morbidity in mine workers, it became clear to him that this increasing incidence of nervous illness affected the total working population. At the same time, this Report, as well as the ones that have appeared since then, showed that there was a far higher incidence of incapacitating sickness among miners than in all the other occupational groups. For the years 1930-33 there were 405 cases per 1,000 miners, and only 190 cases per 1,000 males of the total insured population of Scotland, yielding a ratio of 2.2. Inflammatory skin conditions and incapacity due to accidents were mainly responsible for this large morbidity in miners; but if, in addition to neurasthenia and nervous debility, conditions certified as tachycardia, D.A.H., undefined debility, gastritis and peptic ulceration were included to form a psychosomatic group, it was found that the incidence of these illnesses together was almost twice that in all other male insured workers (ratio: 1.8).

This is also the opinion of Halliday (1943), who approached the subject from eight years' experience as a medical referee under the National Health Insurance Act. In his view, the most frequent syndrome was one in which hysterical symptoms occurred in a setting of anxiety. Examinations of individual miners suggested to him that there had been a chronic state of tension owing to constant stimulation of the fear mechanism. He found that important etiological factors lay in the local working conditions, the effect of accidents, conscious fears, and especially unconscious or at least unacknowledged fears, as shown by the frequent admission of anxiety dreams of "run-away hutches," "cage slipping," etc. Breakdowns seemed to occur in the presence of intercurrent sources of difficulty, e.g. personal, financial, or occupational. He thought that the illness frequently retained a characteristic of primitive emotional response in that it served a blind purpose, namely that of escaping from a dangerous working environment.

THE RELATION OF UNDERGROUND CONDITIONS TO PSYCHIATRIC ILLNESS.

In the present investigation, 58 of 100 miners blamed the conditions of underground work for their breakdowns, and in 41 cases a medical man had initially agreed with this view. But in the light of further investigations and later events, only 28 cases remain in which the main etiological factor was closely connected with work underground. In keeping with current psychiatric thought, these special strains and stresses played a much larger aetiological role with hysterical and anxious-depressive cases than in other types of breakdown. In the first group comprising 40 men, at least 20 showed clearly and conclusively that occupational factors were predominantly important, but this could only be said with conviction of 5 among 55 patients with organic psychiatric, schizophrenic, melancholic, and persistent psychoneurotic illness. In a large proportion of cases it was possible to form an estimate of the man's attitude to coalmining, and it was found that of 55 patients in the "mainly endogenous" group, 32 had been reasonably happy at their work, whereas

among the 40 patients suffering from hysterical or anxious-depressive illness only 9 were contented in their jobs, and 25 frankly disliked coalmining; 26 patients in this group had shown excessive emotional reaction to the dangers of underground work even before they fell ill. It seems justifiable to conclude that although coalminers suffer from the usual types of psychiatric illness with the same etiological structure as is found among the population in general, in addition there occur breakdowns which are more specifically caused by occupational risks.

ACCIDENTS.

Accidents are responsible for a large share of incapacity in coalminers, and it is therefore not surprising that they precipitated the psychiatric illness in one-third of our cases. A few of these patients were found to be suffering from organic nervous diseases in no way connected with an injury, while in a number of cases of head trauma organic mental sequelae had ensued. For the rest, the role of injury in the production of psychiatric symptoms was just as difficult to determine as in cases of post-traumatic illness in other occupations. Certain aspects of this problem seemed to have a special significance in miners, and the return to a dangerous environment was without doubt the leading factor in the production of neurotic symptoms in many instances, at the same time detailed case studies reveal that other factors are at least of subsidiary significance. This point may be illustrated by quoting the case of a patient who suffered from a depressive illness following a head injury:

CASE I.—Aged 37. His mother had at one time suffered from a mild depressive illness with anxiety attacks, and a brother was killed in a pit accident. After a normal childhood he had been working underground regularly and without nervous symptoms, though always disliking the conditions. Three years before admission, he had a severe attack of cerebrospinal fever from which he recovered without sequelae, and eighteen months later he met with an accident at work. He fell on his face when trying to jump clear of some derailing "hutches" (carriages). He was unconscious for a few minutes without retrograde amnesia, and in addition to lacerations of his face, he sustained a fracture of tarsal bones; X-rays of the skull were negative, and there were no headaches. When he returned to work some four months later he felt that he had lost his previous vitality and interest in hobbies. After a few months he began to feel frightened in dangerous parts of the pit and when working with the hutches; so he made up his mind to quit the mines as soon after the war as possible, and began to work overtime and on Sundays in order to save sufficient money to start in a greengrocer's business. A few weeks before admission he became unduly pre-occupied with his daughter's moral character, and at the same time he developed bouts of depression with severe headaches, attacks of crying, loss of appetite, weight, and libido; finally, he made two attempts at gassing himself.

When first seen he was still moderately depressed as well as retarded, and in poor physical condition. He showed no deterioration of intellectual faculties or personality, and made an excellent recovery in two months of routine hospital treatment. He returned to his previous work and reported symptom-free six months later.

This man's dislike of "the pit," even before his accident, is fairly typical of a large majority of patients with post-traumatic psychiatric illness. Excluding cases with organic sequelae, only 5 patients out of 23 gave evidence of liking their work, and of only 9 could it be said that their emotional reactions

to the incidents of a miner's life had been within normal limits. These patients frequently related how for years they had been struggling against a rising tide of fear, until an actual breakdown was precipitated by an accident.

CASE 2.—Aged 50, an underground miner all his life, had as a sideline engaged in various business enterprises with a view to keeping his sons out of the mines. As a young man he saw a fellow worker killed under particularly harrowing circumstances; for the following six weeks he was unable to work or sleep because he was haunted by this man's voice.

For seven years before the onset of acute symptoms he had been working as overman in a mine where he regarded the roof as unsafe and the safety arrangements not in accordance with Government regulations. There were frequent accidents, which caused the patient to be in a constant state of fear and tension; especially as one of his sons was working at his side. He had nightmares of accidents, frequently jumping out of bed with a shout, and his family were so accustomed to these occurrences that they would jokingly remark, "That's father getting killed again." In the two years preceding the patient's illness he had several narrow escapes from falling stones, and an accident in which another man was seriously injured reminded him of his earlier experience. Finally, he himself met with an accident in which he was momentarily knocked out by a falling stone. Owing to copious bleeding he considered himself seriously injured, whereas in reality he had only sustained a trivial scalp wound. However, during the year which preceded his admission to hospital he was unable to return to work on account of various strange sensations in his head and neck, as well as attacks of anxiety and depression.

Though the majority of patients in whom symptoms arose following injuries received compensation pay, less than half of them were suffering from a "compensation neurosis." All patients, except one in this group, had disliked their work, and with many there had been litigation over compensation claims following earlier accidents. All the usual features occurring in compensation neuroses of other occupations were found, but the following case may be quoted to illustrate some of the special points which arise when a mining accident is followed by post-traumatic hysteria and litigation over compensation pay.

CASE 3.—Aged 26, had been excessively shy and a bad scholar. One year previous to admission he sustained burns, small flesh wounds, and concussion while firing explosive charges at the coalface; his companion was found with him unconscious, and died a few days later with subdural and cerebral haemorrhages. The patient soon recovered physically, but remained completely amnesic for the accident, and a year later he still had an extensive amnesia covering most of his earlier life. He had remained emotionally labile, with headaches, sleep-walking, and fugue states. In view of the wide amnesia, the presence of pseudo-dementia, as well as the patient's emotional attitude, occurring in a man of well-retained personality and without evidence of neurological lesions, the condition was regarded as essentially hysterical by several neuro-psychiatrists.

There was a good deal of litigation over the patient's compensation claim, as the employers contended that the patient and his dead colleague had been guilty of "serious and wilful misconduct," because after lighting the fuses leading to the explosive charges they had failed to take cover. The onus of proof lay with the employers, and they had a good case, all indirect evidence pointing to negligence on the part of the workmen; but the only direct evidence could have been given by our patient, who had lost his memory and whose mentality was impaired; the Court found against the employers and awarded full compensation pay. The impression that this man's psychiatric condition was a hysterical (purposive) prolongation of an originally organic mental state was strengthened by the fact that after three years, during which period further evidence accumulated of the hysterical nature of his intellectual disturbance, the patient returned to his work at a time when he was forced to get married in order to legitimize a child.

ACUTE FRIGHT.

A number of miners dated their illness from an emotional shock. Transitory nervous symptoms following narrow escapes or accidents happening to fellow workers undoubtedly are very common; but when these disturbances continue and develop into a psychiatric illness, there usually is evidence either for a hysterical (purposive) maintenance of symptoms, or of reactivation of neurotic manifestations dating from childhood and presumably involving the deeper layers of the personality.

CASE 4.—Aged 41, gave up his work on account of indigestion, feelings of faintness, sleeplessness, and mild phobic symptoms. During X-ray investigation of his stomach he was asked by the radiologist whether he had recently experienced a fright, and he recalled a shock which he had suffered a few weeks before the onset of symptoms, when he narrowly escaped a serious accident. A "cage" which he was about to enter began to descend prematurely owing to negligence on the part of the operator, and it took the patient about an hour to compose himself sufficiently to resume work.

During out-patient attendance over a number of weeks no evidence for early instability could be obtained either from the patient or his wife, but he had disliked the pits all his life and had made various vain attempts at obtaining different employment. Since the early part of the war he had been suffering intermittently from gastric symptoms, first noticed during heavy lifting at his work (steel propper). On medical advice he had all his teeth extracted, and while waiting for the anaesthetic he had an attack of faintness and sweating indistinguishable from his present turns. Though he improved steadily, he felt unable to return to underground work, and finally advanced the opinion that he ought to receive compensation pay. In view of his favourable progress and the history of symptoms before the precipitating incident, the patient was advised against engaging in litigation. He discontinued out-patient attendance forthwith, but eight months later his solicitor requested a medical report to support a compensation claim.

In the following case the illness was also precipitated by a frightening experience, but here we seem to be dealing with a much more deeply seated disorder:

CASE 5.—Aged 30, labourer in a shale oil plant released from underground work two years previously. Eight years before coming under observation he was hit by a runaway hutch and sustained slight lacerations not requiring absence from work. A few months later he narrowly escaped a similar accident, and reacted with an attack of trembling, sweating, faintness, palpitations, and vomiting. Since then he has been suffering from frequent similar turns, as well as pains, weakness, and stiffness of his limbs.

The patient had preferred mining to farm work on account of the shorter hours and better pay; he had worked regularly, and before his illness had taken part in the social life of his fellow workers; his married life had always been happy. The patient's mother was a hypochondriacal woman, constantly preoccupied with her heart, and in his childhood she had kept the patient in bed for a whole year following pneumonia because he had lost the use of his legs. His schooling had been irregular on account of frequent attacks of dizziness and vomiting associated with weakness and stiffness of his legs.

The patient agreed that his present attacks strongly resembled this childhood "biliousness," but in spite of reassurance by specialists he thought that his anxiety attacks were due to heart trouble, and that the doctors "were cheated" in their view of his case. Release from underground work had not produced any improvement of his condition, which had deteriorated into a chronic anxiety neurosis with hypochondriasis.

PERSISTENT FEAR.

A continuous state of fear and apprehension arising from working conditions underground was admitted by 41 of 100 patients, and was the emotional back-

ground in 26 of 40 miners suffering from psychoneurotic illness of recent origin. There were some men in whom chronic fear alone was the main aetiological factor, as exemplified by the following case-record, which at the same time illustrates the stresses to which some miners may be subjected for prolonged periods.

CASE 6.—Aged 26, whose father was killed in a pit accident and whose mother was a lifelong sufferer from nervous palpitations. The patient's own personality showed only mild neurotic traits; circumstances had forced him into coalmining and he had delayed going underground until the age of 19, when he was placed in a particularly difficult and dangerous job at the junction of three "roads," all of which went uphill. Almost every day trucks broke away in one or other of these tunnels and his predecessor had his leg broken three times in 5 years, as well as sustaining a fractured wrist and many minor injuries. Each morning when going out to work he was apprehensive of what might happen to him during the day, and indeed he had numerous narrow escapes, such as the following: While at his post he heard some hutches rumbling down one of the tunnels, but the only getaway was closed by stationary trucks, which were filled up to within an inch or two of the roof. He was only saved from being crushed by the oncoming trucks owing to the fact that the first of them caught on a projecting beam and derailed the others a few feet away from him.

He gradually developed sleeplessness and morning headaches with an increasing sense of strain and anxiety, as well as hatred of the pit; at night he frequently woke crying out with the idea that the "hutches were down upon him." His doctor noticed the man's shaky condition one day when he was attending him for an abscess not connected with his work and advised him to take a few weeks' rest. This was two years before admission (1936), and the patient had never been able to face up to his work again on account of various symptoms of anxiety, depression and hypochondriasis. He made a good symptomatic recovery in hospital, but several months later was still trying in vain to obtain work outside the mines.

In most cases the sequence of events leading to a breakdown was less clearcut. When the patients were first seen their reaction to mining conditions appeared to be a highly important aetiological factor, but as treatment proceeded and the illness was studied in therapeutic interviews more and more personal factors gained in significance, until the illness began to show a pattern similar to psychoneurosis found in men of nervous make-up belonging to other occupational groups.

CASE 7.—Aged 35, gave a year's history of mild hypochondriacal preoccupations following a minor operation. A month before his first attendance he began to suffer from short depressive episodes, phobias, as well as feelings of unreality and lack of contact with other people, which amounted to a mild state of depersonalization. Both the patient and his wife made much of his unhappy position in the mines, where he had been working since the age of fifteen, originally in order to help his widowed mother and the younger members of his family, and then owing to the impossibility of obtaining alternative employment. At first he was frightened by the conditions underground and had frequent anxiety dreams relating to his work, but later on he thought that he had grown accustomed to the dangerous aspects of his employment. He was, however, very resentful of the discipline enforced in the mine, always hoping for a possibility of leaving the pits in order to become his own "gaffer," and he regretted having missed the opportunity of entering more congenial employment in the early part of the war before the Essential Works Order as applied to coal mining came into force.

The patient had lost his father early in childhood, several of his siblings showed neurotic traits, and he had as a boy suffered from fainting turns, nocturnal enuresis, sleep-walking, and various morbid fears, e.g. of finding himself blind when returning from a dark room. Later on he had to overcome sexual difficulties, and had

remained of a morose, hypochondriacal, and easily worried disposition. From the wealth of psycho-pathological material offered by this intelligent and co-operative patient mention may be made of a dream which, recurred frequently during his illness and which at first seemed to be related to the mine: he is walking through an underground passage on rotten boards with water underneath them; he is frightened, and has the feeling that he will meet his death in a similar situation. The patient later on recalled that he had had the same dream in his childhood, and that it was connected with a childhood memory of being dared to cross the faulty wooden cover of a disused pit shaft in the woods near his home.

After admission to hospital the patient made little progress until he confessed a sexual digression while drunk about a month before the onset of his first symptoms. His feelings of guilt on this account were so severe and he felt so humiliated that he had not been able to discuss this experience in spite of repeated probings during numerous therapeutic interviews. Improvement began immediately after full discussion of this matter, and the patient was finally able to resume his work underground; a few slight relapses could be dealt with during out-patient attendances.

Apart from illustrating the danger of attributing too much aetiological importance to attitudes and motives connected with working conditions, this case shows in combination several findings encountered in a large majority of miners with recent psychoneurotic illness: a neurotic personality based on constitution and early environment; neurotic manifestations in childhood; chronic fear and unhappiness in the mines; and finally some precipitating event, which may or may not be connected with underground conditions. The resulting psychoneurotic breakdown often resembles in its structure and symptoms an earlier childhood neurosis, much as can be demonstrated in cases of psychoneurosis among the general population.

PERSISTENT PSYCHONEUROSIS IN MINERS.

When miners suffer from a persistent psychoneurosis, the course and symptomatology of their illness appears to be but little influenced by circumstances connected with underground work; they continue at their job for years in spite of neurotic symptoms, though the following case shows that this adjustment can become temporarily upset by additional factors:

CASE 8.—Aged 43, an underground miner since the age of 14, suffered from a chronic phobic-obsessive psychoneurosis, and had been twice previously incapacitated for a few weeks on account of exacerbations of his symptoms with a mild depressive mood disorder.

Without going into the details of this patient's earlier history, it can be said that he had suffered from his present symptoms continuously though with fluctuating intensity since the age of 21. Apart from mild obsessive-compulsive tendencies, these symptoms consisted of obsessional fears of losing his reason, of killing himself, of injuring others, of knocking at the doors of strange houses, etc., and of phobic sensations in the street as well as indoors. It was interesting to note that the panicky feeling of "as if there was not enough space" was no worse 400 ft. underground than in a small room of the patient's home. The claustrophobic symptoms, which were the first manifestation of his illness and which appeared at a time of psycho-sexual difficulties, arose acutely one day while the patient was travelling in a crowded train, and not in association with his work in the pit.

Four years before coming under observation, this miner developed "occupational dermatitis," and was given work as a bricklayer underground away from the dust of the coal face; there were, however, frequent recurrences of his skin condition associated with troublesome itching. This interfered seriously with the patient's sleep, and was thought to have precipitated an exacerbation of his neurotic symptoms as well as a mild depression, for which he attended as an out-patient. After a few months he readjusted once more and returned to underground work.

A good work record and lack of causal nexus between neurotic symptoms and underground conditions, as exemplified in the last case, are fairly typical features of the chronic psychoneurotic group of miners; this is in keeping with a psycho-pathological view which regards chronic psychoneurosis as a deep-seated disorder the symptoms of which are symbolic, and not reactive to the patient's situation in reality. It may be relevant to this point that a fair number of chronic neurotic patients are seen at this hospital who have been coalminers in the past, but who changed their work on account of nervous or vague physical symptoms; while some benefited temporarily from the change, in others the course of their illness remained unchanged.

WARTIME CONDITIONS.

The impact of the late war on the coalmining industry not only produced a host of social and economic problems which have been widely discussed, but there have also been psychological repercussions on the individual miner. In the absence of published morbidity statistics for the war years, only tentative conclusions can be drawn regarding the significance of the relative as well as absolute increase in the number of miners admitted to the Jordanburn Nerve Hospital. While in the years between 1933 and 1941 3-7 per cent. of male in-patients were miners, the figures for 1942 were 9.5, for 1943, 13.0, for 1944, 14.0, and for the first half of 1945, 12.0 per cent. This trend seems parallel to a rise of absenteeism among underground workers; according to Redmayne (1945) the rate was about 8 per cent. in 1926, 9.65 per cent. in December, 1941, 10.79 per cent. in 1942, 13.40 per cent. in 1943, and 14.40 per cent. in 1944; in Scotland the figure was about 12 per cent. early in 1945, but since then higher figures have been quoted in the press. Redmayne thinks that at present between one-half and two-thirds of absenteeism is voluntary, i.e. not certified as due to illness.

It is outside the scope of this paper to discuss possible sociological and economic reasons underlying this trend, but it appears highly probable that when morbidity statistics become available, psycho-somatic factors will be found to have played their part in the rise of absenteeism during these last years. As far as the psychological aspects of coalmining in wartime are concerned, it can be stated that it did not become a more dangerous occupation: the pre-war trend towards improvement in the accident rate and death rate from accidents per man shift worked as well as per persons employed has continued (Redmayne, 1945). In contrast to other industries, the duration of each shift has remained unaltered, and in Scotland at least, the number of shifts worked per week has not increased materially. Some patients worked excessively by putting in extra shifts on Sundays as well as during the week, but frequently this type of overwork, could be regarded as a symptom of a developing psychiatric disorder (e.g. unreasonable fear of financial difficulties) rather than as its cause. On the other hand, several consecutive years of uninterrupted work with only very occasional holidays appear to have been an unwonted experience for most patients, and in the presence of a wartime diet the occurrence of genuine industrial fatigue must be kept in mind.

It is probably not mere coincidence that there has been an increase in the number of miners seen at this hospital since 1942, the first year in which the Essential Works Order as applied to the mining industry (December, 1941) was in operation. Many men who had been unhappy in the mines had failed to find alternative employment before the war, and the Essential Works Order came into force at the moment when for the first time in their lives these miners would have been able to change over into more congenial and better paid work in the armament industry. Release became possible on medical grounds only, and especially in the out-patient clinic a number of men with previous neurotic tendencies were seen suffering from anxious and hysterical symptoms; with them the purposive motive of their illness, medical release from the pits, was only thinly disguised.

A further group of patients under observation were wartime miners who had failed to adjust. These were temporarily released from the Forces under the condition of working in the mining industry, as well as "Bevin Boys." All but a few in this group of patients disliked their new occupation intensely; they had all of them been of unstable make-up, and broke down either on account of the strenuous nature or of the dangerous circumstances of their new calling. The following case illustrates how a genuine psychoneurotic illness can arise under these conditions:

CASE 9.—Aged 19, was referred by his doctor 5 months after being conscripted to the mines. His mother had had a brief "nervous breakdown" following an emotional upset, and the patient himself had shown undue fear of the dark as well as a tendency towards gastric symptoms during childhood and adolescence. At the age of sixteen he spent several months in hospital with a left-sided chorea which had developed after he had been hit on the left side of his face by another boy. He felt anxious and cried easily at that time, and since then has continued to have slight recurrences of his choreiform movements at each anniversary of the assault. Hoping to get into the Navy, he withheld this illness during his medical examination and was graded I. He was very disappointed at being drafted into the mines.

At the time of his first attendance he complained of headaches, poor sleep, and loss of appetite. He had, however, gained a good deal of weight at his job, which consisted in carrying wood, and apart from a mild tremor could not be regarded as ill at that time. He was encouraged to carry on and seemed to respond quite well during two months of regular attendance. He had a great dread of having to work at the coalface, where he considered the roof to be dangerous, and continued to be severely upset by occasional small accidents occurring in the pit. Finally, he was ordered to the coalface, which caused a sharp increase in his symptoms and, objectively, his tremor became more severe, he developed a coated tongue, and began to look ill and depressed.

He was recommended for a safe job underground, where he worked practically symptom-free for several weeks, until he was declared "redundant" by the manager, and allowed to return to his old job on a grocer's van. Follow-up by the psychiatric social worker some six months later confirmed that he had remained well; but he was apprehensive and resentful about his impending call up into the Navy.

CONCLUSIONS.

As a result of the present study certain conclusions appear permissible. In more than half of miners suffering from a psychiatric illness occupational factors were absent or unimportant from the point of view of aetiology, and

apart from cases arising under the artificial conditions of wartime control and compulsion, only few men broke down on account of the unpleasant and dangerous nature of underground work alone; in fact, on closer investigation deeply seated personality problems eclipsed in importance the occupational factor. More significance should be attached to the finding that almost 60 per cent. of patients blamed their work for their illness when they first came for treatment, indicating a basic readiness of accepting their occupation as an unhealthy one, and 40 per cent. frankly disliked being coalminers, on account of the general conditions of work rather than of its dangerous nature.

Clearly these observations made on psychologically ill men cannot be applied to miners as a group without complementary field studies among the normal mining population. Recently H.M. Chief Mines Medical Officer (Fisher, 1944) pointed out that only investigators who are working in the mine itself and who are in constant close contact with the miner should make pronouncements on mining questions, but even authors who fulfil those conditions are seen to draw conflicting pictures. Redmayne (1945) stresses the great improvements made in recent years, and deprecates the view that the conditions under which the coalminer works underground are not only unpleasant, but highly dangerous and unhealthy. In contrast, Eliot Dickson (1936) describes vividly the gruelling conditions of work at the coalface combined with its monotonous and mechanical nature, with only one short interruption for the "piece." Coombes (1944), while admitting modern improvements, gives a most gloomy and pessimistic account, which has a depressing effect on the reader, and which is in line with the picture of mining conditions emerging from some of the case histories quoted in this paper: admittedly, a picture seen through the eyes of morbidly sensitive individuals. Though there are the stabilizing factors of a corporative spirit and, especially in the face of danger, of a fine sense of comradeship among miners, it is difficult to eradicate the general impression of an atmosphere of disgruntled resentment and restiveness, which must surely provide a favourable culture medium for neurotic reactions. This is particularly apparent in psychiatric cases falling under the Workmen's Compensation Act, where "the miner's bitterness never seems against the staff or the work which has crippled him, but to be intensified against the colliery company, or more distantly, the insurance company" (Coombes).

Preventive medicine has played an increasingly active part in the development of a modern mining industry, and recently the Mines Medical Service has been established. While the improvements in safety arrangements and the checking of the recognized occupational diseases have given more security and hopefulness to the miner, an investigation into the psychological aspects of coalmining might be equally worth while, as it should lead to adjustments likely to improve the general outlook of the miner, and at the same time to attract the badly needed recruits.

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PSYCHIATRIC CASUALTIES IN BURMA, 1945.

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It is likely to be contended that climatic conditions, jungle warfare, distance from home, long separation from wife and family, difficulties in obtaining leave in the United Kingdom, delay in the receipt of mail, close association with members of different races and problems in regard to evacuation contributed to the incidence of psychiatric illness in Burma. It will be interesting to note in due course, when the total figures of psychiatric casualties from all theatres of war are available, whether or not conditions in Burma were in fact relatively more productive of psychiatric illness than they were, say, in North Africa or Italy. Then only will it be possible to conjecture on the relative effects of one type of climate as compared with another, or jungle warfare as compared with desert fighting, and so on.

The writer considers that environmental factors do not materially determine neurosis, and that changes in the same environment are more important than an alteration of environment.

We know of many stable survivors of the unspeakable horrors and hardships of concentration camps like Dachau, Belsen and Buchenwald, and it is stated by responsible authorities that the incidence of neurosis was higher amongst prisoners of war of the Nazis than it was in the case of those in the hands of the Japanese. The inference is that environment is not a potent factor in the production of neurosis. The extent to which environment constitutes a stress depends on the capacity of the individual to accept and adapt himself to the conditions of his environment. The onus is on the individual, not the environment. Numerous authorities have agreed that every man has his breaking point, although it is clear that the degree of stress necessary to precipitate a psychiatric illness varies enormously in different individuals.

A faulty personal history or constitutional predisposition to neurosis is said to be the most important single factor in the causation of breakdown. The writer believes that breakdown occurs as a result of the detrimental effect of one or more stresses, physical or psychological, on a constitutionally, emotionally or intellectually inferior individual who has temporarily or permanently lost his stability. Predisposition, in the writer's opinion, can only truly be said to be present when an individual has never succeeded in attaining stability. This is vouchsafed by the fact that many individuals regarded as neurotic by the usual standards have often managed to acquit themselves with distinction in the face of the enemy, and conduct themselves generally more successfully than men with good psychiatric histories and satisfactory previous performances.

In an attempt to assess the importance of predisposition in its relation

to psychiatric illness in the Burma theatre, case-histories were accumulated in the following groups :

1. Personnel who had broken down in action.
2. Personnel who had broken down after action.
3. Personnel who had broken down before action.
4. Personnel who had broken down without reference to action.
5. Personnel who had been evacuated on account of wounds or illness in which no apparent psychiatric genesis or complication could be identified.
6. Personnel with no disability who had been in action.
7. Personnel with no disability who had not been in action.

It was anticipated (a) that certain criteria would be found common to each group ; (b) that certain predisposing factors would be identifiable in those who broke down with psychiatric illness, i.e. groups 1 to 4 ; and (c) that breakdown under certain specific conditions might be found common in similar personality-types.

No special significance was attached to breakdown associated with dysentery or malaria, owing to the prevalence of these diseases.

All the factors usually regarded as predisposing and likely to precipitate psychiatric breakdown were registered.

Historical data were noted on a proforma which had 147 items arranged under 19 headings. Items suggestive of neurotic predisposition included nail-biting, bed-wetting, sleep-walking, nightmares, spoiling, stammer, tics, faints, phobias, seclusiveness, over-conscientiousness, timidity, rebelliousness, fluctuations of mood, truancy, illiteracy, delinquency, poor school and work record. Items of a provocative nature, viz. precipitating factors, were also noted, and included exposure to battle, type of battle experience, domestic stress (moral, medical or financial), bereavement, sickness, wounds, exposure, bad conditions, wrong employment, absence of mail, frustration, injustice, lack of confidence in leaders, etc.

Symptomatology was noted in considerable detail.

No conclusive evidence could be adduced to satisfy (a), (b) or (c) above. For example, so-called predisposing factors were identifiable in the control groups almost to the same extent as in those in which psychiatric illness was exhibited, the essential difference being that while "casualties" generally tended to parade, elaborate or exaggerate their neurotic propensities, "fit" men did not do so.

It was found that some soldiers with previous histories heavily loaded with factors usually regarded as predisposing to psychiatric breakdown had managed to maintain their composure and efficiency often in spite of severe and repeated battle stress. It was equally common to find "combatant failures" in personnel with "satisfactory" previous histories, even although the battle stress had been mild and isolated.

It was obvious that soldiers with an idea and feeling of fitness had or developed a raised threshold to psychiatric disability which not only enabled them to contend with actual or potential stresses, but also favourably influenced their subsequent attitude to previous experiences.

Although careful history-taking tended to indicate that the presence or absence of items suggestive of neurotic predisposition were not essentially material to the exhibition of neurosis, it nevertheless indicated the behaviour pattern, type of personality and reaction type of the individual. This in turn provided a very useful guide as to a particular individual's liability to subsequent breakdown and the factors most likely to precipitate that breakdown. It was clear that over-emphasis had been laid upon such items as "bad home environment," "enuresis," "nail-biting," "somniaambulism" and so on. The attainment of a fair degree of stability is much more significant than the exhibition of a variety of neurotic traits.

It may be contended that early neurotic traits could only have been acquired in consequence of previous emotional disturbance or experience, and that their presence therefore should be regarded as of prognostic importance. The experience of growing up is quite a painful one, and individuals may at times have exhibited overt signs of their difficulties in negotiating some of life's early hurdles. By far the majority, however, succeed in attaining a fair degree of stability, even although vestiges of some early conflicts may persist into adult life.

Neurotic traits are therefore relatively unimportant. Reactions to situations constitute essential criteria in war psychiatry. The mistake has repeatedly been made of assessing an individual's war potential on his disposition and not on his actual performance. Symptoms must be considered in relation to the latter. Too often, however, they are considered in association with certain trends of the individual's personality, and together are regarded as constituting a psychiatric disability. Symptoms must be assessed on the basis of the situation in which they have been precipitated. Far too many soldiers were evacuated from forward areas because they exhibited physiological fear on their first experience of battle. Evacuation then engendered the idea of security, and what had been a normal reaction then assumed psychological significance. The prompt return to action of such cases from forward Psychiatric Centres stemmed the backward flow of many soldiers who might otherwise have become confirmed neurotics. When men required treatment at forward centres on more than one occasion it became clear that battle experiences were exercising an adverse effect on their stability. Prompt evacuation was then indicated in order to interrupt the conditioning process, and preclude physiological fear with minor secondary psychological ingredients from developing into a permanent disability.

Some of the men who so satisfactorily served the British Army in peacetime, and helped to defeat Germany twice in 31 years, were recruited from the stable dullards, failures and psychopaths of civil life. As often as not they joined the Regular Army in order to escape their civil responsibilities and difficulties. Many of them would have been eliminated from military service by methods of selection based on the identification of unfavourable features or traits in their previous histories.

One would have expected to find similar symptoms precipitated in comparable personality types, or that specific conditions would have produced psychiatric disability in those types. One's experience, however, was that

while hysterical dissociation occurred in hysterical personalities, it also occurred in chronically anxious types with almost equal frequency. While each individual's ability to withstand stress varied enormously, it was generally found that there were some clearly identifiable types who tended to break down, but their disabilities were precipitated by widely divergent experiences. In some cases it was being sniped at or actually wounded. Oft-times disappointment over promotion, wrong employment or bad news from home would precipitate symptoms. The most harrowing experiences were endured by apparently immature and inadequate soldiers, while a near miss or the death of a pal in action was frequently found to precipitate symptoms in previously adequate and robust individuals.

Cumulative factors were frequently responsible for breakdown in soldiers who had previously withstood severe battle and other stresses.

Soldiers who became casualties tended to fall into one or other of the following groups :

1. Steady, sober, rigid individuals in the older age-groups who had in civil life had many years' experience of one type of employment.
2. Reliable, responsible, over-conscientious and intelligent individuals who had been exposed to severe stress, suffered from repeated frustration or had bad news from home, etc.
3. Timid, dependent, over-emotional and immature types who had failed to find someone to whom to attach themselves for security.
4. Constitutionally inferior types (often self-evaluated) who had always taken life easily.
5. Dullards, especially when wrongly employed or left alone in a dangerous situation.
6. Psychopaths.
7. Psychotics.

Patients seen in forward areas exhibited hysterical conditions and anxiety states. The former were commonly of the dissociated variety, e.g. amnesias, aphonias and motor disturbances such as weakness and marked tremor. The latter were characterized by fear, depression, loss of confidence, inability to control their actions, nightmares, etc. Monocular soldiers readily became anxious about the sight of their remaining eye, and older men frequently complained of the effort syndrome symptom-complex.

As was to be expected, the most consistent precipitating cause of psychiatric illness was exposure to battle, but the only types of individuals who could be expected to break down with certainty were the unstable dullards. All the others either managed or failed to withstand battle experience, just as they succeeded or failed in other situations.

Soldiers with wounds tended to become anxious during convalescence, as did many men who had various constitutional disturbances. In the latter connection dengue and typhus fevers were predominant. The neurotic condition tended to vary inversely with the severity of the concomitant disability, which is just what one would expect. The slightly wounded man was reasonably apprehensive over the severity of the next wound he might sustain. Soldiers who had recovered from serious wounds, however, were equally prone

to psychiatric illness for the same reason. Wounds and illness only tended to preclude superadded psychiatric disability when their severity permanently removed the victim from service in operational areas.

The incidence of toxic psychosis was found to be much higher in Burma than in the U.K. This was accounted for by the prevalence of illnesses liable to involve the patient in cerebral complications and the readiness with which dehydration occurred in the humid climate. Ten per cent. of the total psychiatric casualties were psychotic. The mortality-rate in toxic psychoses was 60 per cent.—approximately double that stated in most text-books. In a series of ten cases admitted to hospital from widely separated areas of Burma during May, 1945, there were six deaths. They all exhibited similar features, namely, acute confusion with excitement, followed by fever. There were no signs of meningeal irritation. Reflexes were initially normal, disappearing in the later stages of the illness (i.e. from two to eleven days) when the muscles became flaccid and incontinence of urine and faeces occurred. No gross ocular signs could be identified, and the discs were normal in appearance. There was nothing found in the C.N.S., cardiovascular or other systems. No rashes were seen, and there were no glandular, splenic or liver enlargements. Blood slides were negative. Oral and intravenous quinine was administered empirically without benefit. Penicillin had no effect. Polymorphonuclear leucocytoses were present. C.S.Fs. were normal in pressure, quality and cell count. Widal and Weil-Felix reactions showed no increase in titre. In one case *Staph. aureus* was cultured from the blood. Urine and faecal investigations yielded no information. Throughout the illnesses the patients were restless, confused and disorientated. Loss of consciousness occurred within a few hours of death, except in one case, an officer patient, who became mentally clear and correctly orientated for three hours before he died.

At post mortem the brains showed oedema and congestion of the arachnoid membrane. In one case there were two large subdural haematomata. Three cases showed congestion of the small gut. The patients were all aged between 19 and 31 years.

Such information as could be obtained from the units of these men was quite satisfactory. No details of personal history could be elicited.

A number of psychotic episodes appear to have been precipitated by alcoholic over-indulgence. These were invariably paranoid in nature.

A series of patients with hysterical types of personality admitted to hospital with "amnesia," "panic reaction," "exhaustion," etc., developed frank hallucinations, and were ultimately evacuated as schizophrenics. One such amnesic case responded well to hypno-analysis under sodium hexobarbitone, developed what appeared to be perfect insight and was returned, full of confidence, to his unit, only to be readmitted a few days later with a frank schizophrenia. Another youth reported the proprietor of a Chinese restaurant to the Security Police in consequence of a number of questions which the restaurateur had put to him. The place was put out of bounds a few days later for reasons other than security. The patient then became apprehensive and agitated lest the Chinaman should endeavour to avenge himself, and after his admission to hospital became acutely hallucinated.

It seemed that limited stress precipitated hysterical reactions in patients in whom more severe stress produced a schizophrenic illness. These patients had an equivocally hysterical or schizoid type of personality. The impression was gained that there is an hysterically motivated variety of schizophrenia which tends to improve rapidly under treatment. These cases might fall into the group of schizophrenics who manage to maintain their mental integration in a protected environment.

Parallelism between hysteria and schizophrenia is suggested by the fact that both conditions are common at puberty when decisions involving independence have to be considered and carried into effect, and that hereditary factors, progressive maladaptation to environment, hypochondriacal trends and a tendency to dramatization are common to both. Further evidence of this parallelism is to be found in the indifference, tendency to dissociate, exhibitionism, suggestibility and inadequacy of the former compared with the emotional incongruity, splitting of personality, absence of regard for conventional behaviour, plastic obedience and the state of general immaturity frequently found in schizophrenics. In this connection, also, the similarity between hysterical pseudo-dementia and the marked regressive features in some types of schizophrenia is significant.

It was consistently found that married men were no more prone to psychiatric illness than were bachelors, and that the three essential features which most contributed to a soldier's stability were a feeling of importance, an acceptance of his role and a knowledge of his relatives' well-being at home.

The tendency of the authorities in the U.K. to embark men under detention without first having them examined by a psychiatrist as a routine measure resulted in many useless types getting overseas, where rehabilitation was exceptional. In fact, increased resentment against authority was engendered more often than not because the detainee considered that he had been additionally penalized by transportation. The loss of the soldier's right to embarkation leave under such circumstances naturally intensified this view. When the option of overseas service was offered as an alternative to detention, good results were frequently obtained.

Homosexuals only constituted a problem when concurrent disability rendered them unsuitable for their duties. They were usually tolerated good-naturedly by their comrades, and those of the constitutional variety usually managed to adapt themselves quite happily to some suitable occupation.

Enuresis was rare. The following routine was provided for those cases which reported sick. On admission to a treatment centre they were supplied with a pickle jar or some suitable receptacle and instructed to arrange it in such a way that it remained *in situ*. Usually the patient remained dry when he realized that it did not matter whether he micturated or not so far as soiling was concerned. If, on the other hand, he partially filled the bottle he was told to adopt the practice of using a receptacle in future. The essential point was the transferring to the patient of the responsibility for not soiling his bed.

Frank malingering was rare. Conscious elaboration and exaggeration of

non-incapacitating symptoms were, however, commonly encountered. This was fostered to some extent by the readiness with which some medical officers referred cases of this kind to specialists. Whether greater harm than good is likely to accrue from such a reference is a difficult decision to reach in some cases. Some patients are thereby encouraged to persist in stressing their "disabilities," whereas a definite opinion expressed by the medical officer *ab initio* would interrupt the malingering trend.

The tendency of referring cases for psychiatric opinion following negative investigations for organic disease also tended to stimulate a malingering or hystero-malingering attitude. The most propitious time for reassurance is immediately following clinical examination, but such occasions were frequently found to have been wasted. Instead, doubt was allowed to permeate the patient's mind—"They can't find out what is wrong with me, so I am being sent to another specialist." When Medical Officers and others are in doubt as to whether or not a case should be referred to a psychiatrist the following points should be considered :

(a) Are the symptoms unusual, i.e. inappropriate, incongruous, exaggerated, etc. ? ; (b) is the patient unusual, i.e. depressed, anxious, fearful, apathetic, etc. ? ; (c) is there any apparent motive for the exhibition of symptoms ? ; (d) in what manner were the symptoms precipitated ? ; and (e) is there any evidence or previous history of neurotic illness ?

The possibility of cowardice masquerading as a neurosis always had to be considered. By cowardice is meant the conscious reluctance or unwillingness to take risks and make sacrifices in the common interest and in common with one's comrades, as opposed to the inability of a fearful, inadequate, unstable or unintelligent soldier to do so. Failure to identify and punish the coward encourages certain other individuals to elaborate their reasonable and legitimate nervousness.

Symptoms frequently included a complaint of "black-outs." These varied from "unconsciousness" lasting anything up to some hours to transient attacks of giddiness. Patients often insisted that if they did not sit down during a "black-out" they would become unconscious. Very rarely indeed was this so-called "black-out" found to be of any clinical significance or to render a soldier unfit for his job.

Cases of functional breathlessness were repeatedly referred for psychiatric investigation by medical specialists. It should be realized that "functional" disabilities are not necessarily psychologically or emotionally determined.

Differences in performance cannot be forecast or explained as a result of clinical and other examinations in every instance. The medical authorities have to contend with discernible structural and qualitative changes with impairment of body function and unidentifiable organic changes resulting in altered function and differences in performance. The fact that the latter changes cannot be identified by normal or present-day clinical methods does not warrant the assumption that the resulting impairment in function is necessarily psychogenic.

Soldiers who returned to Burma from leave in the U.K. appeared prone to psychiatric illness. In one instance an Officer had a psychotic episode

within a few hours of disembarkation. The explanation of breakdown in such cases may be a complete failure in re-adaptation in those types who had, previous to leave, with difficulty adapted themselves to conditions in that theatre. One of my colleagues informed me that breakdown in troops during a period of leave in the U.K. was by no means uncommon.

TREATMENT CENTRES.

A psychiatrist was attached, as far as possible, to each division in action. The Divisional Psychiatric Centre was most frequently located at a Main Dressing Station, where treatment was instituted in cases in which return to duty was anticipated within approximately three to seven days. Such treatment usually consisted of rest, sedation, liberal diet, narcosis, narco-analysis, narco-synthesis and artificial hypnosis by use of the intravenous barbiturates.

Corps Exhaustion Centres were usually situated in close proximity to a Casualty Clearing Station, and received cases whose return to duty was anticipated within three weeks. Here treatment was given with less urgency and greater security. The more complicated and time-consuming psychiatric therapeutic procedures could be undertaken and the atmosphere approximated to that of a hospital.

Casualties requiring more prolonged treatment than could be undertaken at Corps Exhaustion Centres were evacuated to an Advance Base Psychiatric Treatment Centre, where they could be retained for as long as three months provided that return to duty was anticipated within that period of time.

Downgrading could be undertaken at both Corps Exhaustion Centres and Advance Base Psychiatric Treatment Centres, following which such personnel were referred to an Army Selection Centre for re-employment according to intelligence, experience, aptitude, stability and physical condition, for which items they were examined and tested. Casualties regarded as unsuitable for retention in Burma were evacuated to Base Hospitals in India for either further treatment, employment in Base duties or evacuation to the United Kingdom. Patients were transferred only when sufficiently improved or fit to travel.

Owing to the very great distances involved, evacuation to India was often a lengthy and tedious journey necessitating sojourns in one or more Transit Hospitals en route.

The psychiatric condition of the men tended to deteriorate while in transit. Often they did not know what was in store for them. They were afraid to discard or ignore their symptoms lest they might be returned to the front. Before the establishment of the Advance Base Psychiatric Treatment Centre all cases requiring lengthy treatment had to be evacuated to India. One of the main reasons for the provision of treatment up to three months in Burma was the deterioration which occurred in transit to an extent that rendered casualties unfit for employment of any description on arrival in India even after months of further hospitalization.

At the Advance Base Psychiatric Treatment Centre most of the facilities for modern therapy were available. At all Centres those who were considered

suitable and sufficiently fit were put on P.T., weapon training, camp fatigues and games. Talks were given on simple psychological mechanisms and such subjects as instincts, emotions, etc. Expectancy of complete recovery was encouraged.

From Divisional and Corps Exhaustion Centres upwards of 75 per cent. and 50 per cent. of casualties respectively could usually be returned to the fighting line. Of these approximately 10 per cent. subsequently relapsed, but gave useful service for varying periods before doing so.

The percentage disposal of casualties from the Advance Base Psychiatric Treatment Centre for the period March to June, 1945, was as follows :

Return to Unit	22.6 per cent.
Return to duty in a lower category	52.75 "
Non-psychiatric cases	5.2 "
Evacuated to Base Hospitals	17.55 "
Deaths	1.9 "

It was clearly an advantage to have an Army Selection Centre closely associated territorially and administratively with an Advance Base Psychiatric Treatment Centre. The writer frequently had the experience of seeing a soldier as an out-patient, arranging his admission to hospital, supervising his treatment, sitting on the medical board which downgraded him, transferring him to the Army Selection Centre, and finally interviewing him there to agree or advise some alteration in the recommendation of the Personal Selection Officer with regard to the soldier's prospective re-employment. Some of the feeling of loss of importance which psychiatric casualties often experience, and which is an important factor in many cases of breakdown, was compensated for to some extent by the personal attention and interest which they felt they were receiving under such an organized policy.

The one measure most consistently effective in eradicating symptoms and restoring stability was telling the patient, once the decision had been reached, that he was unlikely to be sent back into action. He was encouraged to appreciate that he was a fit man who had become temporarily disturbed by his war experiences, and that the effect would pass off provided he was removed for a time from operational duties. He was reminded that he could still make a useful contribution to the war effort although employed in a rear area. He was told what to expect at the Army Selection Centre, and asked to do as well as he could in the various aptitude and intelligence tests there so as to qualify for the job, provided it was available, for which he was considered most suitable.

It was surprising how readily even severe casualties improved when some idea of their future disposal was conveyed to them. Above all, the feeling of security which was thereby engendered made all the difference between chronic reluctance to abandon symptoms and disabilities and the readiness with which these were discarded.

SELECTION.

Selection testing is effective in finding the most suitable employment for soldiers, and much can be achieved in the prophylaxis of psychiatric illness by

putting them in work for which they have the appropriate temperament, aptitude, intelligence, experience, stability, etc. Further, selection procedure is essential if the best results are to be obtained from the human material available for war purposes.

The situation and setting in which a casualty may occur, however, are so variable that they cannot be produced artificially for testing purposes. It is obvious that selection will eradicate the hopeless or unstable dullard, the over-dependent, unaggressive, emotionally unstable hysteric and the chronic obsessional type, etc., but these are cases in which disability would be precipitated long before the soldier went into battle, and it is unlikely that they would ever have been enlisted at all. In other words, selection can adjudicate on the type of individual suitable for military service, but cannot accurately forecast which soldiers are likely to break down in action. The only satisfactory method of attempting to do so is by a combination of a close study of previous history, character, temperament, past performance and reactions to various experiences, plus a study of the individual's reaction to exposure to artificial battle conditions.

The success of the scheme for the re-employment of low medical category soldiers can be gauged from the fact that only 14 per cent. of the total which passed through Selection Procedure were readmitted to the Selection Centre for the six months ending December 31, 1944. Some of these were returned on account of illness, and others because the jobs to which they had been posted were of a temporary nature. Poor selection, i.e. inability of the individual to undertake the work to which he had been assigned, or cases in which the soldiers were considered unsuitable for the job, amounted to 2.8 per cent.

SUMMARY.

A brief account of the common types of psychiatric casualty encountered in Burma is submitted, with observations on predisposition, precipitation and selection of personnel.

The clinical features in six fatal cases of toxic psychosis are described.

A parallel is suggested between hysteria and schizophrenia.

The indications for reference of cases for psychiatric advice are mentioned.

The function of the Treatment Centres at various levels is described, and the treatment at these Centres is indicated.

The writer is indebted to Brigadier H. A. Sandiford, *M.C.*, Director of Army Psychiatry, The War Office, for his valued criticism and permission to publish.

PAIN AND ITS UNDERLYING PATHOLOGY.*

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INNUMERABLE attempts have been made to define pain by physiologists, by pathologists, by clinicians and by philosophers, who all see the problem from a different angle, and who discuss it each according to his own particular mode of expression and training. The distinguished writers of the past centuries devoted much attention to the subject of pain, but wrote largely on its origin and on the various types rather than on its actual nature.

This communication, I believe, would serve a useful purpose if its sole achievement were to persuade readers to write down their own definitions in clear, unambiguous language. My own opinion is that pain is the sensation of disagreeableness; of disagreeableness in its own right, as distinct from that type of disagreeableness which exists as a quality of other modalities of sensation such as smell and from misinterpretations at the neural level of consciousness. The first type of pain will, in future, be referred to as true pain.

It is very illuminating to listen to a patient's description of his symptoms unaided by suggestions or by leading questions. Usually the investigator receives a very blurred picture of the discomforts from which the narrator is suffering. On prompting, a pain may be described as "sharp and shooting," "deep and boring," "bursting," "pressing," "dragging," "burning or cold." Severity of pain is also variable and one commonly hears the terms "unbearable, awful, terrible, just annoying or irritating." Allusions are occasionally made to colour and, of course, description depends on temperament, education and nationality, etc.

In the attempt to solve any scientific problem the first thing to do is to formulate the questions that are going to be asked and on which the research must be based. In the case of pain the questions to which an answer must be attempted are five-fold, and they are, I believe, as follows:

1. What is the essential disturbance that causes the pain cycle?
 2. At what region does the pain impulse arise?
 3. How is the pain initiated or—in other words—what is the adequate stimulus?
 4. What are the pathways by which the pain impulses are conveyed to the brain?
 5. Where does the impulse reach consciousness?
- i. Disturbances causing a pain cycle fall easily into three distinct categories:
- (a) When the lesion is obvious.
 - (b) When the lesion is not obvious, but can be demonstrated by special investigations.
 - (c) When the lesion cannot be demonstrated by any known means.

* A Paper read at the Quarterly Meeting of the Royal Medico-Psychological Association held on May 8, 1946, at The Retreat, York.

2. A painful impulse can arise in any region from the terminal nerve fibrils to the sensory cortex ; moreover, with the exception of the cerebral cortex, any quality and any severity of pain can be aroused in any region and by all sorts of pathological lesions. On the other hand, sensations other than those of pain seem to be appreciated only when they are initiated at their specialized end-organs, and I can recollect no case where stretch or any other kind of interference with the trunk or root of a mixed sensory nerve has led to an unpainful sense of touch, or of heat or of cold. From the cortex of the brain itself it is exceedingly difficult to arouse by artificial stimulation any sensation other than that of pins and needles, and this probably by means of initiating an epileptic disturbance.

How is a Painful Impulse Initiated ?

In the large majority of cases, whether the pathological lesion be a carcinoma, an abscess or a spasm of the bowel resulting from an ulcer, the painful impulse is probably initiated by distortion. More rarely the impulse is aroused by the direct action of noxious chemical substances or by physio-chemical phenomena, such as osmosis.

Pathways by which Pain Impulses are Conveyed to the Brain.

Can a true pain, which arises peripherally, be transmitted to the brain by any sensory nerve fibre and tract, or is it conducted along pathways restricted to painful impulses only ? The problem is not yet resolved, but there is a good deal of evidence that there are specific pathways for pain. For example, there are special nerve-endings for every modality of sensation, and in the antero-lateral or spino-thalamic tracts of the spinal cord there is a discrete tract for the conduction of painful impulses. Also, in peripheral nerve, histology has shown that there are fibres of differing diameters and myelinizations suggesting that each is concerned with conduction of a different type of message. By means of the oscillograph, electrical disturbances of differing patterns and speeds can be registered when differing sensations are passing along the sensory nerves and, in particular, a pain sensation arouses a relatively constant type of electrical disturbance.

It must be realized, however, that our knowledge of the sensory pathways is still very imperfect. Little or nothing is known of the sensory autonomic pathways, and I believe that pain impulses not only travel up the spino-thalamic tracts, but also up the posterior columns of the spinal cord.

Sensations, other than those of the special senses, enter the brain stem from the face and head, not only through the trigeminal nerve but through the 7th, 9th and 10th cranial nerves and probably through the others also.

With these few introductory remarks let us venture into the realms of clinical medicine, and in particular let us consider the very difficult problem of pains in the head and face. A pictorial representation of the various painful syndromes will save time, and this can be done most easily in the form of graphs (see Fig. 1). Let us consider the problem of migraine. This is a well-known disease. It is common amongst university staffs and, like epilepsy, it remains

one of the enigmas of clinical medicine. Typically, a patient gets up in the morning feeling a little off colour, with a sense of discomfort in the head. He may feel sick and refuse breakfast. Soon his head begins to ache, the pain slowly increasing in severity until a plateau is reached, as shown in the diagram. Classically, the pain is unilateral, though often it is bilateral, severe pains

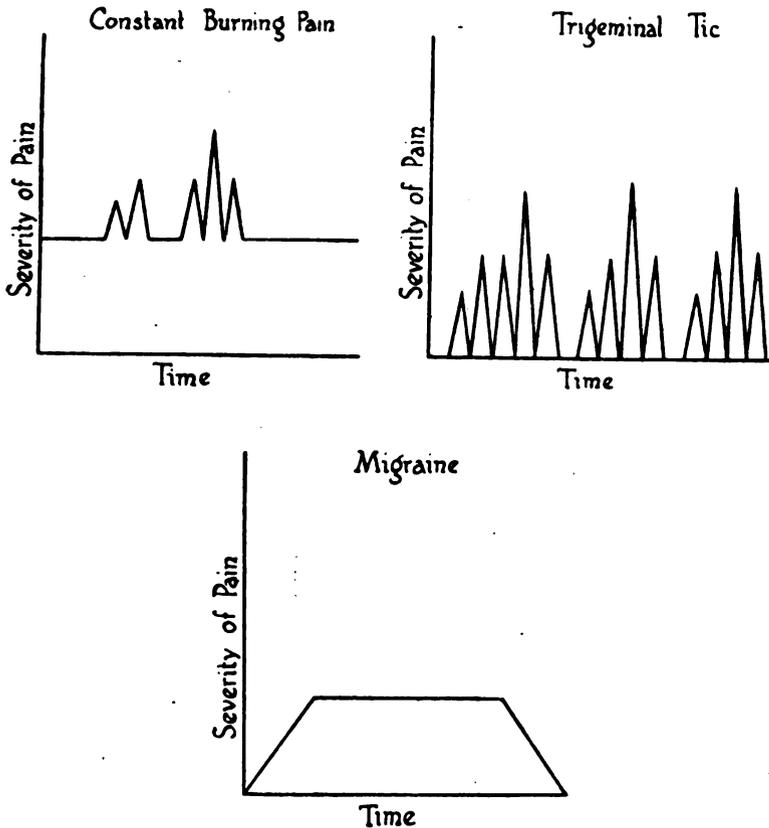


FIG. 1.—Diagrams.

behind the eyes or in the forehead being common. Occasionally the pain radiates into the ears and down into the neck, and more rarely into the face. There may or may not be visual hallucinations, such as spots, lights, scotomas or blackouts. In severe cases transient palsies, particularly of the extra-ocular muscles, may result. Relief most easily comes with sleep. The variants of migraine are, of course, legion. I take it that most of you are clinically acquainted with the picture and, no doubt, some of you have had first-hand experience.

According to medical writings the causes of an attack of migraine are innumerable: a stuffy atmosphere or too much fresh air; too little or too much sleep; too little or too much food; boredom or mental exhilaration. Often the attacks come on for no known reason, and many sufferers will tell you that their malady is controlled or conditioned by the phases of the moon.

First of all, let us ask in what structure does the painful impulse arise and what is the adequate stimulus? We know from operative experiences that :

1. The scalp with all its five layers is painful.
2. The periosteum is extremely painful.
3. The bone itself is insensitive and can be cut without causing the slightest discomfort other than that of noise.
4. The dura is painless save for three distinct regions—
 - (a) Near the meningeal vessels.
 - (b) Around the margins of the bony foramina at the base of the skull.
 - (c) Near the large dural sinuses, and particularly at the points where the cerebral veins drain into them.
5. The large vessels at the base of the brain before they enter the brain tissue itself are sensitive.
6. The brain tissue is completely insensitive. It can be cut, diathermized, squashed, torn, etc., without causing the slightest sensation, given that an epileptic disturbance is not started up in the sensory cortex.

Now of all these possibilities, which of the tissues are affected in migraine? Most of the evidence, I believe, points to the blood vessels of the scalp and dura and to the large arteries at the base of the brain, the adequate stimulus for pain being excessive spasm or dilatation. The reasons for this belief are as follows :

- (a) The walls of large blood vessels have been proved to be painful and to possess local sign.
- (b) Spasm of a large artery will lead to pain.
- (c) Extreme dilatation will lead to pain, and this fact I have proved by forcing saline under pressure into a segment of the auricular temporal artery.
- (d) Vascular changes which accompany migraine: for example, the skin of the forehead in an attack is often deadly pale and the temporal arteries sometimes can be seen throbbing wildly. Also associated neurological signs can only be accounted for easily by cerebral ischaemia. Occasionally a retinal vessel can be seen to be in spasm.

If we believe that the painful impulse in migraine does, in fact, arise in the surface arteries of the head and that excessive spasm or dilatation is the adequate stimulus, then we may continue our inquiry and ask by what pathways the painful impulses are conveyed to the brain. The answer to this question is exceedingly difficult, because few anatomical facts are known about the sensory side of the autonomic nervous system of the head.

It has been one of my interests to try to solve this part of the problem. In a small series of cases of migraine I have divided the upper third of the posterior trigeminal nerve root on the affected side with satisfactory relief from pain. Thus, it is reasonable to say that at least in some cases of migraine, the painful pathways pass through the upper third of the trigeminal root.

It is known that no sensory fibres enter the Gasserian ganglion other than through its trunks or divisions. Since the ophthalmic division is represented in the upper part of the trigeminal root, the pain pathways in migraine

must traverse the ophthalmic trunk for, at least, some part of its distance. Exactly where the nerve fibres do enter the ophthalmic trunk is not known. At the periphery, it is not known with certainty whether nerve fibres subserving pain actually end in the arterial coats themselves. What is certain, however, is that most of the large vessels of the head are accompanied by branches of the trigeminal nerve which could be easily effected by movement

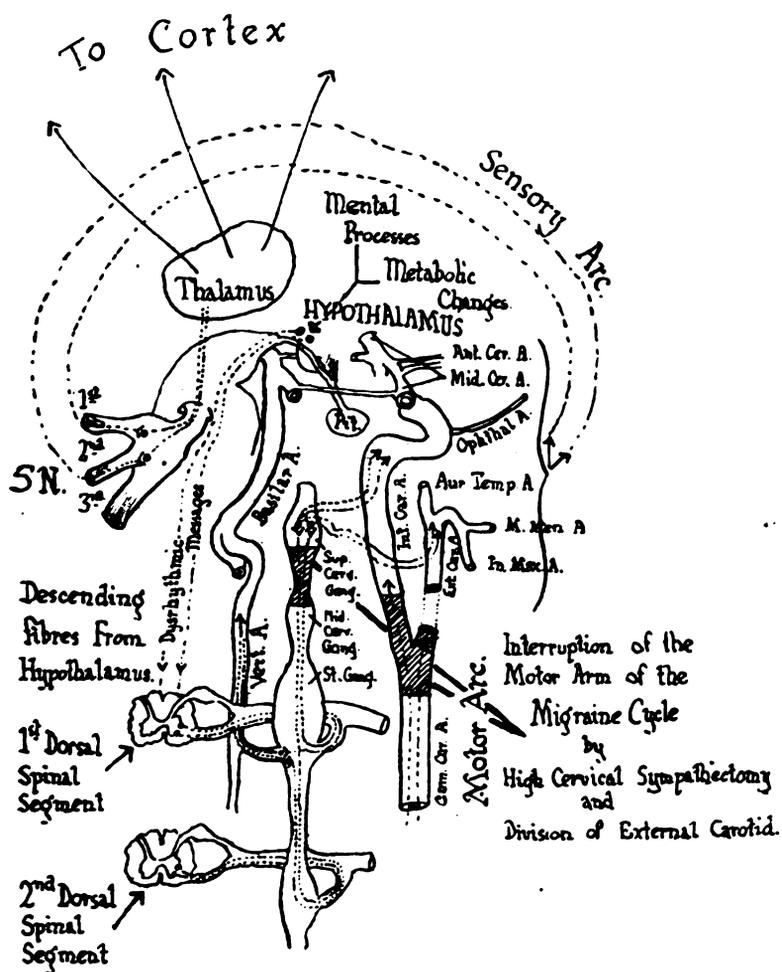


FIG. 2.—The Migraine Cycle.

of the adjacent blood vessels. To summarize, the only fact of which we are absolutely certain is that in some cases of migraine the pathways of pain traverse the upper third of the sensory root of the trigeminus.

The Motor Arm of the Reflex Arc.

Let us now consider the efferent autonomic nerve supply to the blood vessels concerned. The efferent or vaso-motor pathways are fairly well known to neuro-anatomists and the diagram summarizes present-day knowledge (Fig. 2). In a series of cases I have divided the cervical sympathetic

pathways high up in the neck, have stripped the external, internal and common carotid arteries for a distance of one inch each way from the bifurcation of the common carotid, and at the same time have ligatured and divided the external carotid artery. In other words, I have made radical attempts to prevent motor impulses from the brain reaching the arteries concerned. The results have been as follows :

CASE 1 concerns a young medical practitioner, born of migrainous parents, who suffered from such severe and oft-repeated headaches that he had become completely incapacitated. After a bilateral high cervical sympathectomy he was relieved of his pains and has now been free from headaches for over a year; he is back at work.

CASE 2.—The second patient was a young man whom I saw at the request of Dr. Pool. He had been admitted to The Retreat as a result of intractable headaches, and Dr. Pool believed that this young man was not a psychoneurotic and that he showed no psychotic tendencies; in fact, it was suspected he might be suffering from a cerebral tumour or some other equally serious intracranial lesion. I was fortunate to see him in a severe attack of pain and diagnosed a cerebral aneurysm. Neither diagnosis was confirmed by special investigations, and later it was obvious that the man was suffering from severe migraine. A high cervical sympathectomy completely relieved him of his pain, and he is now fully occupied on the land and can carry out a heavy day's work without inconvenience.

CASE 3 concerns an Assistant Matron who was in danger of losing her position because of intractable and incapacitating migraine. Satisfactory relief was obtained in this case, again by cervical sympathectomy, and she has been back at work for many months without a break.

CASE 4 was a young lieutenant in the Army who suffered from severe and oft-repeated unilateral headaches, to account for which no organic lesion or metabolic disturbance could be demonstrated. In this case a sympathectomy gave him no relief.

The Migraine Cycle. (Fig. 2.)

With the foregoing experimental information allied with neuro-anatomical and neuro-physiological facts, we can build-up a system that will help us in the better understanding of the mechanism of migrainous pains. It is justifiable to suggest that there is but one cause of migraine—an inheritance of an unstable mechanism, usually in the hypothalamus. This unstable mechanism reacts excessively, on occasions, to some of the multitudinous stimuli that normally reach it, either from the higher centres or from the blood-stream, and consequently sends explosive or dysrhythmic messages to the blood vessels concerned, setting them into spasm and dilatation, too much of this or too little of that being merely precipitants or activators of the migraine cycle.

From the spinal cord dysrhythmic messages are conveyed to the cerebral vessels via the known motor pathways of the cervical sympathetic nerves. The painful messages are conveyed to the brain via the upper part of the posterior trigeminal root. Thus, relief from pain in certain cases of migraine can be obtained by interruption either of the sensory or motor arm of the migraine cycle, by fractional trigeminal root section or by high cervical sympathectomy.

I could take up many similar problems—for example, the problem of pain in the pelvis—but time makes it necessary to ascend to higher neurological levels. My experience of trigeminal tractotomy has been that it relieves

pains that are relieved by posterior root section, but does not relieve pains that are unrelieved by trigeminal root section.

The Higher Neural Levels.

I have had no operative experience with the optic thalamus, but I have had some with the cerebral hemispheres. In three cases of intractable facial pain I have resected the facial area of the sensory cortex, the delineation being accomplished, first of all, by mapping out the corresponding motor area with a faradic battery. In the first case there was no relief from pain, and no material difference in the mental attitude of the patient towards his pain. The same result was obtained in the second case. In the third, though there was no relief of pain, the patient's attitude changed. Instead of being completely morose, he became a little more social and genial; in particular, whereas before the operation he would sit brooding by the kitchen fire, he would now go out and meet his friends and drink a glass of beer. In a few weeks' time he had put on $1\frac{1}{2}$ stones in weight.

Again, in three cases of intractable facial pain I have performed a bilateral frontal leucotomy with the following results:

(a) In one case there was no relief from pain and no apparent difference in the patient's reaction towards it.

(b) In Case 2 there was no relief from pain and the patient showed a tendency to exhibitionism.

(c) In the third case, following operation, the patient remained mentally confused, and probably he should be regarded as a high-grade mental defective. He was incontinent of urine and of faeces, and his condition was suggestive of akinetic mutism. When spoken to he would answer after a long latent interval, often relevantly, usually facetiously, and occasionally impertinently. When chided about his incontinence he would go off to the lavatory and remain there for hours until somebody went to bring him back. On the other hand, he voluntarily declared that he was free from pain, and when questioned would never admit that he was suffering any facial pain.

If this experiment can be repeated I believe it is an observation of fundamental neurological importance, because it shows that interruptions of the sensory arm of the nervous system can be made at levels higher than that of the well-known cortical reception areas. Surgical interruptions, of course, cannot be made at the thought level; they must be neuronal disturbances, and thus leucotomy raises the question whether physical sensory impulses do, in actual fact, reach consciousness in the post-rolandic sensory cortex. We are led to the conclusion by the foregoing experiments that some forms of consciousness are reached only at the highest neural or neuronal levels. Possibly, when in other surgeons' experiences resections of the sensory cortex have given rise to relief from pain, the relief may have been due to subtle changes in personality and in ways of thinking. There may be more than one way of performing a leucotomy, since the operation is merely a surgical interference with a neural integration, and would have been classified by the old physicians as an alterative. For the appreciation of pain there must be a certain type of neural "set-up," and certain alterations of this "set-up," whatever agencies are sought to bring them about, may so alter the mechanism that it is no longer receptive to pain. Leucotomy, as we all know, is a crude alterative.

It has, however, directed our thoughts to the highest neural levels for the relief of intractable pain and, no doubt, other and better methods of interfering with the highest neural integrations will be found, the best of which would be of a psychiatric nature.

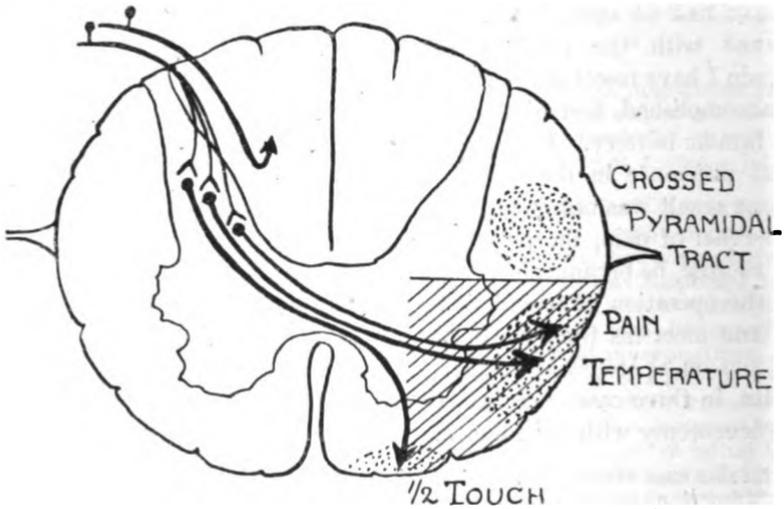


FIG. 4.

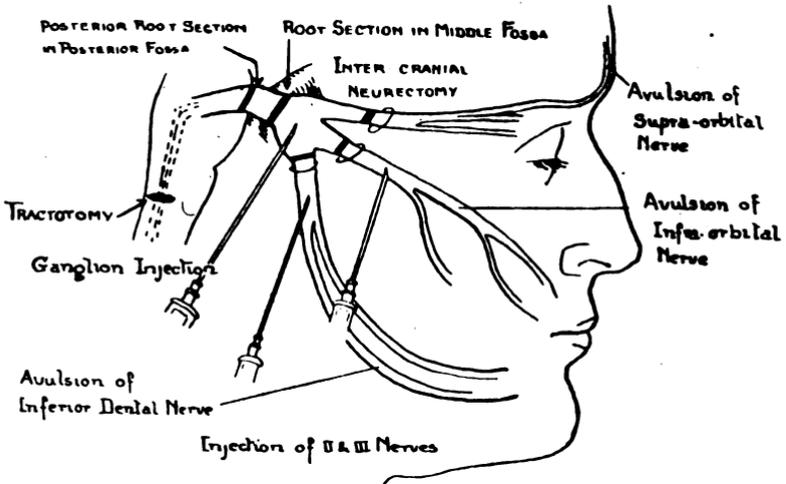


FIG. 5.—Injections of the Trigemini.

Pathological and Clinical Groupings.

From the study of 1,000 cases of intractable pain and from my surgical experiments of cordotomy, injection of the trigeminal nerve, trigeminal root section, tractotomy, corticectomy and leucotomy (Figs. 3, 4, 5, 6 and 7), I believe that pain rests on four broad pathological bases and consequently there emerge four distinct clinical groupings :

Group I consists of those cases where the essential cause of pain is a physical agent, such as a pin-prick, and where a physical message is aroused thereby

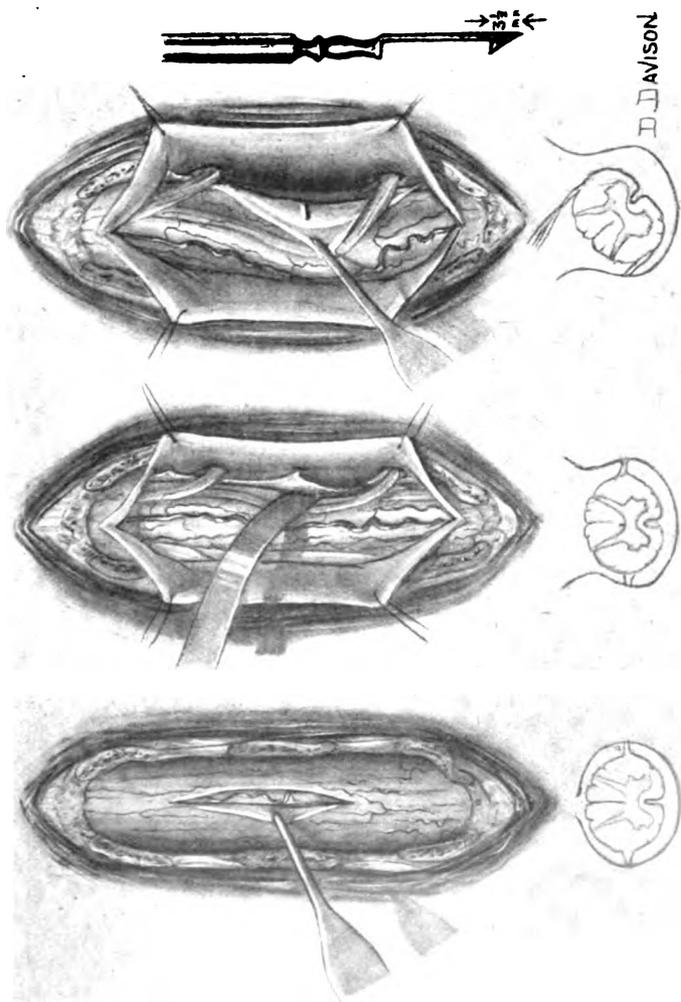


FIG. 3.—Operation of Cordotomy.

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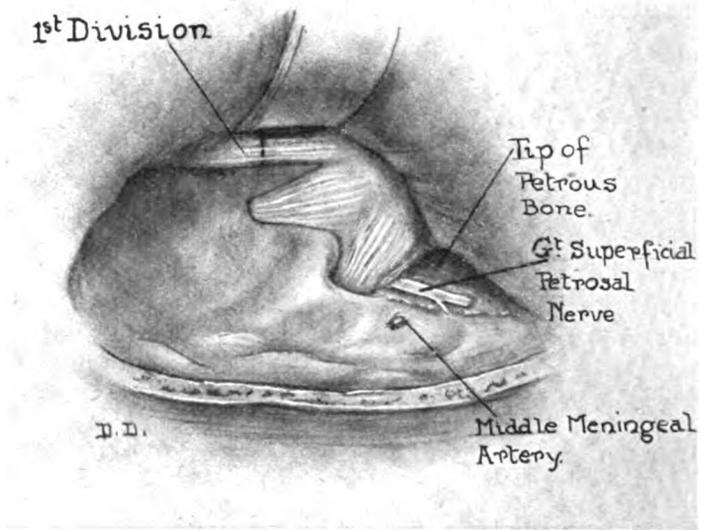


FIG. 6.—Exposure of the Gasserian Ganglion via the temporal route.

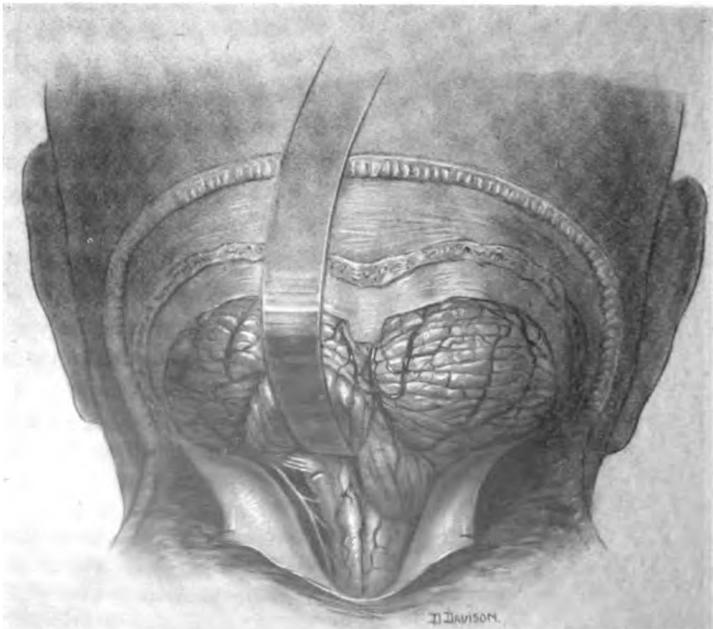


FIG. 7.—Tractotomy.

and conveyed along physical pathways to arouse a physical activity in the neurones of the brain. From the brain a non-physical translation occurs into the mind.

Group 2 contains those cases where the abstract or thought process or worry, anxiety or ambition arouses a physical message in the periphery of the body followed by a physical neuronal disturbance in the brain. This type of case we find in migraine and in some instances of duodenal ulcer. This is a most important group from the psychological point of view, and merits a further study by this society.

In Group 3 we have those cases where sensations of the autonomic activities, which normally are quiescent, reach consciousness; we see this possibly in psychosis where patients complain of "feeling like a block of ice from the neck downwards" or a feeling of board-like rigidity in the stomach or perineum, or who say that when food reaches their throats it becomes completely lost and does them no good. I would like here to suggest that this be a subject for discussion at a future meeting.

Group 4 concerns psychogenic pain. By this we mean pain which is indistinguishable from physical pain but which arises in the mind and has no known accompanying physical process.

Conclusions.

In some conditions, of which migraine is an example, the start of a pain cycle is in the abstract—a thought process. The thought process initiates a physical disturbance in the periphery of the body, a physical message in the nerves and, finally, a physical metabolic disturbance in the neurones of the brain. From the neurones the physical phenomena go back to the abstract—to consciousness. This complex abstract-physical-abstract mechanism must engage the interests both of the psychiatrist and of the organic neurologist. The thought process is essentially in the province of the psychiatrist; the physical disturbance is the concern of the organic neurologist. The link between the abstract and the physical processes is a metaphysical one, and it is on this metaphysical no-man's land that the psychiatrist and the organic neurologist are now meeting. Moreover, this metaphysical link occurs at the beginning as well as the end of the pain cycle, and up to now it has been at the early link where the neurosurgeon's interest has been primarily engaged.

The nature of the metaphysical link is one of conjecture, and as far as I can understand from the writings of Locke, Hume and Berkeley, the answer is not known, and cannot be until the stature of man's mind increases and a better conception of the universe is formulated.

DISCUSSION.

The PRESIDENT said that the paper would arouse much thought and was open to a variety of comment. As a neurologist he would be interested to know whether patients after the operations suffered corneal lack of sensitiveness, and whether they had to use a Buller's shield. At the end Mr. Rowbotham had raised the question of the physiogenic and psychogenic basis of pain. One could not afford to ignore either aspect. Different schools of thought had been fashionable from time to time. Whereas twenty years ago the psychogenic approach was the more

popular, recently there had been, as it were, a reaction in favour of the physiogenic, with leucotomies and insulin shock treatment. They had all seen the vast number of "causes" to which Mr. Rowbotham had referred, but in some cases symptoms suggested a definite toxic basis, although others seemed to show a psychogenic origin. Perhaps further developments with electro-encephalography would vouchsafe an answer in the future. He was interested, too, in the comments on hypothyroidism.

He would like to hear the comments of a gynaecologist. Those psychiatrists who worked in out-patients' departments often had referred to them women who had lost a considerable portion of their internal genitalia before it occurred to someone that the trouble might be psychogenic in origin. Often it was largely a defence reaction against advances on the part of the other partner which were not desired. He had had one such woman who had one ovary removed as well as the whole of her uterus and half of the other ovary; it was only after the pain had spread up her side that she was referred to the psychiatrist.

If they had a discussion on the paper from the psychogenic and neurological points of view, it might last until many of them were in London!

Dr. POOL described a case whose history showed two epileptic fits at five-year intervals up to 1939. The subject was then called up, and although he reported the epileptic fits and a typical migraine, he was accepted for the Army. He was promoted to be an officer and was sent out East, where his migraine became worse and worse, and he was finally sent home and discharged on medical grounds. The Army psychiatrists considered him to be a psychoneurotic, but Dr. Pool said he considered their statements much too dogmatic, particularly in view of the past history of epilepsy. The Ministry of Pensions rejected the man's claim for compensation, but Dr. Pool advised him to appeal, and told him to write out in support of his appeal extracts from all the standard text-books, which showed that all neurologists classed migraine with epilepsy, whereas Ross did not mention it among the neuroses.

He felt that tribute must be paid to the organic and autonomic basis of migraine, and one must not neglect the borderland between the two. He was interested in Mr. Rowbotham's diagram of the cycle of migraine, and his query as to whether it might be completed through the meninges. He had had a case in which the cause ultimately turned out to be a parietal tumour.

Mr. ROWBOTHAM, in reply, told how he, as a young man, had been in a company of neurologists when another young doctor who was with him, said, "Look here, it is no good being a neurologist; one must either be a neuro-surgeon or a psychiatrist. What are you going to be?" Mr. Rowbotham replied that his course was already mapped out for him; his companion was, of course, going to be a psychologist. Another of those present overheard this conversation and said: "I suppose you two think you are taking divergent routes and will never meet again, but I tell you that before long you will both meet—somewhere in the frontal lobe!"

Part II.—Bibliography and Epitome.*

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Residual Disturbances in the Higher Functions of the C.N.S. Induced by Oxygen at High Pressure.

Young albino rats were subjected to high O₂ pressure for 16 exposures and then trained on the Lashley Maze III, a control group being treated comparably but without high O₂ pressure exposure. No significant difference in learning ability was demonstrated, although the retention of the maze was adversely affected in a marked manner by exposures to increased O₂ pressure. This result is interpreted to mean that the higher C.N.S. functions of memory are inhibited by intermittent exposures to increased O₂ pressure, which has a cumulative effect.

T. G. ANDREWS (Psychol. Abstr.).

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Convulsive States and Coma in Cases of Islet Cell Adenoma of the Pancreas.

This report is an analysis of neurological and psychiatric manifestations observed in 27 patients suffering from verified adenoma of the islet cell apparatus of the pancreas. In addition relevant laboratory data, mainly those related to the glucose metabolism and in the last 11 patients also the EEG findings are discussed.

The clinical data were arranged in four groups: (1) autonomic-visceral, (2) somatic-neurological, (3) "psychomotor" manifestations, and (4) seizures and seizure fragments.

These four groups of data are then discussed in terms of anatomic-physiological levels using concepts established by Himwich. The authors' findings differ in several important aspects from those found in therapeutic insulin shock. An attempt is made to understand the reasons for this divergence.

Glucose tolerance curves in a majority of the cases are diabetic in pattern and often also in level. "Flat" curves are the exception in the authors' experience.

The EEG findings are those to be expected in patients whose cerebral metabolism is depressed. In addition suggestive "convulsive" patterns such as spike-and-wave bursts are found in most of their patients, even those who had no clinical convulsive seizures.

(Authors' abstr.)

ANN. MÉD.-PSYCHOL.

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Psychopharmacologic Study of Schizophrenia and Depressions.

Patients with schizophrenia are characterized by reacting to the intravenous administration of subnarcotic doses of sodium amytal and amphetamine sulfate with (a) psychologic responses which, in the present study, were clinically measurable in approximately 50 per cent. of the group, and (b) the rapid development of tolerance in terms of type and duration of the psychologic responses. In contrast, patients with pathologic depressions are characterized by reacting to the same drugs with (a) psychologic responses which, in the present study, were clinically measurable in approximately 90 per cent. of the group, and (b) absence of rapid development of tolerance in terms of type and duration of the psychologic responses.

(Authors' abstr.)

Action of Acetylcholine on Motor Cortex.

The electrical discharges of the cortex produced by acetylcholine are similar to seizure discharges. These discharges can be correlated with the motor components of seizures. Variations of cortical stimulability, neuronal transmission of discharges, sensory precipitation and sensory inhibition have been correlated with acetylcholine discharges and epileptic discharges. Because of these observations and the normal presence of acetylcholine in the cortex, the view is taken that acetylcholine plays an essential role in the physiologic genesis of epilepsy.

(Author's abstr.)

Histopathologic Effect of Anoxia on the Central Nervous System.

Twenty-five dogs were exposed daily to atmospheres of low oxygen concentration at the pressure of sea-level and 10 monkeys were similarly exposed in a decompression chamber. The oxygen content of the arterial blood was measured in the dogs. Histologic studies were made on the central nervous systems of all the animals and on the adrenal glands of the dogs.

The degree and duration of anoxia were important:

It was found that a single, sudden exposure to a simulated altitude of 32,000 feet (10,000 meters) for 25 minutes was capable of producing extensive laminar necrosis in the cortex of the monkey.

With repeated exposures to mild hypoxia, it was observed that the first histologic changes occurred in the cell bodies of the cortical gray matter. This took place at a level of about 12 or 13 volumes per cent. of oxygen in the blood if the exposures were long enough and were repeated often enough.

When the percentage of oxygen was reduced still lower, to about 10 volumes per cent., and the number of exposures was increased, the white matter also became involved and presented a pattern of demyelination in the corpus callosum, the

centrum semiovale and the adjacent fingers of subcortical white matter which, in the cases of more severe anoxia, suggested a resemblance to Schilder's disease.

Aside from the lesion of the white matter, frank necrosis was usually found to occur only after episodes of anoxia sufficiently severe to produce cessation of respiration.

The frontal lobe was most often involved and the temporal lobe least often. The cerebellum was more frequently affected than the basal ganglia, and the spinal cord and medulla were unaffected by any degree of anoxia compatible with life. An oxygen level of 4 or 4.5 volumes per cent. was about as low as a dog could tolerate. Respirations quickly ceased below that level.

The adrenal glands showed increased cortical activity. (Author's abstr.)

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PHILADELPHIA NEUROLOGICAL SOCIETY.

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Histologic Changes in the Brain in Cases of Fatal Injury to the Head.

As a result of craniocerebral trauma, certain changes may result in the structure of the cortical nerve cells of the cerebrum and cerebellum. These changes may be general, as a result of shock of the original traumatizing force (chromatolysis), or consequent to the generalized edema (vacuolation) which so often follows such injuries in civilian life. More noteworthy, because of their variety and degree, are those alterations which are the direct result of focal injuries of the cortex. Among the various local cellular reactions may be named preservation necrosis (retention of normal structure by dead cells); pigmentary infiltration (which is found in the vicinity of traumatic cortical hemorrhages); pyknotic, ischemic or sclerotic change and lipoidal degeneration (all resulting from local circulatory disturbances); a modified edematous change (incident to local edema following contusion or laceration); acute traumatic change (which may occur in the form of acute traumatic chromatolysis); acute total disintegration (ghost cells) or acute progressive

necrosis; multinucleation of nerve cells (evidence, presumably, of an abortive attempt at regeneration); and, finally, ferrugination (wrongly designated by some as "calcification"), a process by which a dead cell may remain among the living as a mummified relic for many months or years.

The occurrence of definite and widespread chromatolytic changes in the nerve cells, which may persist for some time before reversible change takes place, furnishes a possible basis for the persistent psychic residual disturbances which so often follow craniocerebral injury. Local changes in nerve cells observed at the margin of regional traumatic injuries of the cerebral cortex not only furnish an explanation of the deficit pictures which result from loss of functioning areas, but probably are responsible for residual convulsive seizures. The possible physical counterparts of abnormal discharge of electric current responsible for such seizures could not be determined in this study, concerned as it was largely with cases of craniocerebral injury with relatively short periods of survival. (Authors' abstr.)

Disturbances in Sleep Mechanism: A Clinicopathologic Study. III. Lesions at the Diencephalic Level (Hypothalamus).

Of 17 cases of pathologic sleep, there was direct involvement of the hypothalamus in 14 cases. In three cases there was compression of the hypothalamus with pathologic changes in its nerve cells. In 16 cases the caudal part of the lateral hypothalamic area showed changes bilaterally. There were, however, only 7 cases with pure hypothalamic involvement. In the remaining 10 cases there was also invasion, compression or edema of either the thalamus or the basal ganglia or of both, with implication of the thalamohypothalamic and striohypothalamic pathways.

Increased intracranial pressure was present in 13 cases and absent in 4. A high incidence of increased intracranial pressure in this series should be expected, as the neoplasm encroached on the ventricular system.

Ocular manifestations, in the form of diplopia, ptosis, defective conjugate deviation, paralysis or paresis of ocular muscles, or nystagmus, were present in 14 cases. These symptoms were undoubtedly the result of compression or edema of the nuclei of the ocular nerve or their pathways.

Endocrine disturbances were present in four cases. In all these cases the tumor was situated in the pituitary region, or there was compression of the hypophysial duct or gland.

Deviations in temperature were present in the form of hypothermia in five cases and of hyperthermia in four cases.

From this series of cases of diencephalic lesions, it may be concluded that damage to the hypothalamus, especially the posterior part of the lateral hypothalamic area and of its various pathways bilaterally, causes somnolence. The influence of the thalamus or the basal ganglia on this disturbance cannot be completely ruled out. (Authors' abstr.)

Disturbances in Sleep Mechanism: A Clinicopathologic Study. IV. Lesions at the Mesencephalo-metencephalic Level.

In eight cases of pathologic sleep there was involvement of the mesencephalon and metencephalon. The hypothalamus was normal in all cases. In all the cases there was implication of the descending hypothalamic pathways and the nerve cells of the vegetative nervous system of the brain stem.

Increased intracranial pressure was present in all cases. The high incidence of increased intracranial pressure in this group should be expected, as in all cases the neoplasm encroached on the fourth ventricle or the aqueduct of Sylvius.

Ocular manifestations, consisting of diplopia, paresis of ocular muscles and nystagmus, were present in all instances; in two cases only nystagmus was shown. This phenomenon should be expected because of the location of the nuclei of the oculomotor nerves in this part of the central nervous system. The lack of sleep disturbances in other cases with ocular manifestations would seem to indicate that the various components of the ocular mechanism are not an indispensable part of the sleep mechanism.

Slight hypothermia was present in two cases and hyperthermia in one case.

From this series of cases it can be assumed that lesions of the ascending and descending hypothalamic pathways of the mesencephalon (mammillary peduncle and mamillotegmental tract) and some of the vegetative nervous centers in the brain stem result in disturbances of the sleep mechanism. (Authors' abstr.)

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Importance of Neural Fibroblasts in the Regeneration of Nerve.

1. The perineurium and endoneurium of peripheral nerve are formed of specialized connective-tissue cells of two types. One is a large flat cell of mesothelial type, seen typically in the perineurial lamellas; the other is a specialized fibroblast.

2. The Schwann cells play only a subsidiary part in the regeneration of nerve. The neural fibroblast is immediately activated by injury and then proliferates. It invariably accompanies regenerating nerve fibers, often preceding them, and ensheaths newly formed nerve fibers and bundles. The large flat mesothelial cells provide an outer perineurium.

3. The uncontrolled migration of these mesoblastic cells is responsible for the traumatic neuroma. Dispersal can be prevented by the provision of an intact perineurial sheath.

4. The fibrosis of suture lines and grafts is associated with previous activity of the neural fibroblast. Factors of importance in the production of collagen by these cells when once activated are ischaemia, tension and their ageing without provision of nerve fibers.

5. The perineurium can be utilized for efficient repair of defects in nerve.

(Author's abstr.)

Vasoparalysis and Vasothrombosis of the Brain in Infancy and in Early Childhood.

In three illustrative cases of a rapidly fatal disease in early childhood, attended by symptoms of acute encephalitis, necropsy revealed circulatory disturbances characteristic of vasoparalysis and vasothrombosis.

In all three cases there were no signs of inflammation. The most striking observations were different phases of vascular alteration.

The earliest manifestations of the pathologic process consisted in focal areas of perivascular transudation of serous fluid and concomitant liquefaction of the adjacent nerve parenchyma. Since no lesions could be seen in the walls of the vessels, the pathologic process was interpreted as due to increased permeability of the vessel for serous fluid.

In Case 2 a more advanced stage of vasoparalysis was displayed with increased permeability of the vessel wall for red blood cells, resulting in perivascular hemorrhages in the white matter.

The changes in Case 3 were characterized by thrombotic occlusion of the smaller veins, and were interpreted as late sequelae of a prolonged state of vasoparalysis.

The pathologic changes in the three cases appear to represent three phases of

the same morbid process. The difference in their morphologic features can probably best be explained by the difference in the duration and severity of the circulatory disturbance.

Regional peculiarities of vascularization appear to be responsible for the greater vulnerability of the white substance and the relative preservation of the cortex.

(Author's abstr.)

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Narcolepsy. II. Theory of Pathogenesis of the Narcolepsy-Cataplexy Syndrome.

On the basis of analysis of a case of narcolepsy in a combat soldier, a theory of the pathogenesis of narcolepsy, which is essentially an elaboration of the formulation of Wilson, is advanced.

1. The brain of the narcoleptic patient is regarded as having an abnormal susceptibility to inhibition, and it is held that this is the fundamental pathophysiological cause of the disorder.

2. The nature of the process of inhibition in the central nervous system is unknown, and the cause of the abnormal susceptibility of the narcoleptic patient to this process is equally obscure.

3. It is held that Pavlov's law of the limit of the intensity of stimulation is applicable to the narcoleptic patient. This law states that when a single stimulus or the summated effect of repeated stimuli becomes too strong for the capacity of cortical cells the ultraparadoxical phase of cortical activity supervenes, in which excitatory stimuli become inhibitory.

4. In conformity with this law it is held that the phenomenon of cataplexy results from a single excessive ultra-maximal stimulus, the magnitude of which is such that it produces the ultraparadoxical phase and consequent sudden internal inhibition in motor cortical cells which were destined for excitation. This sudden inhibition in these cells causes loss of tone and falling to the ground. In cataplexy it is held that there is no spread of internal inhibition to cortical fields involving consciousness.

5. The case of the combat soldier described here is used to illustrate the fact that it is not the effective quality but, rather, the magnitude of so-called emotional stimuli which provokes the phenomenon.

6. The trancelike cataleptic states seen in narcoleptic patients are held to be due to the summation of repeated stimuli provoking the ultraparadoxical phase, with partial spread of internal inhibition to the motor cortical area, producing a partial alteration of movement and plastic tone, or catatonia, without spread to the cortical fields involving consciousness in the usual case.

7. The phenomenon of sleep paralysis sometimes seen in narcoleptic attacks is held to be similar to that of cataplexy, but the patient does not fall because he is in the sleeping position at the time. It is held that in sleep paralysis there is partial spread of generalized inhibition, together with sudden isolated inhibition in motor cortical cells.

8. The narcoleptic attack itself is held to be due to the effect of the summation of repeated stimuli, which produce the ultraparadoxical phase, and consequent massive internal inhibition, which spreads widely over the cortex and subcortical centers as well, leading to both the motor and the psychic phenomena of sleep.

9. The failure of autopsy material to shed light on this disorder is explained on the basis that abnormal susceptibility to inhibition is probably a chemical disturbance without demonstrable structural change. (Author's abstr.)

Disturbance in Sleep Mechanism. A Clinicopathologic Study: V. Anatomic and Neurophysiologic Considerations.

From the analysis of the clinicopathologic material presented, the cases reported in the literature and animal experiments, it is possible to reconstruct the centers and pathways concerned with the sleep mechanism.

The cases of cortical lesions indicate that fibers for the control of sleep may originate in the cerebral cortex, especially the hippocampal, cingular, frontal, premotor and temporal convolutions. To a certain extent, therefore, the hypothalamus is under cortical control. These impulses are mediated by voluntary and involuntary pathways. The main afferent and efferent pathways connecting the hypothalamus and the cortex are: (1) the medial forebrain bundle, which runs between the ventromedial olfactory correlation areas of the cortex and the preoptic and hypothalamic areas, and (2) the corticohypothalamic pathways, which are essentially the fornix and the inferior thalamic peduncle. The connection furnished by the latter fibers between the cortex and the hypothalamus is best illustrated by the cases of corticodiencephalic lesions. Other, less well established, corticohypothalamic pathways are the frontotuberal tract and the neocorticoseptal tract. There are experimental suggestions that in normal sleep the cortex becomes deafferented. Sleep, therefore, is impossible without the cortex. Forced wakefulness and diurnal sleep are cortical functions.

The evidence in the clinicopathologic cases of the diencephalic group and the results of other anatomophysiologic investigations indicate that the hypothalamus is the main center regulating sleep. The hypothalamus is in intimate connection with the thalamus, the striopallidum and the hypophysis, and its main afferent and efferent pathways are as follows:

1. **Thalamohypothalamic and hypothalamothalamic pathways:** They consist essentially of fibers from the medial and midline thalamic nuclei to the hypothalamic nuclei.

2. **Thalamomammillary fibers:** These pathways set up relays of somatic, visceral and sensory impulses from the neopallidum to the hypothalamus. The impulses from the hypothalamus to the thalamus are mediated via the mammillothalamic tract.

3. **Mammillotegmental tract:** This tract consists of fibers from the mammillary bodies terminating in the tegmentum.

4. **Stria terminalis:** This structure, which also contains preoptic and hypothalamic components, conveys fibers from the amygdaloid nucleus to the hypothalamus.

5. **Supraoptic commissure.**

6. **Striopallidohypothalamic and subthalamohypothalamic pathways:** The existence of such connections, reported by many observers, has not been fully accepted.

7. Hypothalamohypophysial pathways: These fibers run from the supraoptic, paraventricular and tuber nuclei to the neurohypophysis.

8. Interhypothalamic pathways: These fibers connect the various hypothalamic nuclei.

Lesions interrupting these pathways may lead to sleep disturbances. Some of our clinical material and the results of animal experimentation indicate that bilateral damage to the posterior part of the lateral hypothalamic area produces somnolence. When the waking center, the hypothalamus, is disturbed, somnolence ensues. The secondary involvement of the thalamic nuclei, striatum and pallidum in many of the clinico-pathologic cases and the edema of these structures in the experimental animal suggest that these areas may also be concerned with regulation of sleep. Their influence, however, is mostly the result of involvement of the pathways which are in intimate association with the hypothalamus.

There is some evidence, largely clinical, that somnolence or other disturbances in the sleep mechanism may result from lesions at the mesencephalometencephalic level. These lesions were usually in the region of the periaqueductal gray matter. The known hypothalamic and mesencephalometencephalic connections are via (1) the mammillary peduncle, probably an ascending system of mesencephalic origin ending mostly in the lateral mammillary nucleus, and (2) mammillothalamic tract, an efferent pathway arising most likely from the dorsal part of the medial mammillary nucleus and terminating in the dorsal tegmental nucleus of the midbrain.

The opinion that somnolence and lethargy are related to lesions in the nuclei of the ocular nerves cannot be accepted, for these phenomena were essentially observed in the cases of the mesencephalometencephalic group and in some of the cases of the diencephalic group. The absence of such dysfunction in the other groups and the lack of sleep disturbances in other cases with ocular manifestations would seem to indicate that the various components of the ocular mechanism are not an indispensable part of the sleep mechanism.

Psychologic consideration of psychogenic disturbances and of some organic disorders with psychoneurotic symptoms indicates that the pathways and centers aforementioned, especially the hypothalamus, are important in the regulation of sleep. In most of the cases of psychogenic disorders sleep is a retreat in order to avoid the unpleasant features of reality, the powerful and perverted instinctual drives. In some cases of somnolence the retreat is resorted to in order to obtain gratification—a wish fulfilment of the distorted instinctual drives. The repressed drives lead to emotional tensions, which, in turn, result in dysfunction of the vegetative nervous system, of which sleep forms a part. (Authors' abstr.)

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The Development of the Human Lateral Geniculate Body.

(1) The human lateral geniculate body (pars dorsalis) differentiates in the lateral thalamic nucleus, while the pars ventralis is subthalamic in origin.

(2) The pars dorsalis is recognizable in the embryo of 22 mm., and arises as the optic tract reaches this region of the thalamus. It is the first nuclear mass to be distinguished in the thalamic portion of the diencephalon. The pars ventralis is first seen at 35 mm.

(3) No lamination is evident until the 6th month of gestation.

(4) From the outset there are six U- and V-shaped laminae which present their closed convex aspects ventro-laterally and receive the fibres of the optic tract. From the dorso-medially directed concavities issue the optic radiations.

(5) The four larger outermost laminae consist of small cells, while the two smaller innermost laminae contain large cells.

(6) There is no such thing as "eversion" of the laminae in the human or monkey lateral geniculate body as originally described and figured by Clark and his associates. The laminae are curved to a lesser degree in the lemurs and to a greater degree in man and the monkeys, but all are curved in the same direction, the convexity always receiving the optic tract. (Author's abstr.)

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The Interrelation of the Strio-Pallidum and the Thalamus in the Macaque Monkey.

Experimental lesions of the strio-pallidum were made in nine monkeys and the resulting degeneration was studied with the Marchi technique. Area 4 was found to project into the putamen, area 6 into the pallidum. The caudate nucleus and the putamen send their fibres mainly into the pallidum. The internal division of the rostral part of the pallidum forms the ansa lenticularis, which sends fibres into the ventral anterior nucleus and the ventro-medial nucleus of the hypothalamus. Some fibres of the internal divisions pass directly into the ventral anterior nucleus. External and internal division together form the fasciculus lenticularis and pallido-subthalamic fibres. The fasciculus lenticularis distributes numerous pallidal efferents into the lateral thalamic nucleus via Forel's field and the fasciculus thalamicus. Some fibres from Forel's field terminate in the mammillary body and hypothalamus while others end in the region between mammillary body and subthalamic nucleus as far as the level of the interpeduncular nucleus. The fibre tracts described above indicate a close interrelationship between the strio-pallidum, the thalamus and hypothalamus. (Author's abstr.)

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Discrimination Between Normal and Psychotic Subjects by Revised Examination M.

Comparison of scores on the Revised Examination M (an intelligence test used by the Canadian armed forces) made by psychotics and by a normal army group reveals the existence of a psychotic profile. With statistical weighting of subtest scores, normal males average about 700 ± 220 points, and mentally ill males average less than 300 points.

F. W. FINGER (Psychol. Abstr.)

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Iron Encrustation of Nerve Cells in the Vicinity of Old Traumatic Lesions of the Cerebral Cortex.

1. A change in nerve cells in which these elements become transformed into a deeply staining, bluish-purple mass has been recognized for almost a century, being first seen by Virchow at the margin of an old brain wound.

2. Because of the deep color assumed by these cells in the presence of hematoxylin, it was assumed for many years that the material with which they were encrusted was of the nature of calcareous salts. It has since been determined that these granules are composed instead of some ferrous salt.

3. This change is found in a great variety of conditions aside from traumatic lesions—in old encephalitic lesions, ischemic foci, areas of arteriosclerotic softening, at the margins of cerebral tumors, in juvenile paresis, and in degenerative lesions of the cerebrum and cerebellum.

4. This particular type of cell change may be divided into two phases: (1) a pre-encrustation stage which is characterized by its shrunken irregular contour and double coloration of its cytoplasm, and (2) the encrustation stage in which granules of some ferrous salt are first deposited on the exterior of the cell and then within its substance. This process continues if uninterrupted by death until the cell is a more or less solid mass of iron.

5. This alteration seems to occur at the margin of the scar in areas where the regional circulation has been partially preserved—sufficiently so as to permit survival of the interstitial elements but insufficient to maintain the life of the nerve cells. Thus the areas in which these elements are found have a "fibrous" appearance, which stands out, differing from the anisomorphic scar which surrounds them.

6. Ferrugination seems to be a continuation of pyknotic change beyond the point where reversal is possible with functional restoration of the cell. The cell goes on to cell death but is preserved by some means in its (pre-encrustation) shrunken state until iron salts are deposited in its structure (encrustation stage), by which process its identity may be preserved for many years.

7. The iron is apparently derived from some soluble ferrous salt in the blood plasma. It is precipitated on and within the dead nerve cell in some form which is demonstrable with hematoxylin stain. At first these granules are discrete, but ultimately become confluent to transform the cell into a minute pyramid of iron which remains for months and years at the margin of the scar.

(Authors' abstr.)

Intracranial Complications of Infections of the Nasal Air Passages and Accessory Sinuses.

1. This study is concerned with the intracranial complications of diseases of the nasal air passages and accessory nasal sinuses as found in a consecutive series of 30,000 autopsies performed at the Los Angeles County Hospital. This survey is therefore an extension of a study made several years ago of similar findings in the first 15,000 autopsies.

2. There were 160 cases of intracranial complications associated with infectious or malignant disease of the nasal cavities, but in 42 cases there was an associated otitis media, and in these cases it was often very difficult or impossible to know just which of the two infectious foci was responsible for the intracranial lesion.

3. The extracranial, cranial, and intracranial complications of suppurative processes within the frontal sinuses present the most kaleidoscopic group of lesions. Aside from a localized osteitis, or a spreading osteomyelitis as cranial lesions, there may be found pachymeningitis externa or extradural abscess, pachymeningitis interna or subdural abscess, thrombosis of the superior longitudinal sinus; and as cerebral lesions, foci of red softening, small cortical or subcortical or large central abscesses, the latter being found most commonly in the frontal lobes, but when secondary to subdural abscess occurring in any portion of the affected hemisphere.

4. Ethmoiditis as an isolated lesion is rarely responsible for an intracranial infective lesion, but in some acute and fulminating cases septic meningitis may follow incident to focal erosion of the cribriform plate or extension along the spaces about the filaments of the olfactory nerve. Rarely, thrombosis of the cavernous sinus develops. The occurrence of frontal lobe abscess under such circumstances has been postulated, but is as yet an unproved assumption.

5. Sphenoiditis is likewise rarely primarily responsible for intracranial lesions. But when this is the case septic meningitis is also the most frequent complication, although thrombosis of the cavernous sinus may also occur. Regional (perihypophyseal) subdural abscess may also occur, but abscess of the brain is of questionable occurrence as a direct complication.

6. Infections in the maxillary sinus do not often produce intracranial complications, but when these do occur, they are found most often in denterigerous osteomyelitis of this bone in childhood. At times, however, osteomyelitis arising from a primary sinusitis may occur, and spread via the greater wing of the sphenoid to the tip of the middle fossa to produce a local subdural abscess, local meningitis, and abscess of the tip of the temporal lobe.

7. In a goodly number of this group of cases, an association of rhinal and otitic infections is found in the presence of some intracranial infectious complication. It is then difficult or impossible to determine which lesion is responsible. The association of otitis media and sphenoiditis in the presence of septic meningitis has become a well-known pathologic complex in otorhinologic circles.

8. Next to infectious lesions, neoplasms constitute the second most interesting group of nasal lesions responsible for secondary intracranial ones. These complications may be the result of direct invasion of meninges, nerve roots, or brain, or may by erosion provide an atrium for infection.

9. As a pathologic curiosity, there sometimes is found a granulomatous infection which erodes the skull in the vicinity of the sinuses, and either extends its process into the cranial cage or provides an avenue for the entrance of pyogenic organisms. Some of these rare examples have been cited in this contribution.

10. It is to be expected, with the introduction of the sulfonamide drugs and penicillin and other antibiotic substances, that the next 15,000 necropsies from this institution will show a sharp drop in the incidence of these lesions. Rare though they will likely be, they are not to be forgotten, for such lesions will continue to occur in the ignorant, the prejudiced, and the predisposed.

(Authors' abstr.)

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Preference for Sex Symbols and their Personality Correlates.

To investigate the relationship between attitudes toward sex and personality structure, preference for male or female sex symbols was correlated with responses on a personality questionnaire. Pairs of pictures each showing one male and one female symbol were presented to 119 female undergraduates, who indicated their "aesthetic" preference in each pair. Scores were assigned to the female symbols.

The group was divided into a low and a high half. Relationships between responses to each of the questionnaire items and both the score groups were tested by the Chi Square method.

Sixteen questionnaire items proved significant on the 5 per cent. level or better. Considering all of these differences together, it was concluded that girls preferring male symbols were more mature, i.e. accepted their role as women and accepted men as their counterpart, while girls preferring female symbols were less mature.

(Author's abstr.)

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The Human Pyramidal Tract. XIV. A Study of the Representation of the Cortico-spinal Components in the Spinal Cord.

1. Many fibers remain in the pyramidal tract area of the spinal cord following unilateral hemispherectomy which causes practically complete degeneration of descending fibers within the pyramids.
2. Relatively more fibers are left intact in the cord area in the crossed or lateral than in the direct or ventral cortico-spinal component.
3. It is believed that, on a numerical basis, the ventral cortico-spinal tract may be important.
4. Lesions in the pyramidal tract area of the spinal cord must affect fibers other than those arising from the cerebral cortex of one side.

(Authors' abstr.)

The Cerebellar Nuclear Gray in the Sparrow (Passer domesticus).

1. The cerebellar nuclei in the sparrow constitute on either side a mass of greatly convoluted gray. The degree of convolution has some relation to the

degree of development of the inferior olive in this particular bird, and probably to the degree of activity of which this bird is capable.

2. Such relatively narrow bands of cerebellar gray consisting of various cytologic fields indicate probably the presence of specific functional areas.

(Author's abstr.)

The Ponto-cerebellar Projection in the Rabbit and Cat. Experimental Investigations.

By means of a modified Gudden method (Brodal, 1939, 1940) the retrograde changes in the pontine nuclei (griseum pontis) following circumscribed lesions of the cerebellum are studied in cats and rabbits.

After a survey of the normal anatomy of the pontine nuclei in the species employed in this investigation the principal features of the cellular changes are analyzed. The findings in the individual experiments are presented diagrammatically.

The existing discrepancies between some of the earlier authors and our own results on certain points are analyzed and discussed. The more important conclusions reached on the basis of the present study are the following :

1. All parts of the cerebellar cortex, probably excepting only the flocculo-nodular lobe, receive pontine fibers.

2. The vermis receives a good many ponto-cerebellar fibers, although the relative amount of fibers to the vermis is by far not so abundant as to the ansoparamedian lobule.

3. A considerable mass of the ponto-cerebellar fibers pass to the paraflocculus, especially in the rabbit. The paraflocculus has a comparatively well circumscribed area of projection in the pontine gray.

4. The ponto-cerebellar fibers connect the nuclei of the griseum pontis partly with the homolateral half of the cerebellum, partly with the contralateral half. The homolateral connections are proportionately more prominent in the projection on the vermis.

5. The major cerebellar subdivisions receive the bulk of their fibers from distinct, but rather diffusely delimited areas of the pontine nuclei.

6. The dorsal and rostral parts of the nucleus reticularis tegmenti have no cerebellopetal connections.

7. The concept of neo- and paleocerebellum (Edinger) is discussed in the light of the demonstrated pontine connections with the vermis and the paraflocculus. It appears most practical to reserve the term neocerebellum for those parts of the cerebellum which are characterized not only positively by receiving "pontine fibers predominantly" (Larsell), but also negatively by the absence of spino-cerebellar and vestibulo-cerebellar fibers as well. The neocerebellum thus will comprise Ingvar's lobus medius, the lateral parts of the anterior lobe and the paraflocculus.

8. The significance of the presence of pontine fibers also to paleocerebellar division is discussed. No doubt their presence may give hints as regards the understanding of cerebellar function, demonstrating as it does that also the older parts of the cerebellum may be influenced from the cerebral cortex.

(Authors' abstr.)

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Effects of Anoxia on Performance at Several Simulated Altitudes.

Critical flicker frequency and perimetry can be used to detect changes in performance of small groups of Ss under anoxic conditions (10,000 ft. and above). Body sway can be employed to demonstrate differences in performance at 14,000 ft. and above. The magnitudes of most of these changes are such that individual scores are within the normal distribution of values at sea level, and thus cannot be used as criteria, in a clinical sense, of the extent of anoxia in the individual.

Body sway increased markedly in Ss about to collapse, and suggests a possible use of the test as an indicator of acute anoxia. Perimetry and critical flicker frequency were not significantly altered in these Ss at this time as compared with the performance of other Ss under comparable anoxic conditions. Apparently the visual functions do not reflect factors determining imminent collapse of an S due to anoxia, but rather, appear to follow the blood oxygen tensions.

The lack of correlation among performance decrements in the tests suggests considerable variation in the underlying physiological adjustments to anoxia. Hence, it would seem desirable to use groups of Ss and several measures of performance requiring various levels of activity when attempting to relate personnel efficiency to anoxic stress. These procedures are indicated because of the intra-individual variability and the lack of high inter-correlation of performance decrements.
(Authors' abstr.)

An Empirical Test of a Derived Measure of Changes in Skin Resistance.

The usual measure of the galvanic skin response (GSR) is in terms of a change in skin resistance, measured in ohms. The change of resistance, however, is directly related to the level of skin resistance just before the change. If the GSR scores (in ohms resistance) are grouped according to the general level of skin resistance at the time the measure is taken, it is found that both the means and the sigmas of these distributions increase as the general level of skin resistance increases. With this type of relation, it is impossible to make statements concerning the relative size of one GSR score as compared with another GSR score falling at another resistance level.

From the direct measurement of the change in ohms resistance a measure of the GSR may be derived which is independent of the general level of skin resistance. This derived measure is—

$$\frac{\log \text{GSR} + k}{\text{level of skin resistance}} \times 100.$$

If these derived measures are grouped according to the general level of skin resistance, both the means and the sigmas of the distributions are independent of the general level of resistance. Furthermore, the sigmas are independent of the means. This derived measure gives a double distribution of scores: one of these distributions approximates the normal distribution of scores, while the other seems to be a distribution of zero scores (i.e. small random fluctuations).

In practical application of this refinement, a conversion table is constructed which is used to convert the ohms resistance scores into the derived measure. The table is entered with the general level of skin resistance and the ohmic change in skin resistance, and the derived (or corrected) GSR measure is obtained directly.
(Authors' abstr.)

An Attempt to Correlate the Occipital Alpha Frequency of the Electroencephalogram with Performance on a Mental Ability Test.

1. In 1,100 adult subjects no significant correlation was found between the occipital alpha frequency of the EEG and the score on a group test of mental ability (the R.C.A.F. Classification Test).

2. It was suggested that, if the positive correlations found by other investigators for eight-year-old normal children and mental deficient are representative of a true relationship, the developmental change in alpha rhythm may be associated with a change in mental age only to a critical mental age level, presumably between eight and twelve years.
(Author's abstr.)

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A Quantitative Approach to the Study of Responses of Psychotics in the Completion of Figures Involving Visual and Motor Responses.

1. A quantitative analysis of the responses made by 40 controls, 30 manic-depressives, and 30 schizophrenics in completing eight figures, involving visual and motor components, was performed in order to determine the perceptual principles which govern the atypical responses of the psychotics.

2. All of the differences which the manic-depressives displayed from the controls and the schizophrenics in completing some of the figures can be accounted for by an increase in motor activity. The schizophrenics completed some of the figures in such fashion as to indicate a decrease in motor activity.

3. The methods used by the schizophrenics to complete some of the figures also showed that the perceptual process was affected. The principle underlying this process appears to be due to the "patterning of stimuli," i.e. the relationship and position of the responses to each other. These atypical patterns, although differing from the patterns used by the controls and the manic-depressives, are used with a great deal of consistency by each schizophrenic patient.

4. It is pointed out that the use of tests which require motor manipulation to study perception can be interpreted only if the effect of the motor component in the test situation is known, and that should such motor elements be eliminated from the test situation, the possibility exists that manic-depressives would show characteristic differences in perception. (Authors' abstr.)

Respiration and Blood Pressure in Sensory Motor Conflict.

The following inferences are tentative, subject to verification on a larger group of subjects, and should be considered as hypothetical trends:

1. The relations between basal time and error scores, and their respective increments under conflict, may involve such personality factors as frustrationality, impulsiveness and prudence.

2. The relation between time and error scores in this experiment may prove to be an indicator of orientive-emotional balance. For example, if a mounting error score fails greatly to affect the time score under conflict, the subject may be considered as well-adjusted to the task, i.e., efficiently reorienting his visuo-motor mechanisms without emotional disruption.

3. The Woodworth I-fraction at rest and the error score with direct vision may be indicators of frustrationality and emotionality, i.e., susceptibility to frustration and potential emotional activity for the conditions of this experiment.

4. The circulatory and respiratory indices each reflect a respective category of psychological change: the former predominantly emotive, and the latter orientive. In the case of respiration, the amplitude and I-fraction seem to be disparate.

5. Some subjects apparently exhibit less emotional activity directly after conflict than during the pre-conflict rest period.

Empirical evidence is presented with reference to the continuous curvilinear relationship presumed, by Jenkins and the author, to exist between emotion and orientation. It is suggested that further study of a theoretical and normative nature be directed toward the elucidation of the limen of orientive breakdown. The concept of "orientive breakdown limen" is proposed as an index of frustrationality and emotionality. (Author's abstr.)

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Studies on Neuromuscular Dysfunction.

(1) Neostigmine has been administered to 11 patients who had developed hemiplegia 1 to 31 years before. Definite improvement was observed in all of these cases, and in a few of them the improvement was marked. Improvement was retained after therapy was discontinued.

(2) Eight patients who had suffered from hemiplegia for a period of six weeks to five months were treated with neostigmine. Acceleration of recovery of motor function was observed in a number of these cases.

(3) Six patients with the spastic type of cerebral palsy were given neostigmine. Three children all showed significant improvement, while of three adults, aged 23 to 33 years, only one showed definite slight improvement from this therapy.

(4) Three patients with the athetoid type of cerebral palsy (adults aged 20 to 31) all showed significant improvement from neostigmine therapy.

(5) Two children with mild ataxia, one of whom was a case of cerebral palsy with severe stuttering and the other of whom had had a subarachnoid hemorrhage at the age of 1½ years, improved remarkably on neostigmine.

(6) Definite improvement from neostigmine occurred in ataxia and facial paralysis in a patient who had had an acoustic neuroma removed more than three years before. Moderate improvement was observed in a disability of the upper extremity in a patient who had had a prolapsed cervical disc removed four months previously. One patient with pseudohypertrophic muscular dystrophy derived no benefit from neostigmine.

(7) Three patients with lesions of the spinal cord were treated with neostigmine with slight or no improvement.

(8) Neostigmine has been found to decrease spasticity, thereby decreasing resistance to passive motion, increasing range of joint motion, relieving muscular pain and decreasing deformity. This drug facilitates voluntary motion, resulting in restoration of motions which had long been absent, increasing strength, improving co-ordination and diminishing fatigue. In addition, neostigmine has resulted in definite improvement in athetosis, ataxia, dysphagia, dysarthria, facial paralysis, motor aphasia (one case), and in conscious proprioception from a variety of types of lesions of the brain. Improvement has been retained after therapy was discontinued.

(9) For maximal functional recovery, neostigmine therapy should be accompanied by exercise and muscle training.

(10) The mechanism of the therapeutic action of neostigmine in patients with chronic brain lesions is discussed. Since the lesion itself is irreversible because of the lack of capacity of the brain for regeneration, the drug can only facilitate the taking over of lost functions by alternate remaining brain pathways. Evidence is presented that the locus of the therapeutic action of neostigmine in these cases is on the central nervous system. (Authors' abstr.)

Electronarcosis: Its Application and Therapeutic Effect in Schizophrenia.

(1) Electronarcosis, previously shown to be a clinically feasible procedure, was applied to 47 patients suffering from schizophrenia, in order to determine whether this procedure would provide a simple and effective method to treat this condition.

(2) The clinical procedure for applying electronarcosis is described in detail.

(3) The patients treated were classified according to type and duration of the illness.

(4) One month after termination of treatment there were 19 complete recoveries, 16 social recoveries and 7 failures. Of special interest were 13 patients in which the disease had a gradual onset; of these 6 recovered and 5 were social recoveries. Those patients whose illness was of more than two years' duration contributed 4 of the 7 failures. In the entire group a check-up after six months revealed that of the 35 satisfactory results 6 had relapsed.

(5) Though over 1,400 treatments were given, no important complications were encountered. (Authors' abstr.)

Histamine Therapy in Multiple Sclerosis.

The use of histamine intravenously in the treatment of 20 cases of multiple sclerosis is reported. Seventeen of these cases failed to show any improvement. Three cases showed only temporary improvement of less than six months and then relapsed. Certain relationships between clinical allergies and multiple sclerosis were discussed. Despite the histopathological similarities between these conditions, the clinical approach to the two conditions seems quite distinct. (Author's abstr.)

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Aphasia, Apraxia and Agnosia.

A reclassification of aphasias, apraxias and agnosias is presented, with three levels of psychic integration above those of sensation and the muscle contraction. The first level, the syntactic, is that of the relation between spatially and temporally adjacent sense data on the sensory side and between simultaneous muscle contractions on the motor side. The second level, the semantic, is that of the relation of sense patterns to memories on the sensory side, and of the relation of memories and ideas to motor patterns on the motor side. The sensory process at this level is one of recognition, recall or labelling of sense patterns, while the motor process is one of the choice of reaction patterns as determined by the verbal or skeletal action plan previously formulated. The third level, the pragmatic, is that of the relations between memories and ideas on both the sensory and motor sides, and is the level of the comprehension of the sensory situation and of the comprehension of and development of a plan of action for the motor situation.

Further terminological simplification is proposed in a plan to limit the term "aphasia" to defects at the pragmatic level, whether verbal or non-verbal, with

the application of the term "agnosia" to all syntactic and semantic sensory disorders, and assignment of the term "apraxia" to all syntactic and semantic motor disorders. (Author's abstr.)

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Thalamic Degeneration following Bilateral Premotor Frontal Lobe Atrophy of the Strumpell Type.

In the brain of an epileptic imbecile atrophy of the cerebral cortex involved the major part of both frontal lobes exclusive of the precentral gyri. Clinically there was no gross locomotor defect. The right side of the brain was examined in detail. It was found that the Betz-cell containing Area 4 and the greater part of the agranular frontal cortex (Area 6) were intact. In the thalamus severe retrograde degeneration implicated the whole of the dorso-medial nucleus, and also the medial third of the anterior part of the ventro-lateral nucleus.

Comparison with the experimental findings in monkey and ape suggests that with the expansion of the frontal lobes associated with rise in the evolutionary scale, so the projection field of the anterior ventro-lateral nucleus shifts progressively in a frontal direction. (Author's abstr.)

Rhythmic Slow Discharges in the Electroencephalogram.

1,316 cases have been scrutinized for—

- (1) Rhythmic slow activity (upper limit 4/sec.).
- (2) Spike-and-wave complexes of all kinds.
- (3) Blocking by eye-opening, or augmentation by eye-closing of all rhythms slower than 8/sec.

The factors involved in the segregation of these groups are discussed.

Apart from one case all reactions to visual stimuli (28) occurred in "rhythmic delta" cases, of which there were 71, composed of 26 idiopathic epileptics, 20 tumours and one abscess, 17 head injuries, and 7 unclassified.

In all groups there was clear correlation with youth.

Wide variation in spike-and-wave activity makes it impossible to draw any line between it and simple delta rhythms. Some "spike-and-wave" appears to be random and some more or less focal, but it is commonly bilaterally synchronous and usually frontal. In two epileptics a delta rhythm which responded to visual stimuli was definitely occipital.

In "organic" cases the delta rhythms are either unilateral and correspond with the site of the lesion, or bilaterally synchronous and occipital. Among the latter there is correlation, definite in tumours and probable in the remainder, with lesions of the epithalamic region. No correlation is found with raised intracranial pressure or internal hydrocephalus.

Response to visual stimuli may occur in unilateral or bilateral rhythms; in the former it is almost confined to the left side.

Despite the similarity of the "organic" delta rhythms to those occurring in epilepsy, no correlation whatever is found in the tumour group between epilepsy and rhythmic delta activity; nor is this correlation apparent in the head injury group, but incomplete follow-up renders this less definite.

Correlation with a short interval between injury and recording is almost complete. Distinction between "organic" and epileptic delta rhythms is not possible in borderline cases, but the epileptic outburst tends to be less continuous and more sharply paroxysmal, while the spike-and-wave complex is rarely associated with organic lesions. (Author's abstr.)

The Effect of Age, Head Resistance and Other Physical Factors on the Stimulus Threshold of Electrically Induced Convulsions.

1. Using a constant stimulating voltage the threshold duration of stimulus for induced convulsions was determined in 70 psychotic subjects.

2. Convulsion threshold was found not to be correlated directly with height, weight, or size of head (inter-electrode distance).

3. A positive correlation was found between threshold and head resistance, and between threshold and age, but not between age and head resistance. There is no reason to suspect that the relation between threshold and age is not linear.

4. Convulsion threshold is determined by more factors than age and head resistance, but the data permit no speculation about the nature, number, or importance of these other factors.

5. A parallel is drawn between the rise in the electrical convulsion threshold of the C.N.S. during the third and fourth decades of life and increasing stability of behaviour over the same period. (Author's abstr.)

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The Effects of Local Applications of Acetylcholine to the Acoustic Cortex.

Application of acetylcholine to the acoustic cortex of cats results in a period of depression of electrical activity with decreased response to auditory stimuli, followed by a period of spontaneous ACh discharges and a heightened response to auditory stimuli. Distant responses to auditory stimulation can be obtained. ACh discharges can be inhibited by repeated auditory stimulation. Correlations between the acetylcholine treated cortex and the cortex of epileptics are discussed. (Authors' abstr.)

Cortical Cerebellar Atrophy without Ataxia.

Parenchymatous cortical cerebellar degeneration may be a primary disorder or it may be secondary to degeneration elsewhere in the nervous system.

The degeneration may affect only one type of cell exclusively or predominantly, such as the granule cell or the Purkinjê cell for example, or it may affect all types of parenchymatous elements.

Parenchymatous cortical cerebellar degeneration is to be looked upon as a histopathological state and not as a disease entity, for it may be found in a variety of disorders.

Sharply circumscribed areas of primary cortical cerebellar atrophy characterized by degeneration of the parenchymatous elements and secondary gliosis probably represent the end state of a degenerative process. The pathogenesis is unknown, and many factors, particularly pressure, may play an important role in its causation.

This disorder may be asymptomatic and be discovered accidentally at necropsy. (Authors' abstr.)

Terminal Degeneration Within the Central Nervous System as Studied by a New Silver Method.

The reported silver method differs from the Bielschowsky method in two main respects: Different concentration of silver nitrate is employed and a preliminary treatment of the sections with the ammonia-alcohol solution is introduced. This procedure dissolves the greater part of the myelin and thus provides the basis for a much more evenly stained section. Other advantages of the method are the perfect staining of the myelinated and non-myelinated fibers and the light brown colour of the nerve cells. The latter allows the more intimate study of the relation between the surrounding nerve fibers and the nerve cell protoplasm.

The Gros modification of the Bielschowsky method uses an ammonia silver nitrate solution as reducer, and therefore tends to stain the nerve cells completely black. Such a simple agent as alcohol, however, prevents the reduction when added to the ammonia-silver nitrate solution, and reduction only takes place in the final 10 per cent. formalin solution. As the result of this the otherwise spotty appearance of the section is prevented and the staining process is considerably stabilized.

For the study of the finer plexus of the corpus striatum the above-described silver stain was the only one which revealed the finest axonal arborizations, whereas all the other commonly used methods gave only a poor impregnation. When studying the fiber degeneration of fine non-medullated fibers, it is of the greatest importance to have at one's disposal a method which permits a clear distinction between degenerated and normal fibers. Some methods, such as the Cajal technique, tend to stain normal fibers in a granular fashion, making it exceedingly difficult to decide whether a fine fiber is normal or degenerated. This difficulty of discrimination, however, is avoided in the method described above.

As has been pointed out in the introduction, the term "terminal degeneration" is used to cover the degeneration of the bouton type ending and the free ending. The bouton type of degeneration within the spinal cord is, on the whole, very conspicuous, due to the abundance of terminal rings in the normal state. Numerous examinations of the cat's spinal cord have convinced us that the most common morphological expression of the synapse in establishing contact with anterior horn cells or internuncial neurons is the ring-like end formation. This view has been arrived at not only by means of the technique reported above, but also by other variations of the silver impregnation methods.

The picture of the cerebral cortex, however, differs greatly from that of the spinal cord. Even with careful examination of the normal cerebral cortex it is difficult to demonstrate ring-like endings. Their possible existence cannot, however, be denied, and a special study devoted to this problem is at present in progress. It seems that the synapse within the cortex is mainly represented by free terminals of the pericellular plexus. However, recent experiments have proved that the absence of the terminal rings is in itself not an impediment in the search for terminal degeneration.

Experiments show that pericellular degenerations can also be detected around Betz cells after interference with intracortical connections. Because of the intricate nature of the morphological aspect of the synapse, much more work is required for an understanding of the cortical synapse. This necessity of studying the cortical synapse in particular has been stressed recently by O'Leary (1944) in his contribution to publications on the precentral motor cortex. (Author's abstr.)

Effect of Extirpation of Parastriate Cortex on Learned Visual Discrimination in Monkeys.

Monkeys have been trained to discriminate between pairs of visual stimuli on the basis of size, shape and color. Monkeys so trained lose the discrimination habit if areas 18 and 19 are destroyed bilaterally in one stage. The discrimination can then be relearned post-operatively at approximately the same rate as originally. If the cortical destruction is carried out in two stages with an interval between (in this case 18 days) during which testing is continued, the habit is lost after neither the first nor second operation. (Author's abstr.)

The Pyramidal Tract. The Representation of the Lateral Corticospinal Component in the Spinal Cord of the Cat.

1. Very few, if any, fibers of the crossed pyramidal tract extend throughout the entire length of the spinal cord in the cat.
2. The tract terminates largely in the upper two-thirds of the spinal cord.
3. There is evidence that many of its fibers terminate high in the cervical region of the cord.
4. Many fibers are normally present in the pyramidal area of the cord which do not belong to any part of the pyramidal system, including the so-called homolateral corticospinal component.
5. Degeneration of axons of the pyramidal tracts in the cat was detected as early as three days by the protargol method of staining.
6. Cellular activity of the supporting elements continues for nine months or more in the pyramids following massive, cortical ablation.
7. In its phylogenetic development the pyramidal tract in the cat appears to occupy a position intermediate between the lower mammals and man. (Author's abstr.)

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Central Nervous System Resistance.

A survey of the literature revealed that although several investigators have reported effects of cerebral anemia, they were not able to produce a complete anemia and their results were variable. It was also noted that other types of deficiency in substances normally brought to the brain, such as hypoglycemia, vitamin B deficiency, inanition, CO poisoning, etc., often produce lesions in the brain which, in many instances, resemble those of the present investigation.

Animals were subjected to periods of complete arrest of the cerebral circulation of two, four, six, eight and ten minutes.

Susceptibility differences are marked in different areas of the brain, and a certain degree of local selectivity or specificity of lesions is evident.

There appears to be a gradient of resistance, which from lowest to highest degree of resistance is as follows: Cerebral cortex (*isocortex*), cerebellar cortex (Purkinjé cells), sensory and integrative centers of brain stem, pons and medulla oblongata, cerebral cortex (*allocortex*), and finally, large motor cells of brain stem, pons, medulla oblongata, and spinal cord.

Some possible significant bases of the cell and blood-vessel changes are discussed. It is felt that, since the lesions appear in many cases restricted to anatomic units (nuclei), these groups may be not only morphological, but also metabolic units.

It is pointed out that the extreme sensitivity of the brain to ischemia and anemia is of great clinical importance, and that lesions observed clinically are often similar to those reported. It is, however, important to consider the technique used, as a

tool for the study of electrical and metabolic changes of the brain under conditions of increasing severity of anemia and blood stasis. Such studies, it is hoped, will lead not only to information of clinical value, but also to data clarifying the basic relationships between abnormalities of structure and function. (Author's abstr.)

Cerebral Cortex in Very Old Human Brain.

The overwhelming majority of very old brains showed at least some degree of cortical atrophy, diffused or regional in distribution. The degree of cortical atrophy was not necessarily proportionate to the age of the patient. The cyto-architecture was surprisingly well preserved in the very old brains, the three types of pyramidization, granularization and spindlization being as obvious as in juvenile and adult ones. Cell changes were consistently present in the very old brains. The cell changes, however, were not proportionate to the age of the patient. Neither the degree of cortical atrophy nor the extent of cell destruction was proportionate to the duration of the clinical history.

There was no constant vulnerability of one of the three cell types, although in some instances the pyramidal cells seemed more vulnerable than the granular and the spindle cells.

Satellitosis was not a constant feature in the very old brain. There was no parallelism between the degree of cell destruction and satellitosis. The latter showed a definite predilection for the anterior parts of the brain. All the anatomical features described occurred regardless of the type of the clinical picture.

(Author's abstr.)

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Reflex Pupillodilator Mechanisms.

Parasympathetic denervation of the eye results in marked enlargement of the pupil, but not in its maximal dilatation. Maximal pupillary dilatation probably requires active contraction of the radial muscle of the iris, which is innervated through sympathetic nerves.

Peripheral pain producing stimulation elicits moderate reflex dilatation of the pupil. This reaction is not altered by sympathetic denervation of the eye, but is abolished by section of the oculomotor nerve or extirpation of the ciliary ganglion; consequently, it is mediated through the parasympathetic nerves.

Strong stimulation of the hind foot or the exposed sciatic nerve, following transection of the spinal cord in the lower cervical region, resulted in slight enlargement of the pupil in some animals under nembutal anesthesia, but not in unanesthetized animals. This response in the anesthetized animals apparently indicates increased excitability of the ciliospinal center due to the anesthetic agent.

Following dilatation of the pupil due to atropine depression of the cholinergic innervation of the iris, moderate stimulation of the oculomotor nerve elicits further pupillary dilatation. The reflex pupillodilator response elicited by peripheral stimulation is greatly reduced following incomplete depression of the adrenergic nerves by the intravenous administration of ergotoxine. These results support the assumption that the pupillodilator reaction mediated through the mesencephalic parasympathetic center is actively integrated and controlled. The inhibition of the circular muscle of the iris is brought about, not by inhibition of the parasympathetic center, but by activation of this center which results in the discharge of efferent nerve impulses through adrenergic fibers arising in the ciliary ganglion.

(Authors' abstr.)

Effects of Inhibitors of Choline Esterase on the Nerve Action Potential.

The effect of choline esterase inhibitors on the nerve action potential has been studied. The preparations used were the giant axon and the fin nerve of the squid.

1. Eserine alters and, in sufficiently high concentration, abolishes within 15 minutes the action potential of both the giant axon and the fin nerve. This is consistent with the concept that ACh is the depolarizing agent released during the passage of the impulse. In that case the physiological role of choline esterase should be the rapid removal of the ester, and consequently, inhibition of the enzyme should result in enduring depolarization and therefore abolition of conductivity.

2. The effect described is easily reversible. This had to be postulated if it is the inhibition of the enzyme which is responsible, since the inhibition of choline esterase by eserine is easily reversible *in vitro*.

3. In contrast to eserine, prostigmine has no effect on the nerve action potential, although both compounds have the same powerful inhibitory effect on choline esterase *in vitro*. Eserine is a tertiary amine which, in its undissociated form, can pass through the lipid membrane. Prostigmine is a quaternary ammonium compound and cannot penetrate a lipid membrane. This has been shown experimentally.

4. Strychnine, another chemical with a high affinity for choline esterase, also alters and then abolishes the nerve action potential reversibly.

5. Cocaine and procaine first depress the action potential and then, as is well known clinically, abolish conductivity reversibly. They act in concentrations so low as to make it improbable that the effect is due to inhibition of choline esterase.

6. The observations explain why ACh, a quaternary ammonium compound, does not act if applied to the axon externally but does at the nerve ending; there the absence of a myelin sheath makes penetration possible. They are consistent with the concept that the physico-chemical mechanism of conduction of the impulse along the axon does not differ fundamentally from its transmission across synapses.

(Authors' abstr.)

The Mechanism of the Electrophonic Effect.

1. Monaural beats may arise when an electrical and a mechanical stimulus are applied to the same ear.

2. The psychological attributes ascribed to the sensations produced by the interaction of two stimuli with varying degrees of difference in their frequencies are essentially similar whether two mechanical stimuli or a mechanical and an electrical stimulus is employed.

3. When a mechanical and an electrical stimulus of identical frequency are applied to the ear it is possible to cancel the one by adjusting the phase and intensity of the other.

These three facts are considered evidence that the two types of stimuli, mechanical and electrical, activate the same cochlear element and that the activating force is mechanical in both instances.

4. When two distinct tones differing in frequency by a few cycles are simultaneously presented to the same ear, and the phase of one of them abruptly reversed, an interruption in the continuity of both stimuli is observed.

This is taken as evidence that the basilar membrane is critically damped.

(Author's abstr.)

Rapid Changes in Cerebral Oxygen Tension Induced by Altering the Oxygenation and Circulation of the Blood.

With a platinum electrode, salt bridge and suitably adjusted voltage it is possible to record the oxygen tension of tissue *in vivo* as a function of the amperage. By this method studies were carried out on the cortices of cats anaesthetized with dial and immobilized with Beta erythroidine. A decrease in cortical oxygen tension invariably followed erythroidinization; this was believed to be due to a decrease in cerebral blood flow secondary to a decrease in systemic blood pressure. When adrenalin or ephedrine were administered, an increase in cerebral oxygen tension occurred; this was believed to be due to an increase in cerebral blood flow secondary to a rise in systemic blood pressure. Amyl nitrite caused a fall

in oxygen tension, probably secondary to the fall in systemic blood pressure. Ergotamine tartrate and nicotinic acid had insignificant effects. Inhalation of nitrogen produced a precipitous fall in cortical oxygen tension to a low level, which was considered asphyxial. With the readmission of air, the cerebral oxygen tension rose rapidly to a level above that observed before asphyxiation. Breathing O₂ raised the cerebral oxygen tension. (Authors' abstr.).

Carbonic Anhydrase in the Nervous System.

Thiophene-2-sulfonamide in concentrations of 27 mgm. per cent. or higher has no effect on several properties and functions of the axone, the spinal cord or the cortex. Since the carbonic anhydrase of the nervous system is inhibited more than 99.99 per cent. by these concentrations of the drug, it is concluded that the catalyzed hydration and dehydration of carbon dioxide are not essential reactions in the nervous system. (Author's abstr.).

The Effect of Cellular Hydration on Experimental Electroshock Convulsions.

1. Cellular hydration produced in rats by depletion of 40 per cent. of extracellular electrolyte without change in total body water lowers the electroshock seizure threshold by an average of 56 per cent.

2. Cellular hydration produced to an equal degree by orally administered water lowers the electroshock seizure threshold to an equal extent.

3. Combination of these two methods of cellular hydration produces a synergistic reduction in threshold for electroshock convulsions, and spontaneous seizures may occur.

4. The threshold for metrazol convulsions is reduced in hydrated rats to the same extent as the threshold for electroshock seizures.

5. Rapid electrolyte replacement increases the electroshock threshold to normal and above. An equivalent amount of electrolyte given to normal rats raises the normal seizure threshold.

6. An increase in extracellular fluid volume without alteration of cell volume or electrolyte concentration does not lower the convulsive threshold.

7. It is concluded that cellular hydration decreases and cellular dehydration increases the seizure level independently of changes in volume of extracellular fluid.

8. Not all anti-epileptic drugs can be shown to raise the normal electroshock convulsive threshold. This is particularly true of diphenylhydantoin. In contrast, diphenylhydantoin as well as phenobarbital and tridione significantly elevate the electroshock threshold lowered by cellular hydration.

9. A method for the laboratory assay of anti-epileptic drugs is suggested which is superior to that employing the normal electroshock seizure threshold.

(Authors' abstr.).

Recovery of Motor Function after Two-stage Extirpation of Area 4 in Monkeys (Macaca mulatta).

A phenomenon of bilateral compensation of the effects of unilateral lesions of area 4 is reported, such that if area 4 of the remaining hemisphere is removed after a suitable delay (3 to 4 months), none of the usual signs of pyramidal injury appear. Such compensation occurs as well in the absence of callosal connections, but is prevented if areas 3, 1 and 2 are also removed. A possible participation of the premotor cortex in the process of compensation is also discussed.

(Authors' abstr.).

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- *Pyruvic Acid Exchange of the Brain. *Himwich, W. A., and H. E.* 133

Effect on the Electroencephalogram of Localized Pressure on the Brain.

1. A new method for the experimental production of seizure patterns has been introduced.

2. Slowly increasing localized cortical pressure produced the following abnormalities in the EEG pattern: (i) seizure patterns; (ii) associated seizure patterns consisting of fast and slow waves, as well as spikes; (iii) delta or slow waves, below 5 cycles per second; (iv) combination wave patterns consisting of fast waves superimposed on delta waves; (v) flat waves wherein the voltage was reduced to below 20 microvolts.

3. The seizure, and associated seizure patterns, showed involvement of all three electrodes in 47.5 per cent.

4. The seizure, and associated seizure patterns, were definitely localized to the pressure electrode in 42.5 per cent.

5. Ninety-five per cent. of the seizure, and associated seizure patterns, involved the pressure-electrode.

6. During a paroxysm single or multiple patterns were observed.

7. The incidence of seizure patterns occurred more frequently during compression than during release.

8. The delta waves, flat waves and combination waves were primarily confined to the pressure electrode.

9. Delta voltage increased during compression until approximately the fourth turn; then the voltage decreased. During release the delta voltage slowly increased.

10. The incidence of flat waves increased in direct relation to the degree of compression.

11. The incidence of combination waves slowly increased until the sixth turn of compression, then decreased. Combination waves were absent during the release stage.
(Authors' abstr.)

Eye Movements following Strychninization of the Superior Colliculus of Cats.

1. The path of reflex attraction of the eyes toward a light in the peripheral visual field is activated in anesthetized cats by strychninizing a small area of the superior colliculus and flashing a light into either eye.

2. Each point on the superior colliculus is found to regulate movement of the eyes to a particular part of the visual field, medial points causing upward lateral movements, lateral points causing downward lateral movements, each colliculus always causing movements to the contralateral visual field.

3. The superior colliculus regulates reflex conjugate eye movements by causing relaxation of antagonist muscles as well as contraction of agonist muscles of the eyes.

4. The superior colliculus charted for control of localized eye movement compares well with the superior colliculus charted for the projection of the visual field on the colliculus.
(Author's abstr.)

Synaptic Potentials of Motoneurons.

Motoneurons of the cat's or frog's spinal cord have been subjected to direct synaptic excitation by a single synchronous volley of impulses, and the resulting potential changes have been recorded from the ventral root fibres as they emerge from the spinal cord.

When synaptic transmission of impulses is blocked by a sufficiently deep anaesthesia, a negative potential change is still set up in the motoneurons and propagated electrotonically along the ventral root fibres. This catelectrotonic potential (called the synaptic potential) is shown to be homologous with the endplate potential of striated muscle and the synaptic potential of sympathetic ganglia. The mean durations of latent period, the rising phase, and the half-time of the exponential decay are respectively 0.7, 2.5 and 5.2 msec. (cat), and 1.5, 5.0 and 29 msec. (frog). The synaptic potential is decrementally transmitted along the ventral root, halving approximately in every 4.5 mm. (cat) and becoming slower in time course.

There is summation of synaptic potentials set up by two volleys, or by repetitive stimulation. Even at the highest frequency (200 per second—frog, 400 per second—cat) cessation of stimulation has been followed by a prompt delay, there being no sign of any enduring depolarizing action, such as occurs in sympathetic ganglia.

In the unanaesthetized preparation the synaptic potential begins at least 0.2 to 0.3 msec. before the discharge of impulses by the motoneurons.

When synaptic transmission of single volleys is just blocked by anaesthesia, a discharge is still produced by a second volley at a short interval—up to 15 msec. in the cat. The size and latent period of this facilitated response show the variation with stimulus interval that would be expected if facilitation were due to summation of the synaptic potentials. Owing, apparently, to an accommodation-like process, the threshold is set by the slope of the summed potential, as well as its absolute value.

Similarly, synaptic transmission to a single nerve volley occurs as if the synaptic potential were the causal factor in setting up the discharge of impulses from motoneurons.

There is no evidence of any synaptic excitatory mechanism other than the synaptic potential. The sole factors governing synaptic transmission would appear to be the synaptic potential (acting simply as a catelectrotonus) and the stability of the motoneurone's surface membrane. The anaesthetic nembutal, blocks transmission largely by increasing the stability of the membrane, but also partly by diminishing the production of synaptic potential. It has no appreciable action on the time course of the synaptic potential.

Analysis of the synaptic potential by means of the local potential theory gives a short duration for the synaptic transmitter action, especially when allowance is made for electrotonic distortion of the synaptic potentials during their intramedullary transmission. The average values for total duration are 2 msec. (cat) and 4 msec. (frog). No appreciable lengthening of this duration is observed after rapid repetitive stimulation.

Curarine has a strychnine-like action on the spinal cord.

Eserine, even in large doses, has no effect on single or repetitive synaptic potentials. This finding is considered in relationship with the evidence so far adduced that acetylcholine is the synaptic transmitter, and it is concluded that acetylcholine probably plays no significant role in synaptic transmission in the spinal cord. The evidence presented in this paper accords with the hypothesis that synaptic transmission in the spinal cord is due to the action currents of the presynaptic impulses. (Author's abstr.)

The Pyramidal Tract. Effect of Maximal Injury on Acid Phosphatase Content in Neurons of Cats.

1. This study demonstrates that the acid phosphatase technic is a delicate method for determining the integrity, and course of subsequent degeneration, of the axis-cylinders following maximal injury to the cells of origin.

2. The enzyme disappears from the axons of the pyramidal tract of the cat between the second and third day following cortical removal. The largest axis-cylinders are more sensitive, and thus disappear faster than the medium- or small-sized fibers.

3. Once disappeared the acid phosphatase does not reform or reappear throughout the prolonged process of secondary degeneration. This has been followed for as long as one year post-operative.

4. The occurrence of the enzyme within the axon is discussed in relation to certain other recent studies on nerve cells, as well as indicating the possible significance of the axis-cylinder in the maintenance of the myelin sheath. (Authors' abstr.)

A Cortico-bulbo-reticular Pathway from Area 4-s.

By strychninizing the cortex and recording the electrical activity of the brain stem of the monkey, a pathway has been found to arise from area 4-s and diverge from the cortico-spinal tract in the pons to reach the bulbar reticular formation. From its known physiological properties this cortico-bulbo-reticular pathway is an extrapyramidal system mediating relaxation. (Authors' abstr.)

Pyruvic Acid Exchange of the Brain.

A study of the pyruvic acid exchange of the brain of 41 patients shows that small, but significant amounts of pyruvic acid, averaging 0.22 mgm. per cent. are

added to the cerebral venous blood in the quietly resting human subject in the post-absorptive state. These data support the conclusion that the brain constantly produces some energy without the equivalent utilization of oxygen. The carbohydrate balance of the brain not only includes that portion which is oxidized, but also the part split to lactic and pyruvic acids. (Authors' abstr.)

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Histologic Studies of the Brain following Head Trauma. II. Post-traumatic Petechial and Massive Intracerebral Hemorrhage.

1. Three cases of post-traumatic petechial and massive intracerebral hemorrhages are described in detail clinically and histologically.

2. Brief notes are presented of five other cases demonstrating the presence, in addition to superficial cortical lacerations, of petechial and massive hemorrhages within the deeper structures of the brain.

3. The view is expressed that the deeper forms of hemorrhage result, in part at least, from vasoparalytic phenomena caused by transmission of force from the site of impact to the deeper structures of the brain.

4. The changes described in this paper represent a more severe stage of brain damage than cerebral swelling and edema, described in the first paper of this series. (Authors' abstr.)

Water Content of the Brain after Concussion and its Non-contributory Relation to the Histopathology of Concussion.

Experiments were performed in guinea-pigs to determine whether previously described structural changes and loss of nerve cells in the brain after concussion might be secondary to pressure occasioned by an increase in water content of the brain. An accurate method for quantitative determination of water in brain tissue was developed. Eight and 17 hours after concussion slight though significant increases in the water content of the brains were observed. The maximum increase amounted to only 19 mgm. It was also shown that concussion was not followed by an increase in the rate of formation or the pressure of the cerebrospinal fluid.

In other experiments a highly significant increase in water content of the brain was brought about by administering excessive quantities of water by stomach

tube. A group of animals so treated was permitted to live for a period of time equal to that after which the greatest post-concussional cytological changes were encountered. In controlled histological studies it was demonstrated that no alterations had been produced. It may be concluded that brain edema after simple concussion in the guinea-pig is slight, and does not produce the degenerative changes in neurons that are characteristic of post-concussion.

(Authors' abstr.)

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The Intelligence-Vocabulary Ratio as a Measure of Temperament.

1. The present investigation provides experimental evidence that differential performance on a conceptual and on a vocabulary test of intelligence is related to temperament.

2. The scores of 1,821 male and of 987 female neurotic patients at Mill Hill Emergency Hospital on the Progressive Matrices and on a vocabulary test of the synonym-selection type were used. Difference scores were calculated for each subject, and the case records of patients with a high intelligence-vocabulary ratio compared with those with a low intelligence-vocabulary ratio.

3. Full information was available on 250 men and 200 women with a high intelligence-vocabulary ratio and on 290 men and 140 women with a low intelligence-vocabulary ratio. The former groups were found to contain significantly more patients with a hysterical make-up and symptomatology, and the latter significantly more patients of an anxious or depressed make-up, suffering from anxiety states and/or depression.

4. The groups differed also with respect to age, education, employment and earnings. The low intelligence-vocabulary ratio groups were on the whole younger and of a poorer educational level.

5. The data were reanalyzed by separately equating the groups for age and for education. Certain differences between the older and younger groups and between the elementary-school groups and the secondary-school groups emerged, but these applied equally to the high and to the low intelligence-vocabulary ratio groups.

6. The separation of patients into the hysterical type on the one hand and the anxious and/or depressed on the other was therefore not due to differences in age or educational background, but was based on their differential performance on two cognitive tests.

7. If the score obtained on a vocabulary test be interpreted as a measure of the application of innate intellectual ability, the anxious and depressed patients utilize their intellectual ability significantly more than the hysterics. Since introversion has been held to be correlated with anxiety states and depression and extraversion with hysteria, the investigation points to a possible correlation between introversion and a low intelligence-vocabulary ratio and extraversion and a high intelligence-vocabulary ratio. (Author's abstr.)

Studies in Insulin and Metrazol Therapy. I. The Differential Prognostic Value of Some Psychological Functions.

A battery of psychological tests was given to 70 male schizophrenic patients two weeks before insulin or metrazol shock therapy was instituted. Test scores on the 1916 Stanford-Binet, the Kent-Rosanoff Word Association Test, and a test of aspiration were compared with the relative clinical condition of the patient at various times following treatment until April, 1942, which constituted a period of one to five years after the first examination. In a search for measures which might be prognostic of long-run clinical improvement, a set of 13 signs was found useful in predicting improvement by insulin therapy. The best results were obtained when the individual subject satisfied four or more of these signs. Another set of 11 signs was found useful in predicting improvement by metrazol therapy, the same general degree of dependability being achieved when the individual satisfied six or more of these signs. The most significant index for predicting improvement from insulin treatment was the number of insulin signs satisfied which exceeded the number of metrazol signs satisfied.

Although the insulin and metrazol signs made use of the same measures, the ranges of scores did not overlap. In each case the signs for improvement with insulin therapy are the higher, more nearly normal, whereas the metrazol signs tend in the opposite direction. It would seem that metrazol therapy is most valuable for persons who, at the time of initiation of treatment, appear from the psychological tests to be the more profoundly affected by the psychosis.

(Authors' abstr.)

Studies in Insulin and Metrazol Therapy. II. Differential Effects of Some Psychological Functions.

A battery consisting of the Stanford-Binet, the Kent-Rosanoff Word Association Test, and an aspiration level test was given to 70 male schizophrenic patients before and after treatment with insulin or metrazol. The means of the test scores before and after treatment were compared to determine the effects of treatment on intellectual functions. Considerable changes in the direction of improvement were noted in most of the measures.

To test the significance of the changes comparison was made with individually matched control patients who had had neither form of therapy, but who had been given two tests while under routine hospital care. The results indicated that approximately two-thirds of the improvement in test scores may be attributed to the ordinary hospital regime and familiarity with the test situation. The data further indicated that those with mental ages below 12-0 on the first test gained more than those with higher mental ages. There appears to be a differential effect between metrazol and insulin in this respect: Metrazol seems more efficacious than insulin with the lower intelligence group, but seems deleterious with the higher group. Insulin, on the other hand, though helpful in both groups, seems more effective in the case of the higher intelligence group when the changes occurring beyond those shown by control patients under routine care are taken as the criterion.

(Authors' abstr.)

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The Pavlovian Theory of Generalization.

The neo-Pavlovian system of explanatory principles is built upon two fundamental postulates: (1) that in primary conditioning all stimuli which act during excitation of an unconditioned reaction tend to be associated with that reaction; (2) that effects of training with one stimulus irradiate to produce association with similar stimuli, with a strength of association proportional to the degree of similarity. Explanations of stimulus equivalence, of generalization, of "afferent neural interaction," and of perceptual organization or "patterning" are based upon these two postulates. Both postulates are contrary to fact.

(Authors' abstr.)

Emotion in Man and Animal.

The main conclusions of this paper can be summarized as follows:

(1) The recognition of a full, characteristic expression of emotion is the classification of a deviation of behavior from an habitual base line. It is not a discrimination of the momentary behavior itself, but of the direction of the deviation, so that both present and past behavior affect the observer's judgment.

(2) The recognition of emotion otherwise is a discrimination of a state of changed responsiveness detected from "associated signs"; acts which would not have a definite emotional significance in themselves, but which have been observed as the accompaniment of more openly emotional behavior.

(3) The emotions thus detected are inferred special states which facilitate or actually produce the primary emotional behavior of (1), although little is known of these states or of a satisfactory classification for them.

(4) The recognition of emotion in man and animal is not fundamentally different. Conceptually, the states of changed responsiveness discriminated are the same in both cases and have the same relationship to overt behavior.

(5) Even when the subject himself does the recognizing, the ultimate criteria of the various emotions are found in distinctions of overt behavior. In subjective recognition cues are available which a second observer cannot utilize, but these cues (of imagery and so on) must be essentially of the nature of associated signs which the growing child learns gradually to interpret after first learning the meaning of emotional terms in relation to actual overt behavior.

(6) Finally, it may be concluded that the failure to obtain a reliable recognition of emotions in the laboratory experiments of the last thirty years was the result of a particular experimental procedure (the use of too short a period of observation), and does not show that emotion cannot be recognized socially. Also, the conclusion of some writers that emotions are nothing but figments of the imagination stems directly from the apparent unreliability of recognition; if recognition is reliable socially and does not depend mainly on knowledge of the stimulus, this conclusion is unjustified.

A strong argument in favor of the hypothesis presented is that it removes the contradictions inherent in current discussions of emotion and emotional recognition. A stronger argument perhaps is found in the original datum of this paper: the fact that psychologically sophisticated and unsophisticated alike experience an overwhelming tendency to name the chimpanzee's emotions, with a human terminology. Yet the details of emotional expression are quite different in the two species. Recognition of emotion from the chimpanzee's facial expression is even worse than with man's, and most of the *incidental* signs of chimpanzee excitement have a significance that must be learned by prolonged observation. Yerkes makes it clear that close familiarity with the chimpanzee is necessary for the discrimination of many emotional states, and that the individual components of emotional behavior do not have the same significance in man and chimpanzee. It is only in the higher-order units that the identity of behavior in the two species becomes evident. Consequently the tendency of any observer to recognize and name chimpanzee emotions is not due to a mere superficial similarity. From my own observations I should say that the recognition of identity really begins only after several weeks of observation, and that the strength of one's conviction that the identity is real, increases thereafter for months.

Such a fact might be evidence only of suggestibility, but this cannot be the whole explanation. The behavior of the dog is complex enough, but life-long familiarity with this animal does not produce the degree of "anthropomorphism"

in psychologically sophisticated persons that six months of exposure to the chimpanzee will produce. The tendency to identify human emotional patterns in the chimpanzee is the more convincing since, as I have shown, the identification is not indiscriminate. The naming of attitude or emotion is much less frequent than the reader might suppose, and occurs only when the behavior in its long-term significance and intercorrelations is something already nameable in man. When the elements of behavior have a relation that is not known in man, no name is given to the underlying emotion. The naming, therefore, is not an irresponsible form of animism, but a classification of deviations of behavior. The facts of behavior must constitute the ultimate reference of emotional terms. (Author's abstr.)

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The Stress Tolerance Test. Preliminary Experiments with a New Projective Technique.

It has seemed from this study that certain clearly demonstrable differences exist between the performance of patients with operational fatigue and the control subjects in the Stress Tolerance Test.

These differences can be expressed qualitatively and quantitatively, and the extent to which certain characteristic answers appear in a record seems to bear a direct relationship to the severity of the case. While no weighting system has yet been devised which will give a specific numerical point at which a patient should be considered severely, or mildly, disturbed, we feel that utilization of the criteria listed will be of considerable help in evaluating records.

These detectable differences, moreover, are understandable theoretically when viewed in the light of the patient's attempt to cope with a situation which precipitates him suddenly into reliving painful experiences. His ability to handle this experience objectively rather than retreat from it or relive it too closely indicates his progress along the return path to stability.

This test proved valuable when used as an objective measure of the degree of the patient's improvement. (Authors' abstr.)

A Study of Conditioned Vasomotor Responses in Ten Human Subjects.

1. The vasomotor system of 4 to 10 subjects was conditioned rapidly to a light stimulus. A faradic current was used as the unconditioned stimulus and the vascular reactions were measured by means of the photo-electric plethysmograph. Once obtained this conditioned response appeared to be relatively stable.

2. Conditioning and extinction curves of this type of conditioning did not always follow the typical curves of learning and forgetting. The irregularity of the curves may be attributed to:

- (a) The instability of the unconditioned responses in some subjects.
- (b) Changes in attitude and emotional set of the subject.
- (c) Other factors not studied in this experiment.

3. Three subjects who manifested signs and symptoms of autonomic nervous system imbalance were more easily conditioned than subjects who did not.

4. Subjects who were relatively easily conditioned showed more rapid and complete elimination of incidental vascular reflexes to the light stimulus, and showed a tendency toward more stable conditioned responses during extinction than subjects who were not easily conditioned.

5. The intensity of sensations as reported by a subject was not a valid indication of the magnitude of the physiological vascular reactions concomitant with these sensations. (Author's abstr.)

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A Study of Personality of Normal Young Men Maintained on Restricted Intakes of Vitamins of the B Complex.

Various aspects of personality were studied in eight normal young men maintained 161 days on a partially restricted intake of B-complex vitamins, which was followed by 23 days of acute deficiency, and 10 days of thiamine supplementation.

Self-ratings and man-by-man ratings gave no evidence of change in the status of well-being and adjustment during the partial restriction, but indicate consistent and striking deterioration during the acute deficiency. Supplementation of the diet by thiamine alone produced rapid recovery. The Minnesota Multiphasic Personality Inventory also gave no evidence of change in the partial restriction. During the acute deficiency significant changes were obtained in the scores on the three psychoneurotic scales—depression, hysteria and hypochondriasis.

In the Rorschach test records made at the end of the partial restriction, slight deteriorative changes were indicated in three out of the four experimental subjects. These changes increased in magnitude in the pair of subjects placed subsequently on the acutely deficient diet. The nature of this deterioration was loss of spontaneity with an increase in tension. The Rorschach findings suggested that individuals with "better" initial personality were better able to resist the dietary stress.

Cattell's Cursive Minature Situations Test during the partial restriction indicated a very slight and statistically *not* significant increase in the number of lines erroneously crossed ("emotionality" score). During the acute deficiency there were evidences of further increased "emotionality" and "timidity." On the other hand, those indices which have distinguished psychotics from normals showed no change in our deficient subjects. The personality changes were among the earliest symptoms of the experimentally produced borderline and acute deficiencies.

(Authors' abstr.)

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Effect of Insulin on Metabolism of Muscles and Brain. Merezhinskii, M. F., and Cherkasova, L. S. [Biochem. J. (Ukraine), 17, 341-56 (in Russian) (English summary, 356-7) (1941).]

The effect of insulin shock, in guinea-pigs (I) 60-80 units, rabbits (II) 20-30 units, and dogs (III) 4-5 units per kgm. of body weight, began to show in the second 0.5 hour in general weakness, inability to stand up, lack of response, followed by sleepiness, salivation, twitching, and convulsions in about 2 hours; subcutaneous injection of 10-15 gm. of a 20-40 per cent. glucose solution to (II) usually resulted in quick recovery and acceptance of food; refusal to eat was generally followed by a more severe recurrent shock. The Q_{O_2} of the total brain tissue for (I) was 5.08-7.05 before the shock and down to 2.12-4.35 at the height of the shock effect; gray matter of (II) from 5.74-6.87 to 2.71-4.05, and white matter from 3.11-4.96 to 2.07-3.60; gray of (III) 5.96-7.14 to 3.81-4.35, and white from 3.11-4.01 down to 2.51-3.71. The Q_{O_2} in the animals killed on the following day (after the shock) was 5.32-8.38 in the whole brain of (I); gray matter of (II) 6.38-8.71, and white 3.04-4.34. The lowering of respiration intensity of brain matter was general for the three classes of animals; at the same time there were cases where this reduction was not observed. Femoral artery, femoral vein and cerebral (sagittal sinus) vein blood in 10 dogs on an empty stomach before the shock showed for O content (volumes per cent.) a range of 16.21-25.14, 6.43-14.48, and 6.18-14.48; for glucose (mgm. per cent.) 73-132, 61-109, 81-128, respectively; 30 minutes after the shock O was 15.35-23.91, 6.56-14.21, 7.49-12.37; glucose, 65-105, 62-97, 50-94. After 60 minutes, O, 15.08-24.62, 8.64-13.98, 7.96-19.18; glucose, 48-96, 41-75 and 42-74 respectively. After 180 minutes, O, 18.02-24.68, 11.24-18.61 and 14.16-20.40; glucose, 31-51, 29-57 and 32-59. On the following day, O, 17.13-24.68, 6.17-13.01 and 6.49-11.89; glucose 96-124, 85-112 and 81-113, in the arterial venous and sinus blood respectively. Instances were observed where the tissue

lost the ability to fix and hold its sugar, and even gave it up, as then the glucose in the arterial blood was equal to or lower than in the venous. An increase in the uptake of sugar by the muscles and partially by the brain in comparison with the O demand indicated that the sugar fixation was not necessarily accompanied by an increased consumption of O. It is also probable that under the influence of insulin some organs gave up their sugar; this caused the fluctuation in the sugar level. That the muscle tissue adsorbs and holds the sugar more intensely than the brain does was shown in those instances in which the consumption of O did not decrease despite the reduction in sugar consumption. Introduction of glucose improved the consumption of O, with a rise in the arteriovenous O difference; this was not observed before the shock. In guinea-pigs killed on the following day, the Q_{O_2} of the total brain tissue was 5.03-8.38; (II), gray matter, 6.38-8.71, white 3.04-4.34. The fluctuating values were probably due to variations of respiration intensity during some stages while the hormone was still in effect. A series of (I) and (II) were given repeated injections of insulin in doses sufficient to cause convulsions; the Q_{O_2} for the whole brain of (I) (each value for a different animal) was, after 8 injections, 6.98; after 15, 7.74; after 25, 8.01; 17, 8.59; 30, 4.39; 34, 3.35; 27, 6.65; 6, 7.95; 35, 4.38; and one after 41 injections, 3.45; the Q_{O_2} for (II), gray and white matter respectively was, after 6 injections, 6.95 and 4.05; after 35, 7.38 and 4.08; 58, 5.37 and 3.52; 64, 3.85 and 2.92; 59, 4.35 and 3.01; and one after 60 injections, 3.92 and 2.92. The injections to individual animals varied from 6 to 63; some survived many, while others died very quickly after only a few injections. All lost weight at once; the animals were killed 2-3 days after the last injection.

B. GUTOFF (Chem. Abstr.).

Absence of Alteration in the Electroencephalogram with Stilbestrol and Progesterone. Cress, Charles H., Jr., and Greenblatt, Milton (Harvard Med. School). [*Proc. Soc. Exptl. Biol. Med.*, **60**, 139 (1945).]

Large doses of stilbestrol and progesterone given alone and together to non-pregnant, non-menstruating women had no effect on the cortical encephalogram.

L. E. GILSON (Chem. Abstr.).

Effect of Glucose Injections on Fasting Ketonemia after Low-protein Diets (in Rats). Tidwell, Herbert C., and Treadwell, C. R. (Southwestern Med. Coll., Dallas, Texas). [*Proc. Soc. Exptl. Biol. Med.*, **60**, 101 (1945).]

Preliminary. L. E. GILSON (Chem. Abstr.).

Experimental Alcoholism and Alcoholic Polyneuritis in Pigeons. Lecoq, Raoul (Hôpital de Saint-Germain-en-Lage, Paris). [*Bull. soc. chim. biol.*, **24**, 320-4 (1942) (see *C.A.*, **39**, 2809*)].

L. E. GILSON (Chem. Abstr.).

Phenylpyruvic Oligophrenia: A Clinical and Biochemical Study. Lepow, Harold. [*Monatsschr. Psychiat. Neurol.*, **110**, 161-92 (1945).]

The effect of various diets and compounds on the urinary excretion of phenylpyruvic acid (I) was studied in a patient with phenylpyruvic oligophrenia. The total amount of (I) excreted in each of from 4 to 14 successive 24-hour urines was determined by the method of Penrose and Quastel (*C.A.*, **31**, 4391*). The (I) excretion increased on a high and decreased on a low protein diet. The average excretion increased after feeding phenylalanine (II) or (I) along with the low protein diet, but the variation from day to day was large and the extra excretion represented only a small part of the amounts given. Neither tyrosine (III) nor vitamins B₁, B₆, B₁₂, or C had any effect on the excretion of (I). There was a small increase in the (II) concentration of the blood after ingestion of (I) and (II), but not after (III). Lepow discusses in detail the metabolism of (II) and (III) on the basis of findings in phenylpyruvic oligophrenia, alcaptonuria and tyrosinosis.

WARREN M. SPERRY (Chem. Abstr.).

Research Work on Degenerative Disease. Kountz, Wm. B. (St. Louis City Infirmary and Washington Univ. School of Med.). [*Biol. Symposia*, **11**, 74-8 (1945).]

In 20 patients (diseases not specified), aged 50 to 90, parallelism was observed between I.Q. and motor functions (strength of grip of the hand, pedal movement

of the legs, vital capacity), and between I.Q. and physiological functions (urea clearance, concentration diuresis, circulation time of the blood, glucose-tolerance, and cardiac activity), but not between motor functions and blood sugar, urine chemistry, electrocardiogram, basal metabolic rate, or chest radiography findings. The closest parallel with declining physical activity of the body was shown by glucose-tolerance and loss of ability of the body to concentrate and hold water. Conclusion : To demonstrate degeneration from a clinical standpoint, the functional ability of the body rather than its state at any particular time should be studied.

MARION HORN PESKIN (Chem. Abstr.).

Arteriosclerosis and Lipide Metabolism. Page, Irvine H. (Lilly Lab. for Clin. Research, Indianapolis City Hosp.). [Biol. Symposia, 11, 43-73 (1945).]

A critical review with bibliography. Evidence is presented that: Atherosclerosis is not invariably associated with the loss of vascular elasticity accompanying ageing; the development of atherosclerosis is favored by mechanical strain (hypertension), by hyperlipemia, hypercholesterolemia, and a factor acting on the artery cells themselves which is inhibited by (I), KSCN, and possibly lipocaic and choline; hyperlipemia and hypercholesterolemia cannot be prevented by withdrawal of fats and cholesterol, respectively, from the diet (with the possible exception of cholesterol in a diet with greatly increased phosphatide content); atherosclerosis can develop in the absence of hyperlipemia; old age does not cause hyperlipemia; lipides other than cholesterol are concerned in atherosclerosis, and are deposited in the arterial wall in approximately the same proportion as they exist in the lipide mixture of plasma. Theories of Virchow and Aschoff, of Klotz and Leary, of Winternitz, and of Hueper are discussed. Possible control of factors predisposing to atherosclerosis involves (1) prevention of hyperlipemia (as by treatment of diseases causing it, e.g. diabetes mellitus), (2) reduction of mechanical strain (as by reduction of elevated arterial pressure), and (3) prevention of that state of the tissues in the arterial walls which increases the receptivity to plasma lipides or prevention of that state of the blood which leads to abnormal precipitability of its lipides (this has been accomplished in experimental animals only, e.g. by iodides and thiocyanates).

MARION HORN PESKIN (Chem. Abstr.).

The Relation Between Etiology and Morphology in Degenerative and Sclerosing Vascular Diseases. Hueper, W. C. (Warner Inst. for Therapeutic Research, New York, N.Y.). [Biol. Symposia, 11, 1-42 (1945).]

An attempt is made to establish the relationship between etiology and morphology of nonsenile arteriosclerosis by systematizing and integrating biological, pathological and experimental data from the literature and from unpublished studies. Hueper believes that the various chemical and physical causes of experimental and spontaneous arteriosclerosis act by interfering with the oxidative metabolism and nutrition of the vascular wall. The anoxemic causative mechanisms are: (a) Changes in vascular tonus, e.g. by histamine, acetylcholine, nitrates, nitrites, cyanides, CO, barbiturates, As, Hg, Mn, reduced atmospheric O pressure, traumatic shock (hypotonic agents), and by adrenaline, sympathomimetics, angiotonin, tyrosine, tyramine, guanidine, ergotine, hydrastine, digitalis, glucosides, nicotine, S-methylisothiouraea, vitamin D, Ca salts, iodine, and adrenal cortical, posterior pituitary, thyroid, and parathyroid hormones (hypertonic agents); (b) changes in hydrostatic intravascular pressure, e.g. by consumption of excessive amounts of liquids; (c) changes in plasma colloid composition resulting from quantitative and qualitative disturbances of plasma carbohydrates, lipides and proteins, interfering with the exchange of gases and nutritive substances through the interface of blood and intima, e.g. in diabetes mellitus, excessive dietary lipide intake, and CS₂ poisoning, and after administration of goitrogenic substances (sulfaguanidine, thiourea derivatives, thiocyanates), saponin, polyvinyl alcohol, methylcellulose, pectin and arabinose; and (d) changes in the O-carrying power and in the O-CO₂ balance of the blood and tissues, e.g. in CO or O₂ poisoning. Primary intimal sclerosis and hyalinosis result from (a) or (b), fibrosing intimal reactions from (c) (plasma protein disturbances), medial calcinosis from severe action of vasotonic and hydrostatic agents or as a late effect of (c), cystic medial degeneration of the aorta from severe hypotonic episodes, and atheromatous lesions from (c) (lipide and carbohydrate changes).

MARION HORN PESKIN (Chem. Abstr.).

Dicholesteryl Ether in the Spinal Cord of the Ox. Silberman, Henryk, and Silberman-Martyncewa, Sofia (Ermington, N.S. Wales, Sydney, Australia). [*J. Biol. Chem.*, **159**, 603-4 (1945).]

Investigation of the cholesterol prepared from spinal cord revealed, in contrast to that prepared from brain, the presence of an impurity which was identified as dicholesteryl ether. The amount of this compound isolated from the spinal cord of the ox is from 1.5 to 2.0 per cent. on the dry basis.

A. E. TEERI (Chem. Abstr.).

Blood-cholesterol Levels in Elderly Patients. (1) *Relation of Age, Sex, Basal Metabolic Rate, Cardiac Decompensation, and Coronary and Peripheral Sclerosis to Blood-cholesterol Levels in the Aged.* Kountz, Wm. B., Sonnenberg, Arthur, Hofstatter, Lilli, and Wolff, Gerhard (St. Louis City Infirmary and Washington Univ. School of Med.). [*Biol. Symposia*, **11**, 79-86 (1945).]

Among 212 patients aged 40 to 85, the females showed an average blood-cholesterol level of 237 mgm. per cent., the males 196 mgm. per cent. Atherosclerosis, however, appeared earlier and more frequently among the men, and in both sexes calcification of the peripheral arteries was accompanied by a lower blood-cholesterol value than was absence of such calcification. Coronary sclerosis was not associated with hypercholesterolemia in either males or females. Hypercholesterolemia accompanied lowered basal metabolic rate in women, not in men.

MARION HORN PESKIN (Chem. Abstr.).

The Effects of Anoxia and of Haemorrhage on the Metabolism of the Cerebral Cortex of the Rat. Wilhelmi, Alfred E., Russell, Jane A., Long, C. N. H., and Engel, Mildred G. (Yale Univ.). [*Am. J. Physiol.*, **144**, 683-92 (1945); cf. preceding abstract.]

Reproducible initial rates of respiration in the absence of substrate and steady rates of respiration for at least 3 hours in the presence of glucose can be obtained in slices of rat cerebral cortex, provided that the medium contains Ca, that the initial dry weight of the tissue is chosen as the basis for calculating the rates of O uptake, and that the time of preparation of the tissue is carefully standardized. The rate of respiration of brain slices from normal rats in the absence of glucose was depressed to an increasing degree with increasing duration of anoxia after incubation in N for 10, 15, 20 and 30 minutes. No consistent effects of shock after hemorrhage on the metabolism of brain were observed.

E. D. WALTER (Chem. Abstr.).

Biological Changes Following Encephalography. Delay, Jean, and Soulairac, André (Univ. Paris). [*Compt. rend. soc. biol.*, **138**, 951-3 (1944).]

Encephalography in man is followed by hyperglucemia, acidosis, hyperleucocytosis, arterial hypertension and bradycardia. These effects are similar to those of electric shock.

L. E. GILSON (Chem. Abstr.).

Protein Metabolism in the Nerve Cell During Growth and Function. Hydén, Holger. [*Acta Physiol. Scand.*, **6 Suppl.**, **17**, 136 pp. (1943).]

During embryonic development as well as during the second period of growth of the nerve cell the total amount of cytoplasmic protein in the cell increases rapidly. The nucleolar and nuclear apparatus show signs of intense activity, as the mechanism for the formation of cytoplasmic protein, but in the adult nerve cell the apparatus exhibits a unique condition not seen in any other cell of the adult organism with the exception of oocytes. In motor anterior horn cells, from animals which had been completely exhausted physically, the protein content of the cytoplasm and nucleus is markedly decreased and the nucleolar system shows symptoms of intense irritation. In spinal ganglion cells irritated by induction shocks new proteins are formed with surprising rapidity but, if the irritation is sufficiently prolonged, the cytoplasm will be eventually drained of these substances.

S. MORGULIS (Chem. Abstr.).

Riboflavin and Temperature During Experimental Poliomyelitis in the Monkey. Kolochine-Erber, B., and Raffy, Anne (Inst. Pasteur, Paris). [*Compt. rend. soc. biol.*, **138**, 963-4 (1944).]

As previously shown, riboflavin plays an important role in thermogenesis. However, the hypothermia of the final stages of poliomyelitis in the monkey is not the result of a decrease in tissue riboflavin. L. E. GILSON (Chem. Abstr.).

Prevention of Formation of End-bulb Neuromas. Poth, Edgar J., Fernandez, E. Bravo, and Drager, Glenn A. (Univ. Texas Med. Branch, Galveston). [*Proc. Soc. Exptl. Biol. Med.*, **60**, 200-7 (1945).]

Opposing the growth of nerve fibers by encasing the proximal stump of a severed peripheral nerve in a rigid tube, or injection of the nerve with tannic acid or gentian violet, inhibits neuroma formation. L. E. GILSON (Chem. Abstr.).

Mechanism of the Action of Sympathomimetic Amines. (1) *The Effect of Various Amines on Synthesis of Cocarboxylase.* Govier, Wm. M., Bergmann, Vera, and Beyer, Karl H. (Sharp and Dohme, Inc., Glenolden, Pa.). [*J. Pharmacol.*, **85**, 140-2 (1945).]

In 0.0005 M concentration phenethylamine, N-methylphenethylamine, N-dimethyl- β -methylphenethylamine, benzedrine, tyramine, and paredrine markedly increased the synthesis of cocarboxylase by pigeon-liver slices.

(2) *The Effect of Sympathomimetic Amines on the Succinoxidase System as Influenced by the Presence of α -tocopherol Phosphate.* [*Ibid.*, 143-9.]

The activity of the succinic oxidase of homogenized rat muscle and liver is inhibited by addition of α -tocopherol phosphate. The sympathomimetic amines, adrenaline, benzedrine, cobefrin and phenethylamine produce an increase in O uptake by neutralizing the tocopherol effect. The increase in metabolic activity following the addition of these amines to the tocopherol-inhibited succinic oxidase system can be used as a source of energy for synthesis of cocarboxylase from added thiamine and pyrophosphate. L. E. GILSON (Chem. Abstr.).

Anaerobic Glycolysis in Nervous Tissue. Utter, M. F., Wood, Harland G., and Reiner, John M. (Univ. of Minnesota, Minneapolis). [*J. Biol. Chem.*, **161**, 197-217 (1945).]

Extracts and homogenates exhibiting high rates of anaerobic glycolysis were prepared from spinal cord, medulla, cerebellum and cerebrum of rats. One part of tissue was mixed with 4 parts of ice-cold water and the mixture homogenized in a Potter and Elvehjem type grinder. No further treatment followed in the case of the homogenates. If extracts were to be prepared, the homogenates were held for 15 minutes in an ice-bath and then centrifuged for 15 minutes at 2400 r.p.m. For complete activity these preparations need, in addition to glucose, adenosine triphosphate, hexosediphosphate, diphosphopyridine nucleotide (DPN), Mg⁺⁺, and nicotinamide. The authors present evidence that the "inhibitor" of brain extract reported by Geiger (*C.A.*, **34**, 5517^o) is a diphosphopyridine nucleotidase. Inhibition of the nucleotidase can be obtained with nicotinamide or by incubation of the preparation with DPN in bicarbonate buffer. Etherization of the animals before the preparation of glycolytic extracts and homogenates did not have any detectable effect on extracts, and had slight or no effect on homogenates. The preparations have approximately linear activity with time and with increasing concentration of tissue for 60 minutes or longer; they thus prove to be useful in assay of enzymes of anaerobic glycolysis of the central nervous system.

GERTRUDE E. PERLMANN (Chem. Abstr.).

Chemical Changes in the Brain and Gasometric Studies of the Blood in Experimental Head Injury. Stone, W. E., Webster, J. E., and Gurdjian, E. S. (Wayne Univ. Coll. Med., Detroit). [*Proc. Assoc. Research Nervous Mental Disease*, **24**, 226-53 (1945).]

Traumatic head injuries, administered to dogs under morphine and procaine analgesia, did not influence the cerebral arterio-venous differences in O, CO₂, or glucose. In areas of contusion, brain tissue, frozen *in situ*, showed greatly increased

lactic acid (I) and inorganic phosphate and decreased phosphocreatine (II) and adenosine triphosphate concentrations. A slight loss of acid-soluble P usually occurred. In brains studied 1 to 6 days after injury there appeared to be partial recovery in (I) and (II). In areas of the cortex showing no macroscopic evidence of damage the concentrations of the constituents studied were sometimes entirely normal; occasionally the (I) concentration was slightly increased. The results indicate that generalized cerebral anoxia does not necessarily follow trauma of the head.

WARREN M. SPERRY (Chem. Abstr.).

Nervous Disorders Resulting from Manganese Poisoning. Bogaert, Ludo van, and Dallemagne, Marcel J. (Univ. Bunge and Univ. Liège, Belgium). [*Monatsschr. Psychiat. Neurol.*, **111**, 60-89 (1945-46).]

A monkey in a closed cage with a circulating fan was exposed to an aerosol containing MnO_2 , $NaClO_2$, and NH_4Cl , in the proportions 50 : 35 : 15 respectively for one hour daily for 95 days. The amount of MnO_2 was increased gradually from 10 to 50 mg. The first abnormal signs appeared at the 40th treatment—hyperexcitability interspersed with periods of torpor. At the 47th treatment massive trembling of the whole body occurred and continued increasingly through the rest of the experiment. Other signs, such as pronation and supination of the hands, appeared as the experiment progressed. After cessation of the treatments the symptoms gradually disappeared within the following 5 months, but then reappeared in a somewhat different and more marked form, with paresis of the legs as an important feature. No Mn was found in any of the organs, including the brain and liver, probably because the animal was killed several months after exposure to Mn. Histopathological examination showed atrophy of the cerebral cortex in accord with the clinical symptoms. Liver, kidney and lungs were normal. Another monkey received $MnSO_4$ by mouth in doses increasing from 10 to 50 mgm. per day for 300 days. The O capacity of the blood dropped gradually during the experiment and returned to normal after $MnSO_4$ administration was stopped, but no signs of nervous disorder were noted clinically or histopathologically. The findings are of interest in their bearing on Mn poisoning in man.

WARREN M. SPERRY (Chem. Abstr.).

A Search for Linkage Between the A, B, O Agglutinogens and Phenylketonuria. Penrose, L. S. (London, Ontario, Can.). [*Am. J. Mental Deficiency*, **50**, 4-7. (1945).]

A study of 74 patients with phenylketonuria (I) and 97 normal sibs gave a strong suggestion of the presence of a genetic linkage between (I) and the blood agglutinogens A, B, O and A_1 .

WARREN M. SPERRY (Chem. Abstr.).

The Neuro-humoral Syndrome of Myotonia. Minz, B., and Passouant, P. (La Sorbonne, Paris). [*Rev. can. biol.*, **4**, 510-34 (1945).]

In Steinerts' disease the myotonic muscle is characterized by the myotonic reaction and by trophic troubles. The study of three muscular biopsies revealed that the myotonic muscle is rich in acetylcholine and poor in cholinesterase. The modifications of the myotonia after the action of pharmacodynamic agents acting on cholinesterase and acetylcholine were studied. With vitamin C, which intensifies cholinesterase activity, there was obtained a marked improvement, which was further strengthened by the associated effect of quinine, which decreases the sensitivity of the motor plate to the cholinergic mediator. Myotonia is considered as being of muscular origin and as responding to the richness of the muscle in acetylcholine. As the latter is produced by the nerve, the primary trouble is considered to originate in the myoneural plate. In the first stage the acetylcholine produced at the synapse would seem to be incompletely destroyed as a result of the lowering of the cholinesterase level. In a second stage acetylcholine diffuses from the terminal plate into the muscle, thus creating a condition of "static myotonia," which will give a myotonic response to mechanical excitation, even if the nerve is completely excluded, e.g. after curarization. The diffusion of acetylcholine involves a lowering of muscle K, thereby modifying the ionic medium of the muscle. There follows a decrease in muscular excitability, thereby creating conditions favorable to the onset of an associated muscular atrophy.

A. PAPINEAU-COUTURE (Chem. Abstr.).

Micro Method for the Estimation of Phosphatidylethanolamine in Nerve Tissue. Edman, P. V., and Aqvist, S. E. G. (Karolinska Inst., Stockholm). [*Acta Physiol. Scand.*, **10**, 144-9 (1945).]

Extract with EtOH for 24 hours finely ground nerve tissue. Dilute extract so that 1 c.c. contains about 0.4 to 1.5 mgm. cephalin. Measure 1 c.c. into a centrifuge tube, add 2 c.c. 2 N HCl, and hold in hot water bath for 3 hours. Cool dry *in vacuo* at room temperature over NaOH. Extract fatty acids with 5 c.c. dry ether, centrifuge, discard ether, and dissolve residue in 0.5 c.c. H₂O. Heat the liberated ethanolamine in a special apparatus with NaOH. The freed NH₃ is collected in 0.5 c.c. 0.1 N HCl. Neutralize with 0.5 c.c. 0.1 N NaOH, add 0.5 c.c. borate buffer (7.32 gm. boric acid + 2 gm. NaOH in 1.1 gives pH 10), then 0.5 c.c. NaClO solution (prepared fresh by adding N NaOH to 0.15 N Cl water to pH 10), and dilute to 5 c.c. The tube and a similarly treated blank are placed for 5 minutes in a vigorously boiling water bath. The stable blue color is examined with filter S₆₁ in a step photometer. The value must be multiplied by the factor 12.2 to convert it to cephalin.
S. MORGULIS (Chem. Abstr.).

Increase in Blood Pyruvic Acid after the Convulsions of Electric-shock Therapy. Gounelle, H., Raoul, Y., Bachet, M., and Marnay, Ch. (Hôpital Foch, Paris). [*Compt. rend. soc. biol.*, **139**, 166-7 (1945).]

Blood pyruvic acid shows a marked increase within 1-2 minutes after the convulsive crisis. The maximum level observed was 6.58 mgm. per cent. A rapid return to normal then takes place.
L. E. GILSON (Chem. Abstr.).

Urinary Acid-base Balance and Electric Shock Convulsions. Delmas-Marasset, P., Servantie, L., Bannel, F., and Maurice, G. (Univ. Bordeaux). [*Compt. rend. soc. biol.*, **138**, 696-8 (1944).]

During electric shock treatment human urine becomes more acid. This is due to an increase in lactic and pyruvic acids, especially the latter, as a result of the violent muscular contractions.
L. E. GILSON (Chem. Abstr.).

Studies on the Protein Concentration of the Cerebrospinal Fluid in Lumbar-disk Prolapse. Friberg, Sten. [*Acta Chir. Scand.*, **87**, 128-37 (1942).]

In lumbar intervertebral prolapses it is recommended that cerebrospinal fluid taken caudal to the prolapse should be examined. Usually it contains 60 mgm. per cent. protein and the globulin/albumin ratio is 0.25 or less.
S. MORGULIS (Chem. Abstr.).

Coagulation-active Substances in the Cerebrospinal Fluid: I. Krafka, V. [*Acta Med. Scand.*, **120**, 147-93 (1945).]

Normal cerebrospinal fluid contains coagulation-active substances, especially the ventricular fluid. Lumbar or cisternal fluid coagulates 0.1 c.c. fresh oxalated plasma at 37° in 22 minutes ± 6 minutes when 1.5 c.c. fluid is used. The coagulating activity is not related to the Ca content, but to the thrombokinase and prothrombin content of the fluid, which is free from fibrinogen. The protein content of the fluid is of no significance.
S. MORGULIS (Chem. Abstr.).

Biochemical Study of Bilirubin of Blood and Spinal Fluid. Polonovski, Michel, Fiessinger, Noel, and Gajdos, Alfred. [*Bull. soc. chim. biol.*, **24**, 221-5 (1942); cf. *C.A.*, **39**, 2794^a, 5304^b.]
L. E. GILSON (Chem. Abstr.).

Flocculation of Resin Suspensions by Proteins. Mechanism of the Colloidal Benzoin Resin Reaction and a New Flocculation Reaction of Cerebrospinal Fluid. Dognon, A., and Simonot, Y. [*Bull. soc. chim. biol.*, **26**, 277-81 (1944); cf. *C.A.*, **39**, 4339^a.]

The effect of pH on the flocculation of colloidal mastic or benzoin resin suspensions is further discussed, and an application of the method previously discussed to the examination of spinal fluid is described. Normal and pathological spinal fluid cause maximum precipitation of the colloidal resin at different degrees of pH.
L. E. GILSON (Chem. Abstr.).

Determination of Total Protein in Cerebrospinal Fluid. Lindenmeyer, Eugen. [*Monatsschr. Psychiat. Neurol.*, **109**, 57-73 (1944).]

The determination of total protein (I) in cerebrospinal fluid (CSF) by precipitation with Esbach's reagent and measuring the volume of precipitate after centrifugation (Kafka and Samson [*Z. Neurol. Psychiat.*, **115**, 85 (1928); **117**, 128 (1928)]) was compared with the Kjeldahl method in 327 patients. In many cases a wide difference between the two methods was observed, with the Kjeldahl method usually giving higher values, sometimes several fold. Frequently the Kafka-Samson method erroneously indicated normal (I) concentration. The upper limit of normal (I) concentration in CSF is 35 mgm. per 100 c.c. W. M. SPERRY (Chem. Abstr.).

Theory of the Colloidal-gold Reaction. (1) *Reactions Between Gold Sol and Isolated Protein Fractions.* Lange, Carl (N.Y. State Dept. Health, Albany). [*J. Lab. Clin. Med.*, **30**, 1006-12 (1945).]

Of the physicochemical factors conditioning the colloidal-gold reaction, the most significant is the pH. This must be fixed, since hemoglobin either coagulates or protects gold sol, depending on whether the pH is below or above 7.0. The loss of sensitivity of citrate gold due to increasing disparity can be eliminated by boiling to a greater turbidity and neutralizing. Temperature is of little influence. The presence of electrolytes is obligatory in the diagnostic test, and their concentrations must be kept constant within the optimal range. At pH 7.4 three qualitatively different reactions with gold sol have been shown: (1) Protection is produced by albumins and normal serum globulins in the prezone, and by hemoglobin at a pH above its isoelectric point; (2) sensitization is produced by serum albumin within an optimal range; (3) true coagulation, without the assistance of electrolytes, is produced in cerebrospinal fluid only by pseudoglobulin-like *degenerative proteins*, such as produce the paretic curve. This curve is fundamentally different from the other (prezone) curves, which, in the absence of a true coagulator, result from differences in the globulins, while the albumins have only a decreasing effect. Euglobulin and pseudoglobulin react differently with gold sol, as shown by the difference of their constant optimal ratio. This ratio is the reason why, in prezone curves, the maximum shifts to the right with increasing globulin concentration. The albumin-globulin ratio has little or no effect, since no variation of this ratio produced a paretic curve in the absence of a true coagulator. Nor does the maximum shift to the right with increasing albumin-globulin ratio. The maximum is regulated by the qualitative and quantitative differences of the globulins. Removal of albumins from cerebrospinal fluids produces no qualitative change in either the paretic or prezone curves. DOROTHY A. MEYER (Chem. Abstr.).

Effects of Small Doses of Vitamins on the Nervous System. Chauchard, Paul (The Sorbonne). [*Bull. soc. chim. biol.*, **24**, 182-5 (1942); cf. *C.A.*, **38**, 1770^o.]

In normal rats and guinea-pigs small doses of any of the vitamins have some effect on chronaxia. Vitamins A, C, and D exert an excitant action, and nicotinic acid has the opposite effect. Vitamins B and E first excite, then depress. All the water-soluble vitamins act on the brain only, as regards effect on chronaxia, while the fat-soluble vitamins act on the brain, medulla and spinal cord.

L. E. GILSON (Chem. Abstr.).

Mirror Carp and Vitamin B₁. Nogueira, Cyro Camargo, and Antunes, Luiz Nora. [*O. Hospital*, **25**, 745-50 (1944).]

Chastek's paralysis is a B₁ avitaminosis due to enzymic destruction of vitamin B₁ by raw fish meat (carp). Unlike that of the ordinary carp, the meat of the mirror carp did not destroy the thiamine present in the food of the experimental animals (female albino rats), and caused no incidence of beriberi; it even acted as a source of vitamin B₁. H. ROTHSCILD (Chem. Abstr.).

Vitamin B Deficiency and Nervous Disease. Spillane, J. W. (York, England). [*Lancet*, **249**, 449-50 (1945).]

Apart from relief of pain and tenderness in some acute cases, neither thiamine nor whole vitamin B complex conferred any apparent benefit in 200 cases of poly-

neuritis (excluding those of obviously infective origin) in malnourished people in the Middle East (Polish refugees, Arab, African and Indian natives, and German and Italian prisoners-of-war), in malnourished German troops from the Channel Islands, and in patients with chronic beriberi from prisoner-of-war camps in the Far East. Rest in bed and "good food" gave as good results as the vitamins mentioned, although these were administered in large doses and by all routes. The vitamin preparations did not hasten the restoration of power, sensibility, or reflex activity, nor shorten the required stay in bed or in the hospital. Conclusion: If vitamin B₁ is the antineuritic vitamin, the results of therapy in chronic polyneuritis cannot be quoted in support of that contention, despite any properties B₁ may possess in combating the acute beriberi of the Far East. The literature on the relationship between vitamin B complex and neuromuscular disorders is critically reviewed, with bibliography. MARION HORN PESKIN (Chem. Abstr.).

Urinary Excretion of Coproporphyrin in Non-alcoholic Pellagra. Rimington, C., and Leiner, Z. A. (Univ. of London, Univ. Coll. Hosp. Med. School, and St. Mary's Hosp., London). [*Lancet*, **249**, 494-6 (1945).]

Normal urinary coproporphyrin values (below 100 γ /24 hours) were found in 13 of 15 patients with non-alcoholic pellagra, whose satisfactory response to subsequent nicotinic acid therapy substantiated the diagnosis. The two pellagrous patients with coproporphyrin values above normal were suffering from sepsis and liver dysfunction respectively, which may have contributed to the high figure. The findings indicate that excess porphyrinuria is not an essential feature of pellagra, and hence is not of diagnostic value. Among 7 patients with Korsakow's syndrome (in 6 instances referable to alcoholism) only 2 showed abnormally high urinary porphyrin excretion; this indicates that alcoholism *per se* is not consistently sufficient to produce excess porphyrinuria. An alcoholic patient with beriberi, however, showed extremely high urinary porphyrin (369 γ /24 hours), unaffected by therapy with vitamin B₁ and marmite; this patient presumably had a permanent hepatic lesion resulting from the alcoholism. Apparently a combination of circumstances (e.g. alcoholism plus certain nutritional deficiencies) is needed to produce liver damage with consequent excess porphyrinuria.

MARION HORN PESKIN (Chem. Abstr.).

Urinary Excretion of Nicotinic Acid Among Normal Chinese, Pellagrins and Other Patients. Hou, Hsiang-Chuan, and Dju, Mei-Yu. [*Chinese Med. J.*, **61**, 192-8 (1942).]

The method of Swaminathan (*C.A.*, **34**, 4439^b) was used to determine urinary nicotinic acid. The average figures obtained in mgm. per day were: 48 normal students 1.621; 6 cases of multiple vitamin deficiency 0.425; 15 cases of pellagra 0.715; 4 cases of beriberi 0.843. Other diseases, tuberculosis, dysentery, etc., also showed low urinary nicotinic acid. There was considerable individual variation in daily nicotinic acid excretion both in normals and in patients, but increased excretion followed promptly upon increased nicotinic acid intake.

WILLIAM H. ADOLPH (Chem. Abstr.).

Disturbances of Neuromuscular Excitability During Dietary Imbalance and Avitaminoses. III. Carbohydrate Imbalance in Rats Compared with Avitaminoses of the B Group and Especially Riboflavin Deficiency. Lecoq, Raoul, Chaudard, Paul, and Mazoué, Henriette (*Hôpital Saint Germain-en-Laye, Paris*). [*Bull. soc. chim. biol.*, **26**, 347-54 (1944); cf. *C.A.*, **39**, 2784^a, 4120^a.]

Rats were fed diets containing 54-72 per cent. of lactose or 25-35 per cent. of galactose and adequate vitamin supplements. Excitation of the central nervous system and polyneuritic degeneration were produced as in pigeons similarly fed, but in the rats these changes were not as readily detected by chronaximetric methods as in pigeons. The symptoms displayed by the rats resembled those of thiamine deficiency in pigeons, but more closely resembled those of riboflavin deficiency previously studied in rats.

IV. Eutrophic Rickets and the Humoral Rickets of Avitaminosis D ("Invisible" Rickets). [*Ibid.*, **27**, 129-35 (1945); cf. *C.A.*, **38**, 2078^d.]

In rats and in children the onset of rickets can be detected by chronaximetric methods before it can be detected by X-rays.

V. Dystrophic Rickets and Spontaneously Curable Rickets. [*Ibid.*, 198-206.]

Changes in neuromuscular chronaxia in rats accompanying the production of rachitic symptoms by Ca insufficiency or the addition of NaHCO_3 or SrCO_3 to the diet are further discussed.

L. E. GILSON (Chem. Abstr.).

Biochemical Study of Avitaminoses of the Pellagra Group. IV. Urinary Polyphenols with Blue Fluorescence (Alkaptonuric and Normal Urines). Raoul, Y. (Hôpital Foch, Paris). [*Bull. soc. chim. biol.*, 26, 355-61 (1944); cf. C.A., 38, 3696^a.]

The urine of alkaptonuric patients has a much more intense blue fluorescence under ultraviolet light than has normal urine. Oxidation of the homogentisic acid (alkaptone) of the alkaptonuric urine to 2,4,5-trihydroxy- α -toluic acid further increases the blue fluorescence. Effects of variations in pH on the ultraviolet absorption spectra of homogentisic acid and its oxidation product are shown in graphs.

V. Protein-derived and Other Fluorescent Substances of Urine. [*Ibid.*, 361-7.]

Among the substances contributing to the blue fluorescence of human urine are polyphenols and indole derivatives of protein origin, some oxidation products of vitamin K, possibly some bile acid derivatives, and other substances of unknown origin and constitution. The addition of $\text{Na}_2\text{S}_2\text{O}_4$ to the specimen may increase the fluorescence by reducing nonfluorescent quinones to fluorescent polyphenols.

VI. Parallelism Between Reactions for Indole Derivatives and the Fluorescence of Normal Urine. [*Ibid.*, 494-5.]

The intensity of the fluorescence and the results of the Nencki-Sieber urorosein test (*J. prakt. Chem.*, 26, 333 (1892) (red color produced by addition of concentrated HCl to defecated urine containing $\text{Pb}(\text{OAc})_2$) were roughly parallel.

VII. Action of β -indoleacetic Acid on Growth. [*Ibid.*, 497-506.]

Indoleacetic acid, 150 γ per day, seemed to have a slight favorable effect on growth of young rats given either a complete diet or one partially deficient in various vitamins of the B group.

L. E. GILSON (Chem. Abstr.).

Nutritionally Produced Cerebellar Disorder in Chicks, Not Associated with E Avitaminosis. Bird, F. H. (Univ. of California, Berkeley). [*J. Biol. Chem.*, 161, 747-8 (1945).]

Chicks receiving a highly purified diet developed a syndrome involving incoordination of movements and convulsions, associated with cerebellar lesions. The diet resulting in this disorder had the following composition per 100 gm.: Water-washed casein 22.2, l(+)-arginine-HCl 0.3, glycine 0.9, l(-)-cystine 0.4, Ca gluconate 5.0, cellulose 5.0, soybean oil 3.0, fish oil 0.25, NaCl mixture (containing 0.49 per cent. Mn, 0.1 per cent. Cu, 0.05 per cent. Zn, 0.05 per cent. Al, 0.002 per cent. Co, and 0.04 per cent. I) 1.0, $\text{Ca}_3(\text{PO}_4)_2$ 3.5, K_2HPO_4 1.3, KCl 0.3, MgSO_4 0.1, Na_2SiO_3 0.25, H_2O 0.25, cholic acid 0.1, choline chloride 0.2, and glucose 56.2 gm. To every 100 gm. of the above mixture were added solubilized liver eluate equivalent to 4 gm. of solubilized liver, thiamine-HCl 0.5 mgm., pyridoxine-HCl 0.4 mgm., riboflavin 0.5 mgm., calcium d-pantothenate 1.5 mgm., nicotinic acid 1.0 mgm. 2-methyl-1, 4-naphthohydro-quinone diacetate 1.0 mgm., synthetic α -tocopherol 1.0 mgm., and biotin 0.01 mg. Chicks fed a compound ration composed of mixed natural foodstuffs showed no signs of disorder of the type described above.

HILDA H. WHEELER (Chem. Abstr.).

An Experimental Study of Disorders in the Permeability of the Cerebral Vessels ("the Blood-brain Barrier") Produced by Chemical and Physicochemical Agents. Broman, Tore, and Lindberg-Broman, A. M. (Lund, Sweden). [*Acta Physiol. Scand.*, 10, 102-25 (1945).]

When the blood-brain barrier (BBB) is disorganized (vessel lesions), dyes like trypan blue can be seen to penetrate the vascular wall. In experiments on guinea-

pigs, rabbits, and cats disorders in the BBB were produced either by direct injection into a cerebral artery, local application to pial vessels, or by one minute perfusion of cerebral vessels with test solutions. Distilled H_2O , hypertonic NaCl, acid, alkali, Na glycocholate, Na desoxycholate, EtOH, cobra venom, and bee venom were effective; adrenaline, acetylcholine, and histamine were ineffective. The noxious substances disturb the BBB function in much lower concentration if applied to the intimal rather than to the adventitial layer of the vessel. The former apparently is the site of permeability. Osmotic pressure or pH changes are effective in disorganizing the BBB only if fairly great. It seems probable that proteins, unless they have some toxic influence on the vessels, do not pass from the blood into the brain. Damaged permeability may make their passage possible. Local brain allergic reactions can apparently be produced by antigens (horse serum) injected intracerebrally. As a result of the mechanical injury, antibodies pass from the blood into the brain.

S. MORGULIS (Chem. Abstr.).

Nervous Excitation and the Chemical Dynamics of the Cell. Koshtoyants, Kh. S. [Bull. acad. sci. U.R.S.S., sér. biol., 170-80 (1945) (in English, 180-1).]

In spite of qualitative differences between the excitation phenomena of differentiated cells via the nervous route and such phenomena as fertilization, growth, or differentiation of tissues, they are united by the leading role played in all these processes by special chemical compounds of the type of activators. A singular place among these chemical compounds is occupied by neurohumors or mediators of the nervous impulse. Research work during the last three decades resulted in a new classification of the nerves as suggested by Dale. This is based on the fact that one group of nerves exercises its influence through the system of choline esters (cholinergic nerves), the other through adrenaline-like substances (adrenergic nerves), and the third one apparently through histamine or like substances (histaminergic nerves). The leading problems in this domain are as follows: (1) The paths of biological synthesis (breakdown and stabilization) of the mediators; (2) the mode of their being released ("microsecretion" after A. Samojloff) in the course of excitation; (3) the paths and the mode of inclusion in the chemical transformations of the cell linked with their functional activity (the inhibitory phenomena inclusively); and (4) their connection with the decisive factors of generation of the bioelectric potentials. These four problems have been studied by Koshtoyants and his associates during the past years. Starting from comparative-physiological data Koshtoyants raised, in 1938, the question as to the connection between the paths of biological synthesis of acetylcholine and certain stages of carbohydrate metabolism. He showed, in collaboration with his associates, that a block (e.g. fluoride) of definite links of the carbohydrate metabolism results in a block of the impulse transmission of cholinergic nerves. A similar block of the nervous impulse called forth by a number of substances which exercise a definite action on cellular transformations contributes to the formulation of some conceptions regarding the metabolic nature of the nervous impulse. The transition from the "chemodynamics of rest" to "chemodynamics of excitation" is accomplished in different nerves along different enzymo-chemical lines, according to the chemical characteristics of their mediator, the modes of its release upon excitation, and the paths and mode of their inclusion in the metabolism of the excited tissue. As to cholinergic nerves, in the case of skeleton musculature, their mediator, acetylcholine, is intimately connected in its synthesis, breakdown, and action with the system of adenosinephosphoric compounds and with the depot of guanidine-phosphoric compounds. It is concluded from some experimental evidence that acetylcholine favors initially the release in the ionized state of Ca, Mg, and K (from the protein or lipide compounds with which they are combined), the latter activating or inhibiting the enzymic activity of adenosinetriphosphatase with all the implications concerning nervous mediation of the contractile process. In the important process of release of ions there probably participates acetic acid, which is formed through hydrolysis of acetylcholine under the influence of cholinesterase. The physiological significance of the hydrolysis phase of acetylcholine is emphasized, as its consequences for the excitation of protoplasm have not as yet been duly considered. These results were obtained by oscillographic studies.

D. I. MACHT (Chem. Abstr.).

Metabolism in Different Parts of the Brain, Especially in the Epiphysis, Measured with Radioactive Phosphorus. Borell, Ulf, and Örström, Ake (Wenner-Gren Inst., Stockholm). [*Acta Physiol. Scand.*, 10, 231-42 (1945).]

The highest P contents in percentage of wet weight were found in the epiphysis, in the anterior and posterior lobes of the hypophysis, choroid plexus, and in the substantia perforata. These experiments suggest a division of the brain parts into a group with very active P metabolism and a group with a slow P metabolism. The latter group consists of the olfactory lobe, parietal and occipital, thalamus, the anterior and posterior parts of tuber cinereum, corpus mammillare, cerebellum, pons, corpora quadrigemina and medulla oblongata, whereas the group with high P metabolism includes the parts enumerated with high P content, except the substantia perforata, which has a low P metabolism. The relative activities are compared by taking that of the cerebellum as 100. Forty minutes after an injection of radioactive P into the epiphysis 25 per cent. of it is in the form of free phosphate, 65 per cent. in acid-soluble esters, and 10 per cent. as compounds, insoluble in $\text{CCl}_4\text{CO}_2\text{H}$. The activity of the epiphysis is generally higher, and frequently 2-3 times higher than the activity of the hypophysis. Next to the epiphysis in metabolic activity are the choroid plexus and the lobes of the hypophysis, which are 4-5 times as active as the cerebellum, whereas all other components of the brain are generally of the same order as the cerebellum.

S. MORGULIS (Chem. Abstr.).

Effect of Transcerebral Dielectrolysis of Certain Ions on the Circulation of the Retina. Bourguignon, Georges, and Baillart, Paul (École des hautes études, Paris). [*Compt. rend. soc. biol.*, 138, 779-82 (1944).]

In 4 men, 1 woman and 1 rabbit, I, Br, Ca, Mg, Fe, K, and Na ions were introduced by iontophoresis from one electrode placed on the back of the neck and one placed over one eye (positive for metals and negative for halide ions). The retina was examined with an ophthalmoscope. In all cases, except with NaCl solution or distilled water; there was vasodilation of the retina and increase in peripheral blood pressure as measured in the arm.

L. E. GILSON (Chem. Abstr.).

The Origin of Electricity in the Nervous System. Beutner, R., and Barnes, T. Cunniff (Hahnemann Med. Coll. and Hosp., Philadelphia). [*Biodynamica*, 5, 117-28 (1945).]

The origin of potentials on collodion membranes in contact with salt solutions is explained by the theory of phase boundary potentials. By use of the "oil-cell" method it was found that acetylcholine in an aqueous phase establishes a negative phase boundary potential with cholesterol. Solvents for nerve or brain extract, such as triacetin and tributyrin are being investigated for use in the "oil cell." Results secured furnish a satisfactory explanation of the origin and the pattern of the negative variations observed in the living nerve.

J. E. WEBSTER (Chem. Abstr.).

Contents of Nitrogen and Phosphorus in Various Architectonic Formations of the Cortex of the Great Brain. Gurvich, E. E. (*Inst. Mozga, Moscow*). [*Byull. Ekspil. Biol. Med.*, 19, No. 3, 60-3 (1945).]

N and P were determined in various regions of the cerebrums of 9 dogs. Analyses were made of brain substance freshly extirpated from the occipital (vision) region, the motor, sensory, and other anatomical divisions. The contents in N and P in different regions apparently depend on the histological structure of the cells.

D. I. MACHT (Chem. Abstr.).

Electrical Pulsations in the Human Brain. Barnes, T. C. (Hahnemann Med. Coll., Philadelphia). [*Trans. N.Y. Acad. Sci.*, 7, 87-9 (1945).]

Mainly a discussion of the physiological and other aspects of electroencephalography. Many physiological conditions (especially blood sugar) influence the brain waves. In normal persons with a blood-sugar value below 130 mgm. per cent., hyperventilation produces the slow delta waves characteristic of certain delinquent individuals. Sugar produces the energy of the brain and may yield AcOH , which combines with choline, forming acetylcholine (I), which is involved in the production

of brain waves. Artificial electric brain waves can be produced by the contact of (I) with brain extract or with cholesterol extracted from the spinal cord.

W. C. TOBIE (Chem. Abstr.).

Vitamin C and Cholinesterase: II. Herschberg, A. D., Frommel, E., and Piquet, J. (Univ. Geneva). [*Helv. Physiol. Pharmacol. Acta*, 2, 507-14 (1944) (in French); cf. *C.A.*, 38, 2364^a.]

The organs of scorbutic guinea-pigs react much more strongly to acetylcholine than normally because lack of ascorbic acid inhibits the activity of tissue cholinesterase. Addition of ascorbic acid to the bath or perfusion fluid restores the activity of the cholinesterase and the organs then react almost normally to acetylcholine. The activating action of ascorbic acid on muscle cholinesterase is also shown by its decreasing sensitivity of frog rectus abdominis muscle to acetylcholine. In guinea-pig serum the cholinesterase activity is lowest in winter and highest in summer. Sex is not a factor.

L. E. GILSON (Chem. Abstr.).

Influence of Certain Reduction-oxidation Indicators on the Activity of Cholinesterase. Klein, Paul (Med. Clin. Heidelberg). [*Biochem. Z.*, 317, 210-16 (1944).]

Thionine, toluidine blue, and methylene blue inhibit cholinesterase activity, but when these are in the leuco form the inhibiting effect is decreased.

S. MORGULIS (Chem. Abstr.).

Effect of Digitalis on Cholinesterase. Miquel, Ovidio, and Riker, Walter F., Jr. (Cornell Univ. Med. Coll.). [*Proc. Soc. Exptl. Biol. Med.*, 60, 120-1 (1945).]

Digitoxin, ouabain, strophanthin and lanatoside C had no effect on the activity of serum cholinesterase or cholinesterase from the electric organ of the eel. These results confirm the observation that cardiac slowing by digitalis is not due to inhibition of cholinesterase.

L. E. GILSON (Chem. Abstr.).

Influence of Amino Acids on Cholinesterase. Anti-acetylcholine Action of Histidine. Aron, E., Herschberg, A. D., and Frommel, E. (Univ. Geneva). [*Helv. Physiol. Pharmacol. Acta*, 2, 495-505 (1944) (in French).]

In concentrations of 0.8-2.0 per cent. glycine, alanine, proline, and especially arginine, lysine and histidine increase the activity of serum cholinesterase *in vitro*. Cysteine and tryptophan have no such effect. Arginine and histidine sometimes double the activity. Histidine weakens the response of isolated frog muscle to acetylcholine by increasing the activity of the muscle cholinesterase. This explains the anti-acetylcholine action of histidine, lysine and arginine reported by other workers. Intravenous injection of histidine-HCl increases serum cholinesterase activity in guinea-pigs and man; in man 0.2 gm. produces an approximate 50 per cent. increase.

L. E. GILSON (Chem. Abstr.).

Action of Essential Oils on Serum Cholinesterase. Caujolle, F., Vincent, D., and Franck, C. (Lab. pharm. matière med. faculté med. pharm., Toulouse). [*Compt. rend. soc. biol.*, 138, 556-8 (1944).]

When added in the proportion of 1 : 10,000 to horse serum containing added acetylcholine, the essential oils inhibited the action of the serum cholinesterase by the following percentages: Peppermint 60, lavender flowers 58, lavender spike 42, bergamot 39, condiment sage 37, thyme 36, marjoram 35, lemongrass 34, petit-grain 32, clary sage 15, and rosemary 13 per cent. Some inhibition was evident with a 1 : 100,000 concentration of the oil in most cases. Menthol acted like peppermint oil; thymol had a much stronger action than thyme oil.

L. E. GILSON (Chem. Abstr.).

Determination of Cholinesterase Activity with Aid of the Glass Electrode. Sanz, M. C. (Hallerianum, Univ. Bern). [*Helv. Physiol. Pharmacol. Acta*, 2, C29-32 (1944) (in German).]

A constant temperature device contains a small cell provided with a stirrer and glass electrode and connected to a saturated calomel electrode. Two or 3 c.c. of the solution to be tested is placed in the cell with 0.1 c.c. of 10 per cent. acetylcholine iodide solution, then 0.02 N NaOH is added from a microburet at such a rate as to keep the pH constant by neutralizing the AcOH as fast as liberated. The

volume of NaOH solution added is noted every 2 minutes for 10–20 minutes, and a curve is plotted. The results compare favorably with those obtained by other methods. Two views of the complete apparatus are shown.

L. E. GILSON (Chem. Abstr.).

Changes in Cholinesterase Activity During the Rhythmic Polarization of Nerve Fibers. Babshii, E. B., and Minaev, P. F. (*Pedagogic Inst., Moscow*). [*Byull. Ekspil. Biol. Med.*, **19**, No. 6, 14–16 (1945); cf. *C.A.*, **40**, 1545^o.]

Previously it has shown that during the passage of a d.c. through nerve fibers or the central nervous system, the cholinesterase activity was increased at the anode and decreased at the cathode. The same effect is obtained by the rhythmic polarization of nerve fibers with a condenser.

H. PRIESTLEY (Chem. Abstr.).

Serum Cholinesterase Activity in Experimental Liver Injury. Sleensholt, Gunnar, and Venndt, Helge (*Univ. Bisheni. Inst., Copenhagen*). [*Acta Physiol. Scand.*, **10**, 23–30 (1945).]

Administration of CHCl_3 to dogs greatly increases the serum cholinesterase activity and decreases serum albumin. An interruption in administration of CHCl_3 caused an immediate fall in serum-cholinesterase activity, while resumption of the treatment caused it to rise again. It is concluded that liver injury produced experimentally is accompanied by a marked increase in serum cholinesterase activity and a simultaneous fall in serum albumin.

S. MORGULIS (Chem. Abstr.).

Effects of Salts on True Cholinesterase. Mendel, Bruno, and Rudney, Harry (*Banting and Best Dept. of Med. Research, Univ. Toronto, Can.*). [*Science*, **102**, 616–17 (1945).]

Experiments show that the relationship between enzyme activity and substrate concentration is changed by the addition of salt to the medium. A stepwise increase in the salt concentration causes a gradual shifting of the optimal activity of the enzyme to higher levels of acetylcholine. With increasing concentrations of KCl an absolute increase in the rate of acetylcholine hydrolysis occurs at the optimum levels and beyond. When NaCl is used in the medium in equimolar concentrations, the activity-substrate concentration curves show the same general trend, but they are not identical.

E. D. WALTER (Chem. Abstr.).

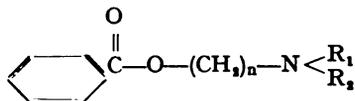
Electrotropic Changes of Activity of Cholinesterase in the Nerve Fibers. Babshii, E. B., and Minaev, P. F. (*Kafedry Fiziologii Cosudarst. Pedagogicheskogo Inst. im. V. I. Lenina, Moscow*). [*Byull. Ekspil. Biol. Med.*, **18**, No. 3, 58–60 (1944).]

Frog nerve-muscle preparations were subjected by means of liquid nonpolarizable electrodes to the action of a direct-current of 0.02–0.1 ma. for 5–10 minutes. Acetylcholine was added to the emulsions to a concentration of 1 : 100,000. At the cathode the activity of the cholinesterase is decreased; at the anode it is increased. The content of unhydrolyzed acetylcholine is higher in the cathode emulsion and lower in the anode emulsion than in control emulsions. The changes in the activity of the cholinesterase may be due to the shift of ions in the nerve.

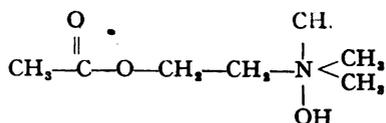
J. DAVIDSON (Chem. Abstr.).

A Theory of Anesthetic Action Based upon Acetylcholine Competition. Schueler, Fred W. (*Univ. Colorado, Boulder*). [*J. Chem. Education*, **22**, 585 (1945).]

It has been known for some time that compounds having the structure—



will generally possess local anesthetic action. Cocaine is a well-known example. In this structure the essential features for anesthetic action are the Bz group, and the carbon chain terminating in the alkylated N. The problem concerning the local anesthetic class of drugs, illustrated above, therefore (if drug competition is assumed) reduces itself to discovering a substance occurring at the nerve-endings and essential for nerve impulse transference, which resembles the anesthetic drugs structurally. Such a resemblance is exemplified by acetylcholine—



On the assumption that the local anesthetic drugs may compete with acetylcholine at the nerve-endings, the writer has carried on some experiments which lend support to his theory. In each instance, the rats used that received both acetylcholine and cocaine were freed from symptoms (or these were greatly reduced) possessed by the rats receiving cocaine or acetylcholine separately, i.e. they appeared normal.

R. K. CARLETON (Chem. Abstr.).

Effects of Choline and Acetylcholine Chloride upon Peripheral Nerve Fibers. Lorente de No; R. [J. cell. comp. Physiol., 24, 85-97 (1944).]

Study of the action of large concentrations of choline and acetylcholine chlorides upon activity in the sciatic nerve of the bullfrog indicates that these substances neither depolarize the nerve fibers nor prevent the conduction of impulses. It is concluded that release of acetylcholine is not the mechanism underlying the conduction of nerve impulses in peripheral fibers, but that ACh is a substance that participates in the metabolic activity of the fibers, although the importance of this participation is at present not understood.

F. A. BEACH (Psychol. Abstr.).

Present Views on the Mode of Action of Acetylcholine in the Central Nervous System. Feldberg, W. (Physiol. Lab., Cambridge, Engl.). [Physiol. Rev., 25, 596-642 (1945).]

Acetylcholine (I) has both stimulating and depressant actions on the central nervous system, and both actions appear to be sensitive to atropine, which also antagonizes the central actions of eserine and prostigmine. (I) is bound in the tissue or cell granules, probably through the action of lipides and proteins. Synthesis of (I) is a property of both nerve cell and fiber; the process may occur in two stages—(1) anaerobic, depending upon the presence of adenosinetriphosphate, and (2) aerobic, depending on the presence of O. The release of (I) from cholinergic nerve fibres is generally regarded as the result of a K-ion mobilization during passage of nerve impulse; this is followed by a resynthesis, which is independent of the passage of the impulse. But it is believed that the K-ion mobilization has also a direct effect upon the resynthesis. The synthesis does not apparently bear any relationship to phylogenetic development and is roughly in this order: Frog > rat, guinea-pig > cat, dog, monkey brain. In different parts of the brain the activity is in the order: cerebral cortex > brain stem > medulla > spinal cord > cerebellum. The theory of the transmission across a number of synapses in the central pathway through the mediation of (I) is discussed.

S. MORGULIS (Chem. Abstr.).

Effect of Inhibition of Glycolysis and Compounds Related to Glycolysis on Acetylcholine Synthesis. Torda, Clara, and Wolff, Harold G. (Cornell Univ. Med. Coll., New York, N.Y.). [J. Biol. Chem., 162, 149-54 (1946).]

The effect of various products of glycolysis, substances involved in the esterification of carbohydrates, and some substances inhibiting glycolysis, on acetylcholine production in minced frog brain was studied by a method previously described (C.A., 39, 1918⁸). Intermediary products of glycolysis and organic phosphates may increase the synthesis, and the energy required seems to be supplied by oxidative processes or by glycolysis under anaerobic conditions, although some acetylcholine may be synthesized in the absence of glycolysis and free O.

B. R. MURRAY (Chem. Abstr.).

Acetylcholine in the Mechanism of the Rise of Refractoriness of a Nerve. Zol'nikova, A. I. (Fiziologicheskoi Lab. Tsentral. Inst. Kurortologii N. K. Zdrava S.S.S.R., Moscow). [Byull. Ekspit. Biol. Med., 19, No. 3, 70-3 (1945).]

Experiments were made on muscle-nerve preparations of *Rana temporaria*. Acetylcholine 1 : 1000 prolongs both the absolute and relative refractoriness. Eserine and prostigmine 1 : 500 and 1 : 1000 inactivate the cholinesterase of the nerve and prolong the refractoriness. Atropine neutralizes the effect of eserine and prostigmine.

D. I. MACHT (Chem. Abstr.).

The Relation of Adrenaline to Acetylcholine in the Nervous System. Burn, J. H. [*Physiol. Rev.*, **25**, 377-94 (1945).]

Adrenaline, which has little action of its own in the nervous system, has a powerful effect modifying acetylcholine action, augmenting it in low concentration or inhibiting it in high concentration. This is also manifested by 2-3-fold increase in transmission of nerve impulses by adrenaline or by sympathetic stimulation, and represents possibly the mechanism for paralysis by fear. Adrenaline or sympathetic stimulation not only improves transmission at the neuro-muscular junction, but also increases the action of prostigmine. Adrenaline in low concentration definitely improves transmission through the sympathetic ganglion and in high concentration inhibits it. Thus, splanchnic stimulation becomes less effective after a large dose of adrenaline. The body becomes, therefore, less capable of maintaining a normal blood pressure after a massive dose of adrenaline, which explains the failures when a sudden stimulus causes a large discharge of adrenaline into the blood.

S. MORGULIS (Chem. Abstr.).

Action of Procaine and Some of its Derivatives on the Contraction of Leech Muscle by Acetylcholine; their Cholinesterase Activity. Hazard, R., Corteggiani, E., and Pelou, A. (*École des hautes études, Paris*). [*Compt. rend. soc. biol.*, **138**, 427-9 (1944); cf. *C.A.*, **39**, 3587⁶.]

Procaine in 1 : 500,000 concentration makes leech muscle twice as sensitive to acetylcholine and in 1 : 9000 concentration makes it 50-200 times as sensitive. Still higher concentrations provoke contraction by themselves. Procaine acetylated on the N of the p-aminobenzoyl radical had no sensitizing action in high dilution, and in 1 : 4000 concentration had a desensitizing action. Higher concentrations caused contraction by themselves. Procaine iodomethylated on the N of the diethylaminoethyl radical had a slight sensitizing action in 1 : 8000 concentration; higher concentrations caused contraction by themselves. When procaine was both acetylated and iodomethylated, it acted like the acetylated compound mentioned above. Procaine and iodomethylated procaine have about the same inhibiting effect on the action of the cholinesterase of horse serum *in vitro*. Acetylation and acetylation plus iodomethylation greatly decrease the inhibiting action on serum cholinesterase.

L. E. GILSON (Chem. Abstr.).

Polarization Effect Under the Action of Acetylcholine on the Nerve Commissure of Anodonta. Babshii, E. B., Merschikov, A. G., and Sheikhon, F. D. [*Byull. Ekspil. Biol. Med.*, **19**, No. 4/5, 17-20 (1945).]

Experiments were made with large *Anodonta cygnea*. When acetylcholine is applied in concentrations of 1 : 10,000-1 : 1000 to the interganglionic commissure, a positive electric reaction is noted in the nerve tissue. This polarizing effect is usually equivalent to 5 to 6 mv., but in exceptional cases may be as high as 25-30 mv. The authors believe that this positive reaction is connected with the formation of acetylcholine.

D. I. MACHT (Chem. Abstr.).

Antagonism Between Adrenaline and Acetylcholine on the Intestine of the Rabbit. Gunn, J. A. (*Univ. of Oxford*). [*Quart. J. Pharm. Pharmacol.*, **18**, 108-16 (1945).]

The physiological antagonism between adrenaline and acetylcholine has been determined on the isolated intestine of the rabbit. Solutions containing a constant amount of one drug were mixed with solutions containing varying amounts of the other drug until a mixture was found which produced complete physiological antagonism. The following conclusions are applicable only within certain limits of concentration of both drugs. On the same segment of intestine, when the concentration of one drug is kept constant, the antagonizing effect of the other drug is proportional to its concentration. On different segments of intestine, the ratio of activities of the two drugs varies. In 10 experiments 5 to 20 parts of adrenaline (average approximately 10 parts) was required to antagonize 1 part of acetylcholine. On the same segment of intestine, when the amount of one drug is increased an approximately proportional increase in the amount of the other is required for antagonism. This can be explained by a coincident corresponding relation between the physiological effects produced.

W. O. E. (Chem. Abstr.).

Acetylcholine Content of Peripheral Nerves During Degeneration. Murali, A. v., and Schulthess, Gertrud v. (*The Hallerianum, Bern*). [*Helv. Physiol. Pharmacol. Acta*, 2, 435-43 (1944) (in German); cf. *C.A.*, 39, 1452^o.]

Immediately after section of the sciatic nerve in the guinea-pig the acetylcholine content of the peripheral portion decreases rapidly. After 50-70 hours it is less than 10 per cent. of the original value and the nerve can no longer be stimulated to conduct impulses. After 100 hours no acetylcholine can be detected in the nerve.

Thiamine Content of Peripheral Nerves During Degeneration. Murali, A. v., and Wyss, F. [*Ibid.*, 445-8.]

In the above experiments the thiamine content of the severed nerve began to fall soon after cutting, and in 50-70 hours had decreased to 40-50 per cent. of the original level. The ratio of combined to free thiamine was 9 : 1.

L. E. GILSON (Chem. Abstr.).

2. Pharmacology and Treatment.

Experimental Cocainism. I. General Toxicology, Addiction and Sensitization. Gutiérrez-Noriega, C., and Ortiz, V. Zapata (*Inst. nacl. hig., Lima*). [*Rev. med. exptl. (Peru)*, 3, 279-306 (1944).]

Chronic oral, subcutaneous, or intravenous administration of cocaine to dogs resulted in increased sensitivity to the drug. The dogs became addicted to the injections. The effects were manifest most rapidly by intravenous injection, least rapidly by oral administration. The convulsive dose and lethal dose often coincided, and the minimal lethal dose was only twice the optimal stimulating ones. The minimal lethal dose given orally was 2-2.5 times as great as that intravenously or subcutaneously.

Action of Cocaine on Nonaddicted Human Subjects. Ortiz, Vicente Zapata. [*Ibid.*, 307-16.]

Cocaine in doses of 1 to 3.5 mgm./kgm. body-weight caused unimportant changes other than the hyperthermic effect, which might reach subfever values with the larger doses.

Action of Coca and Cocaine on Addicted Human Subjects. Mendizábal, Francisco Riemberg. [*Ibid.*, 321-8.]

Chewing of coca leaves or administration of 4 mgm./kgm. body-weight of cocaine results in slight hyperthermia, moderate tachycardia, rise in blood pressure, and stimulation of the nervous system. An increase in basal metabolic rate greater than normal might be observed.

Action of Cocaine on the Resistance to Fatigue in the Dog. Gutiérrez-Noriega, Carlos. [*Ibid.*, 329-40.]

Subcutaneous administration of 4 mgm./kgm. body-weight of cocaine resulted in 69-150 per cent. increase in resistance to fatigue in the swimming test. Increasing the dose to 8 mgm./kgm. resulted in increases of 39-75 per cent., and to 10 mgm./kgm. resulted in increases of 36.6-103 per cent. Cardiazole, 5 mgm./kgm., did not modify the resistance to fatigue.

Historical Data on Cocaine Addiction in Peru. [*Ibid.*, 341-53.]

H. L. WILLIAMS (Chem. Abstr.).

Effect of Phenamine on the Chronaxia of Human Peripheral Nerves and Skeletal Muscle. Filippova, A. G., (*Tsentral. Inst. Kurortologii i Klin. Perwnykh Bolezne, Viem, Moscow*). [*Byull. Eksptl. Biol. Med.*, 18, No. 4/5, 69-70 (1944).]

The chronaxia was investigated in 17 wounded patients with injured spine and spinal cord and spastic paralysis, as well as in healthy individuals. With neck wounds the muscles and nerves of the upper and lower extremities were investigated, and with chest wounds only the muscles and nerves of the lower extremities. The chronaxias of the median, radial, ulnar, peroneal and tibial nerves and the biceps, triceps, gastrocnemius and tibialis anterior muscles were determined.

Phenamine was given internally in dosage of 10 to 30 mgm. 2-3 times a day several days in succession or every other day. It was found to shorten the chronaxia of motor nerves and skeletal muscles, in some cases to $\frac{1}{10}$ or $\frac{1}{15}$ the original value. The clinical picture also changed, for spasms decreased and tonus was lessened. The intensity and the duration of the effect depended on the dose of phenamine. For comparison, the effect of ephedrine (50 mgm. given subcutaneously) was studied. This increased the chronaxia, spasms became stronger, and muscular tonus increased. Healthy individuals given single doses of 10-40 mgm. of phenamine showed a definite shortening of the chronaxia of the peripheral nerves and skeletal muscles.

G. LEBEDEFF (Chem. Abstr.).

Anticonvulsant Effects of Steroids. Spiegel, E. A., and Wycis, H. T. (Temple Univ. School of Med., Phila., Pa.). [*J. Lab. Clin. Med.*, **30**, 947-53 (1945).]

Desoxycorticosterone acetate, progesterone, testosterone, acetoxypregnenolone, androstenedione, and dehydroandrosterone increased the threshold of electrically induced convulsions in white female rats of 100-150 gm. wt. Male rats were found resistant to the anticonvulsant activity. The last three of the above compounds showed a definite margin between anticonvulsant and hypnotic doses. The following compounds had no, or only slight, anticonvulsant effect: Cholesterol, allo-cholesterol, cholesteryl bromide, epicholestanol, stigmasterol, stigmasterylacetate, α -spinasteryl acetate, ergosterol, ergosteryl acetate, α -ergostenyl acetate, dehydrocholic acid, desoxycholic acid, Δ^5 -3-acetoxycholenic acid, sarsasapogenin acetate, pseudosarsasapogenin acetate, diosgenin acetate, pseudodiosgenin acetate, α -estradiol benzoate, theelin in oil, 6-acetoxy- α -progesterone, etiocholan-3(β)-ol-17-one acetate, Δ^5 -pregnen-3(β)-ol-20-one acetate, Δ^5 -16-pregnadien-3 β -ol-20-one acetate, stilbestrol.

WM. M. GOVIER (Chem. Abstr.).

The Central Stimulant Action of Some Vasopressor Amines. Warren, Marshall R., and Werner, Harold W. (Wm. S. Merrell Co., Cincinnati, O.). [*J. Pharmacol.*, **85**, 119-21 (1945).]

In adult male white rats, at 26°, the subcutaneous injection of 7 common vasopressor amines in doses equal to fractional parts of the LD 50 as determined at 26° showed that benzedrine, ephedrine and propadrine (norephedrine) caused the greatest central stimulant action as measured by the total activity of the rats. Maximal stimulating effects were observed with ephedrine at 5, 10 and 20 per cent. of the LD 50, with propadrine at 10 and 20 per cent. of the LD 50, and benzedrine at 20 per cent. of the LD 50. Vonedrine (dl-1-methylamino-2-phenylpropane) produced a slight stimulation at 20 per cent. of the LD 50 and privityne, tuamine (dl-2-aminoheptane) and neosynephrine had no significant effect at 20 per cent. of the LD 50.

L. E. GILSON (Chem. Abstr.).

A Cycle of Morphine Addiction. Biological and Psychological Studies. I. Biological Investigations. Williams, Edwin G., and Oberst, Fred W. (U.S. Pub. Health Service Hosp., Lexington, Ky.). [*U.S. Pub. Health Repts.*, **61**, 1-26 (1946).]

J. A. KENNEDY (Chem. Abstr.).

Marihuana Activity of Cannabinol. Loewe, S. (Cornell Univ. Med. School, Ithaca, N.Y.). [*Science*, **102**, 615-16 (1945).]

The availability of larger quantities of cannabinol and the finding that propylene glycol is an effective solvent for intravenous preparations have made possible a study of the effects of larger doses. Cannabinol, generally believed to be an inert component of hemp oil, is shown to have marihuana activity. The significance of this observation with regard to the relationship between structure and activity in the class of cannabinols is discussed.

E. D. WALTER (Chem. Abstr.).

Effects of Application of Potassium Chloride to the Motor Areas of the Cerebral Cortex in the Dog. Moussatche, H. (Inst. Oswaldo Cruz, Rio de Janeiro). [*Rev. brasil biol.*, **5**, 407-12 (1945).]

Fibrillation and clonic convulsions of the muscles controlled by the centers were produced. In this respect KCl acts like acetylcholine, but not so strongly. Possibly acetylcholine acts by mobilizing the K ion.

L. E. GILSON (Chem. Abstr.).

Inhibition by Sugars of the Excitant Action of Caffeine and Theobromine on the Nervous System. Chauchard, Paul, Mazoué, Henriette, and Lecoq, Raoul (École hautes études, Sorbonne, Paris). [*Compt. rend. soc. biol.*, **139**, 12-13 (1945).]

In rats the disturbance of chronaxia ordinarily produced by intraperitoneal injection of 5-10 mgm. of caffeine or theobromine is prevented by simultaneous or subsequent subcutaneous injection of 0.5 c.c. of a 5 per cent. solution of lactose, sucrose, galactose, or glucose, or by giving small amounts of these sugars orally.
L. E. GILSON (Chem. Abstr.).

Metrazole Convulsions. Leonardi, Félix Grillo (Facultad med., Lima). [*Rev. med. exptl. (Lima, Peru)*, **4**, 37-51 (1945).]

Subconvulsive doses showed a tendency towards habituation. Some cases of sensitization were observed. Increasing the dose increased the length of the attack, reduced the latent period, and increased the post-convulsive depression. The repeated convulsive dose was two or more times the threshold dose. The lethal dose was 2.5 to 5 times the threshold convulsive dose. This indicated an ample safety range.
H. L. WILLIAMS (Chem. Abstr.).

Ammonium Phenobarbital: Preliminary Note. Quesada, Rafael. [*Rev. asoc. bioquim. argentina*, **12**, 195-6 (1945).]

The NH_4^+ salt of phenobarbital was precipitated by bubbling NH_3 through a saturated solution of ethylphenylbarbituric acid in acetone, forming white crystals, which in water solution are stable for at least 20 days. The pharmacological effect seems superior to that of phenobarbital.
F. FROMM (Chem. Abstr.).

Studies on Barbiturates. XXVIII. Effect of Succinate and Fumarate in Experimental Barbiturate Poisoning. Corson, Samuel A., Koppányi, Theodore, and Vivino, A. Earl. [*Anesthesia and Analgesia*, **24**, 177-92 (1945); cf. *C.A.*, **39**, 2330^a.]

Neither disodium succinate nor fumarate in small or relatively large doses exhibited any life-saving effect on dogs, cats, rabbits, and rats poisoned with long- or short-acting barbiturates. Although these drugs increased urinary output and in many instances augmented the percentage excretion of barbiturate, this effect did not appreciably shorten recovery.
G. H. W. LUCAS (Chem. Abstr.).

The Antidiuretic Action of Barbiturates (Phenobarbital, Amytal, Pentobarbital) and the Mechanism Involved in this Action. Bodo, R. C. de, and Prescott, K. F. (N.Y. Univ. College of Med.). [*J. Pharmacol.*, **85**, 222-33 (1945).]

Normal dogs, in the post-absorptive state and in water equilibrium, excreted ingested water (40 c.c./kgm.) or intravenously infused water (25 c.c./kgm.) almost quantitatively within 3 hours. Phenobarbital-Na given intravenously in half the anesthetic dose of 0.04 gm./kgm. either 40 minutes after the administration of water by stomach or a few minutes before the intravenous infusion of water, inhibited water diuresis about one-half. Smaller doses had no consistent action, and full anesthetic doses had no more effect on water diuresis than the half anesthetic dose. Still larger doses caused a greater degree of inhibition. In similar experiments with amytal-Na and pentobarbital-Na the results were irregular, and inhibition of water diuresis occurred only in some of the dogs. The effects of repeated doses of pentobarbital-Na were inconsistent. In dogs in which the entire neurohypophysis (infundibular process, infundibular stem, and media eminentia) was destroyed and in which, as a result, permanent diabetes insipidus developed, water excretion was not inhibited by any of the barbiturates, even in full anesthetic doses. In dogs in which ordinary hypophysectomy was performed, leaving some parts of the neurohypophysis intact (no permanent diabetes insipidus produced), the barbiturates inhibited water diuresis. Phenobarbital-Na in half or full anesthetic doses did not inhibit saline diuresis (after injection of isotonic Na_2SO_4 solution), or inhibited it only in part of the dogs (after isotonic NaCl solution).

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VOL. XCII

Part I.—Original Articles.

“EXPERIENTIA DOCET.”

THE PRESIDENTIAL ADDRESS DELIVERED AT THE ONE HUNDRED AND FIFTH ANNUAL MEETING OF THE ASSOCIATION ON WEDNESDAY, JULY 17, 1946.

By D. K. HENDERSON, M.D., F.R.S.E., F.R.C.P.E.,

Professor of Psychiatry, University of Edinburgh, and Physician-Superintendent, Royal Edinburgh Hospital for Nervous and Mental Disorders.

A NUMBER of months ago Dr. James Gilchrist sent me a reprint of his Presidential Address to the Cardiff Medical Society. In the opening paragraph he relates how he had racked his brains to think of a suitable title, and eventually hit on one which he willingly bequeathed to his presidential successors because he believed it might be “applicable to all circumstances.” As I reflected on the task in front of me many other titles came to my mind, but all were so permeated by the idea contained in the words “Experientia Docet” that I decided to adopt it in the hope that my friend would consider my action the sincerest form of flattery.

A senior position in one’s profession is perhaps not an unmixed blessing, but at least it provides an opportunity to ponder over the years of apprenticeship, to consider what has been learned, and what is still unknown, and to attempt, however inadequately, to express the fruits of one’s experience in the somewhat forlorn, but none-the-less pious, hope that it may be of some help—positive or negative—to those who are following in the same pathway.

It is obvious, of course, that psychiatrists should be well-trained physicians, and it ought always to be remembered that, according to Hippocrates, the fundamental qualities of a good physician consist of learning, sagacity, humanity and probity. For the psychiatrist those qualities can bear a little further elaboration. Learning, for instance, implies a broad cultural background plus specialized knowledge; sagacity is something more than wisdom; perhaps it might mean wisdom plus experience, which is synonymous with judgment; humanity is an indication that Hippocrates was thinking in terms

of the man more than of his disease, that the good physician weighed up all the circumstances and judged them in a considerate manner; whilst probity implies that intimate, confidential doctor-patient relationship (to-day trembling in the balance) which only comes from straightforward dealing. Provided a man possesses the above-mentioned Hippocratic qualities, then he might reasonably stake a claim not only to be a good doctor but even a good psychiatrist. But the psychiatrist requires something in addition. He must be able to acquire that detailed and specialized knowledge both of science and art indicative of his deep interest and insight into the problems and difficulties which beset those who are nervously and mentally afflicted. That is not a task for everyone. I have been fortunate in having had the help and friendship of many assistants who, as part of their native endowment, have been interested in psychiatry, have had a special flair or aptitude for it, and with whom it has been a real pleasure to be associated. I have had others, many of them with excellent abilities, who completely failed to grasp the fundamental implications of psychiatric work, and seemed unable to appreciate or sense the emotional needs of such patients, and thus sympathetically enter into an analysis or discussion of their difficulties. That, however, does not cast any reflection on either their character or their brain-power, but merely indicates an absence of that particular something, that co-ordination of heart and mind which enables a psychiatrist not only to be successful, but to get real pleasure out of his work. While the above opinion applies particularly to the psychiatric specialist, and while it is important that he should be more comprehensively trained in the future than he has ever been in the past, yet it is our special duty to ensure that the general physician of the future is far better equipped, psychiatrically, in relation to the understanding and treatment of those psychological and emotional factors which operate in every form of illness. The really good general practitioner owes his success to his ability to do so. It is because of this that it is now being realized that psychiatry is not just another speciality, but really constitutes the other half of medicine in contrast to those more popular major subjects, medicine, surgery, midwifery and gynaecology.

Of what, then, does psychiatry consist? To express it quite simply it may be said that psychiatry consists essentially in understanding the science of man, and in maintaining the mental health of the individual so as to enable him to conduct his life at the highest level of efficiency. To effect this we require:

1. To study how all personal and environmental factors, how nature and nurture can be so synchronized and controlled as to prevent a breakdown of the personality structure. This entails a wide social programme dealing with the quality of the race and the conditions under which we live. The inherent importance of such a programme depends upon an assessment of backgrounds in relation to personal and family qualities. Galton realized that many years ago when he stated: "The land is over-stocked and over-burdened with the listless and incapable." We can all subscribe to that statement; we realize it is true, and we constantly assert that the world chaos which exists is partly determined by the fact that our study of the quality of the race, the science of man, has failed to keep step with scientific progress in more material directions.

The preservation of mental health constitutes the "Challenge of our Times." But such a statement implies that we must be willing to take a much more comprehensive outlook than merely the care and treatment of those who are mentally ill. President Fosdick in his review of the work of the Rockefeller Foundation during 1945 very pertinently states that our knowledge of human motives and desires will require to be used constructively with a view to increasing the happiness of mankind. "The towering enemy of man is not his techniques but his irrationality, not science but war. Science merely reflects the social forces by which it is surrounded. When there is peace, science is constructive, when there is war science is perverted to destructive ends." . . . "The mighty imperative of our time, therefore, is not to curb science but to stop war—or, to put it in another way, to create the conditions which will foster peace." Well may we ask what we psychiatrists can do to help in bringing about those conditions which have been so admirably expressed by President Fosdick. In the first place we must recognize that it is essential for human progress to improve the law of averages so that the inefficient, listless, incapable type are replaced by the efficient and employable. That is undoubtedly a most formidable task, but it is by no means an impracticable one so long as we are willing to take a very long-term view. It requires, however, that people of all grades and shades of opinion shall develop a higher sense of responsibility than at present exists in regard to their family and social obligations. In other words, we want people so naturally endowed and so nurtured that they will adapt themselves to their social milieu more harmoniously than they have ever done in the past. I need hardly remind you that when Galton introduced the term Eugenics he defined it as the science of improving the stock, but he did not confine its use to assortative or selective mating, but stated specifically that eugenics "took cognizance of *all* influences that tend, in however remote a degree, to give to the more suitable races, or strains of blood, a better chance of prevailing speedily over the less suitable than they otherwise would have had." While, therefore, we prosecute our research work in relation to greater biological exactitude, yet side by side we require to develop our programmes of social reform in regard to housing, slum clearance, open spaces, and industrial conditions generally. Viewed in such a way, then, it is not too much to say that eugenics is the most fundamental of all the applied sciences. But to make it into a real dynamic force there must be a fusion, as Lindemann has suggested, between the biological and sociological sciences.

2. It will be necessary to develop the ability to make a close and careful study of all those subjective, emotional states, and all those objective symptoms and signs which our experience will have taught us to regard as the possible forerunners of disaster. To do this we have to learn to talk to our patients—to size up their personalities—to direct them to the appropriate jobs.

3. We must know how to assess our findings, how to arrange them in orderly groupings so as to facilitate our ability to classify and diagnose.

4. After having ascertained all the available facts, we must learn to relate them to the total personality of the individual as determined by a study of his history in terms of his reaction to the various stresses of the life situation.

If the above assumptions are reasonably near the mark, then psychiatry may be recognized as one of the greatest socializing influences we possess. At the same time the knowledge we gain from the above sources will enable us, should a breakdown occur, to employ those remedies and modes of approach which we have learned to understand. It should be remembered that, even with all the aids that science can provide in the form of various specific therapies, failure will often result unless we keep constantly in front of us the background or setting in which the illness occurs, and the human factor which is present in every ailment. Cabot expressed it thus: "Even in dollars and cents the hospital is losing by its blindness to backgrounds. The same ailments in the same patients are treated again and again with a wisdom equal to that of the sage who dipped up water with a sieve"; and again, "As well might one try to pick up a man's shadow and carry it away as to treat his physical ills by themselves without knowledge of the habits that so often help to make him sick, and the character of which these habits are the fruit." He stressed the view that the humanitarian and scientific side of our work need each other as man and woman do. He illustrated his viewpoint by relating how one morning he said to his resident: "What is there in the waiting room?" "A pretty good lot of material," said the other briskly; "There's a couple of good hearts, a big liver with jaundice, a floating kidney, three pernicious anaemias, and a flat foot." All were interesting no doubt in themselves, but their real significance could never be appreciated unless the human, social and economic factors behind their complaints were fully investigated. I have drawn attention to this matter because in these days of successful empiric methods there is a danger that the philosophical and humanitarian principles on which our work so much depends will be lost sight of. Even now our genial detractors are inclined to describe psychiatrists as not knowing where they stand, as having made a complete *volte-face* from the psychological to the physiological and mechanistic. I trust that no such merry-go-round has occurred. Surely we know that the multiple causation which is at the root of practically every form of nervous and mental illness demands a many-sided approach with a variety of associated techniques, and that the personality of the individual with whom we are dealing must always be kept in the forefront. At least, that has been my experience gained during the past forty years by my association with many of the great pioneers in modern psychiatric work. Clouston, Adolf Meyer, Kraepelin, Alzheimer, George M. Robertson, Ford Robertson, Hoch, Mott, Oswald, Campbell, Kirby, are the names of men I remember with gratitude. All of them were men with great clinical and psychological insight, men who had been trained in a wide cultural and scientific field, and had an intense interest in developing the science and practice of psychological medicine. With such leaders—and with many others as well—it is not to be wondered at that since the beginning of this century we have had an exciting, absorbing, fascinating and productive period in the development of psychiatry. It has become almost too common for present-day workers to dismiss many of the achievements of the past as merely superficial and descriptive. Such an attitude creates a danger of good clinical observation being swamped either from a too intense empiric treatment angle, or

from the over-specialized specific aetiological angle so strongly stressed by the psycho-analytic school. My experience as a teacher of psychiatry, as a hospital superintendent, and as a consultant has convinced me that we are still urgently in need of psychiatrists who will take a comprehensive view, who will continue to be good clinical observers, and who will work with the actual facts rather than with theories which assume a truth which cannot be absolutely justified. There is a place, undoubtedly, for speculation, for cold reason and logic, but emotions and feelings are "chiels that winna ding" unless we are able to effect that rapport that constitutes the human touch. Because some of us may be a shade conservative, yet we need not necessarily be accused of therapeutic nihilism, of being kindly caretakers, of being unduly static. I admit that it does us all good to be gingered up, to keep in close association with our younger brethren, and to be receptive of new ideas, but on the other hand "experientia docet" is a valuable precept for our younger colleagues to remember, because so much of the art and practice of medicine depends on it. In my younger days I, too, scoffed at experience, and used often to say (to myself usually), "Only give me the opportunity and I will show what can be done," but now I trust I have acquired more of that modesty which is so valuable in making one understand how little is known, and how much more there is to understand. To-day, in the rush for speedy results and spectacular recoveries—no doubt very laudable endeavours—there is a danger of our methods and teachings being too rule-of-thumb, our diagnosis too rapid, and our treatment too arbitrary. I merely sound a warning, and express my view that there is still a great opportunity for good clinical psychiatrists, men trained to observe, record and analyse, so that even greater contributions to psychiatry may occur than have so far been recorded. Let me give you a few clinical examples, chosen more or less at random, of conditions which still require intensive study:

1. Unreality states, with their depersonalization and derealization syndromes.

2. Puzzled, perplexed, hypochondriacal states with easy fatigability.

3. The spoiled-child reactive states, which are about as difficult to understand and treat as any group I know. Such persons require everything cut and dried, organized, so arranged as to eliminate failure; it is a querulous, questioning, "unconscious repetition compulsion" state which almost drives both patient and doctor distracted, and reminds one of the insistence and argumentativeness of the epileptic.

4. The stupors, which are so symbolic of the death motif.

5. Obsessive tension states.

6. The relationship of delinquency to mental disorder.

The above list could, I have no doubt, be added to with advantage by others, but it is given merely to indicate some of the gaps in our knowledge which continue to exist, and which we must strive to fill. The above-mentioned clinical examples are not separate entities; they dovetail into one another, and they are merely the individual response of a vast variety of persons who are striving to meet the problem of their lives, even although they may be utilizing methods which are obviously inadequate and distorted. The tech-

niques which have been developed to deal with such matters, psychobiological, psychoanalytic, and neurological, have already scored many individual brilliant successes. Far greater successes are likely to result if, in appropriate instances, we use them in combination rather than in a too exclusive, isolated and highly specialized a manner. While Adolf Meyer's psychobiological approach is the most fundamental, the most satisfying, and the most fruitful, yet, where necessary, it must be fortified by the deeper, finer, more intensive methods of the analyst, by the chemo-therapy of the internist, or even by the scalpel of the neurosurgeon. If, however, anyone fails to use Meyer's concept of the total personality, and omits ascertaining *all the facts*, then woe betide him; a great deal of otherwise well-planned research and therapy becomes too spread over the target and rarely or never scores a bull's eye. Meyer stressed psychosomatic and social medicine relationships—man in relation to his environment—long before they were ever called by such names. He divorced psychiatry from its institutional aspects by emphasizing the view that psychiatry was not solely a medical matter, but that it was one which dealt with the organization of life itself, and required for its adequate functioning the collaboration of the educationalist, sociologist, industrialist, lawyer, pastor, and intelligent public. That is not an impracticable ideal; we have seen it in embryo working successfully in the Armed Services during wartime, and we may hope that the harmony existing between executive and specialist branches may be perpetuated in peace. This, of course, applies not only to the care of those who may be ill, but also to the rehabilitation of those who need a little extra help; in the latter instance the spiritual or psychic vitamins of friendship and companionship are often as efficacious as the more vulgar material ones.

You may think the above formulation is excessively far-flung, and that I am trying to have the best of everything in this best of all possible worlds, but quite frankly I am a little afraid of the rapid growth of the ultra-scientific and over-specialized aspect of medicine which is developing in this country. There is a danger of its becoming too greatly hospitalized and organized. In consequence, while we speed onwards it is always salutary to cast an occasional glance back into the past—thus reminding ourselves of the philosophy of those fine old physicians, our forebears, who knew so much about human nature as to become pretty good psychiatrists. You will find much of it in Dr. John Brown's *Horae Subsecivae*, essays and sketches full of wisdom and humanitarianism. There you find constant emphasis laid on the importance of exact, intense observation, on the value of studying the self-recuperative powers of nature, as in the well-known quotation from Sydenham: "I have been long of opinion that I act the part of an honest man and a good physician as often as I refrain entirely from medicine, when, upon visiting the patient I find him no worse to-day than he was yesterday; whereas if I attempt to cure the patient by a method of which I am uncertain he will be endangered both by the experiment I am going to make on him, and by the disease itself; nor will he so readily escape two dangers as one." That statement does not put a spoke in the wheel of progress, but it reveals the experience of a very wise man who realized the importance of taking time, and of being content to

leave well alone ; the *vis medicatrix naturae* is still an important remedial agent in present-day medicine.

It appears to me that our recognition of the above principle throws up two important issues which have never been very accurately formulated. On the one hand, irrespective of the time factor which is so notoriously difficult to assess, we should now be able to appreciate those signs and symptoms which allow us to formulate a prognosis with a fair amount of certainty. We all know that we must exercise patience, that interference is only justified when our experience has taught us that there is a reasonable hope of effecting a special purpose, but that we are justified in maintaining our opinion so long as it has been based on accurate clinical observation. Such observation must embrace all emotional and intellectual factors, with particular emphasis on the maintenance of affect, the degree of insight, the intactness of judgment, and the general circumstances, and even when regression appears to have proceeded to the most primitive level we need not necessarily despair of a favourable outcome. We have improved, I think, on the prognostic-diagnostic groupings first formulated by the master-mind of Kraepelin. To effect our remedial purpose, however, the great value of individual care and attention must be fully recognized. That is where those spiritual vitamins such as friendship, interest, companionship, patience and experience become such valuable therapeutic aids. I think of them especially not only in the management of a patient's life as a whole, but even in dealing with such a common clinical symptom as sleeplessness. In the latter instance the almost invariable course is to prescribe a drug, forgetting that a great many people fear not only the immediate but the more remote effect of any hypnotic ; under such circumstances sleep represents to them the loneliness of death, which they so much wish to avoid. In many such instances explanation, understanding and the installation of a sense of security does much more good than the whole of the pharmacopoeia put together. "One must not be afraid of falling asleep if one wishes to avoid sleeplessness" (Tolstoy).

In the second place we should be careful not to allow ourselves to be led up the garden path by internists who expect us to accomplish the impossible. Many of them are very naïve about it, and appear to think that it is as easy to relieve a person of their psychological complexes as it is to shell peas. They would help more if they referred their cases earlier, but we on our part should be well aware of our limitations, and should not hesitate to recognize that there are conditions in our world which are just as inoperable and malignant as in the medical and surgical sphere. While the numbers of such cases are showing signs of diminishing, yet it is their accumulation in our mental hospitals which has led to the fatalistic view of the inefficacy of mental hospital treatment, and generally to the belief that our mental hospital patients are the least interesting and the least important part of our work, and that the greater emphasis should be placed on the psychoneurotics who far outnumber them and are more susceptible to successful treatment. I have a good deal of sympathy with that viewpoint, but yet I do not entirely agree with it because there are many excellent psychiatrists who prefer to work with the former rather than with the latter ; they get more satisfaction from doing so, and it is all to

their credit that it is so. Furthermore, the knowledge and experience gained in the wards of our mental hospitals is of paramount importance in preventing many egregious mistakes both in diagnosis and treatment. Our mental hospital physicians, both past and present, have worked often under the most heart-breaking conditions, but yet they have made immense contributions to psychiatric knowledge for which they have never received sufficient credit. If you should think my opinion requires justification I would refer you to the great American philosopher William James, who said: "Insane conditions isolate special factors of the mental life, and enable us to inspect them unmasked." He mentions how "from a study of hallucinations we have learned about sensation; from illusions, perception; morbid impulses and imperative ideas have thrown light on the normal will; obsessions and delusions have led us to study the normal faculty of belief." That statement indicates the importance of tackling our problems with a variety of techniques, and it provides an appropriate spur for continued effort in relation to an admittedly difficult and complicated group of cases. The best and most striking example I can give you is the elucidation of the disease known as general paralysis. Initially we have the clinical observations of Haslam, the apothecary of Bethlem Hospital, soon to be followed by the clinico-pathological correlations of Bayle and Calmeil, and later by the histo-pathological findings of Nissl and Alzheimer. Then we had such special studies as the significance of the Argyll Robertson pupil; the examination of the tendon and other reflexes; the serological researches of Widal and Wassermann; the demonstration of the *Treponema pallidum* in the brain cortex by Noguchi and Moore. Finally we have the triumphant treatment of the disease with malaria as suggested by Wagner-Jauregg, the only psychiatrist, so far, to have achieved the distinction of becoming a Nobel prizeman. All the above work directed first from one angle and then from another should constitute a sufficient warning to prevent us from minimizing one medical field at the expense of another; all are part and parcel of the same problem which may require to be dealt with in a variety of ways, but there always remains the common denominator of a person who requires help in a specialized manner. It is only by such an appreciative attitude that we will get rid of the seven-and-twenty jarring sects which Walshe has referred to. Remember our job is a very responsible one; it deals with the shaping of life's destiny, and in order to accomplish this with justice to ourselves and others, we require with the utmost delicacy to be able to investigate the whole life and development of the individual, always keeping in front of us not so much the limitations as the more positive aspect of the available resources of those whom we may be called upon to help. It is indeed no easy task. It requires patience, tactfulness in handling people, human understanding, and a sureness of touch which will prevent us from adding anything extra to the troubles and difficulties which the person has already experienced. Such helpfulness only comes from wide experience, and from an earnest desire to assist those in trouble. "Before you judge a man you must know the secret of his thoughts, of his sorrows, of his feelings; not to be willing to know more of his life than its material events is to make it a chronology, the history of fools." So wrote that great social

historian Balzac in *The Magic Skin*, a book described essentially as "a commentary on the undisciplined lust of wordly success, indulgence in which shortens life literally and directly by exhausting nervous energy." Therein we have a message which is important for all of us. Our main purpose is to see how man's nervous resources can be conserved so that he will function at the highest level of efficiency. That is what constitutes a real, live, dynamic psychiatry, a psychiatry whose purpose it is to analyse the personality in relation to life's circumstances, the quality of the man even more than his disease. If we fail to do so we will continue to make many serious mistakes; we may be harsh when we should be sympathetic, we may be sentimental and diffident when we should be direct and forceful.

This, however, is neither the time nor the place to enter into an academic discussion of personality in relation to such qualities as character and temperament, or to biology, psychology, ethics and religion. I am thinking of it rather in the clinical sense of diathesis or constitution, of how under a given set of circumstances, physical or mental, that person is likely to react. It is by this insistence on consideration of the personality factor that psychiatry has made, perhaps, its greatest contribution to general medicine, but general medicine has been slow to accept it, and still deals too exclusively in cross-sections rather than in longitudinal life studies. Campbell in his Lowell Institute Lectures entitled "Human Personality and the Environment" illustrated the idea I have in mind very well. There he gave a fascinating account of the personality in relation to all factors, constitutional or environmental, which might influence or modify it. A knowledge of personality, the power to assess it, is shown to be essential for all engaged in directing people in their industrial and social relationships—the school teacher, the factory executive, the social worker, the lawyer, the physician, the minister. It does not matter much what the illness is, whether functional or organic, reversible or irreversible; it is still the same factor, the type of individual in whom the illness is occurring which is of so much importance. Hazlitt, in his essay on "Character," expresses it thus: "There is nothing that helps a man in his conduct through life more than a knowledge of his own characteristic weaknesses (which guarded against become his strength), as there is nothing which tends more to the success of a man's talents than his knowing the limits of his faculties, which are thus concentrated on some practicable object." That is a far grander, wider, and potentially more fruitful working hypothesis than merely to reduce everything to terms of brain function, as contained in the rather out-dated formula, "the brain is the organ of the mind." We must, indubitably, make allowance for a physiological and mechanistic concept, but it is of equal importance to take into consideration the hundred-and-one influences of a personal and environmental nature which so determine our emotional feelings and responses. The work of Rothschild (*Amer. J. Psychiat.*, 1944) on senile and arteriosclerotic states lends much support to the above view. He has pointed out the numerous inconsistencies which exist between the severity of the mental symptoms and the extent of the cerebral lesion. Mild clinical alterations may be associated with severe neuro-pathological damage; pronounced clinical involvement may show only slight anatomic

disturbance; extensive vascular changes may be present and yet there may be no mental involvement at all. He has come to believe, therefore, that structural damage to the brain is only one factor in the production of arteriosclerotic disorders; the individual diathesis of the person must always be taken into consideration: the psychologically handicapped in any way show a high degree of vulnerability. If that statement is true of vascular disease of the brain, it is equally applicable to all other types of organic brain disease. It reinforces the argument that it is not the actual incident or condition which means so much, but rather the way the person feels about it and reacts to it. A common and familiar example is the individual response to alcohol, drugs and head injuries. There too the inadequate personality types demonstrate the most virulent reactions, whether the brain damage has been slight or severe. Masserman's experimental work on animals has been strongly confirmatory, for he has shown that the total personality of the animal rather than the purely mechanical response of the brain to various stimuli is the important point. Superficially it might seem as though we would require to amend the above argument in the light of the remarkable personality changes which can be effected by means of surgical division of the fronto-thalamic fibres. It is evident that conduct and emotional drive may be more closely bound up with hypothalamic function than has been appreciated, and there may be some justification for supposing that we all possess a specific hypothalamic rhythm which determines our particular reactive type. Even so, we may hope that the surgical techniques which are now being employed, and which have resulted in such brilliant results, will be exercised upon a rather specialized group rather than upon people in general. In any case, a wide field of new work has been thrown open, in which the neuro-surgeon and psychiatrist may participate with interest to themselves and benefit to mankind.

It is, however, almost too much to expect that we will ever be able to effect a complete differentiation of personality types. It is wiser to think in terms of inter-mixtures and to learn to pick out what is predominant. Jung has gone so far as to say that "a pure type can never occur in the sense that a person is entirely possessed of the one mechanism with a complete atrophy of the other." Even in those of the same group great differences occur depending on their basic functions, whether thinking, feeling, sensation or intuition. The main distinction for Jung is whether or not tension (introversion) or relaxation (extraversion) is in the ascendant. William James utters much the same thought when he says: "Where the character as something distinguished from the interest is concerned, the causes of human diversity lie chiefly in our different susceptibilities of emotional excitement, and in the different impulses and inhibitions which these bring in their train."

While then it may be legitimate enough to have a number of lines of approach whereby we can study and evaluate the personality, yet we will agree that this is essentially a task for the psychiatrist and psychologist, so that we may come eventually to a clearer understanding of the qualities of man and of the motives and feelings which influence his conduct. This is essential not only in relation to our particular medical problems, but to the

bigger issues of life in general. The man himself, how he is constituted, how he responds biologically to the stress and strain of life should be the main aim of all our work. It is surprising and disappointing, however, to find medical literature so barren of good clinical personality studies. They may be coming, however, because this past war has directed attention more to the value of personality studies than almost to anything else. I would instance particularly such a book as *Men Under Stress*, in which attention is drawn to the ability of essentially normal individuals to adapt to the exigencies of war. "A hair," it is said, "divides the normal from the neurotic"; more or less everyone has his breaking-point leading to the production of neurotic symptoms. The authors of that book give many brilliant, vivid case-records of the Air Force personnel with whom they were associated—"personality profiles" they term them—an analysis of which leads to the determination of those combinations of unhealthy motivation with unsuitable emotional trends which lead to difficulties in combat. They add, however, very wisely, that the only valid test for endurance of combat is combat itself; many anomalies occur. Such case-records have a particular value in that they are red-hot, so to speak, and study the live man in his actual surroundings. To me they are infinitely more satisfying than the (often) invidious analytic studies of great personalities long since departed whose souls might very well be allowed to rest in peace.

In contrast to medical literature, general literature has been rich in the delineation of personality types full of psychiatric interest. Think of the excitement and stimulus afforded by Lord David Cecil's life study of the poet Cowper, or of his fascinating description of Lady Caroline Lamb in *The Young Melbourne*. Joseph Conrad's novels, too, abound in character studies which give us much help in understanding the people whom we are often called upon to help. You remember "Lord Jim," the man "who was overwhelmed by the inexplicable, overwhelmed by his own personality—the gift of that destiny which he had done his best to master." There was a man, an idealist, a man who had attempted to foresee every mischance, and how he would deal with it should the necessity arise, a man who visualized himself as a credit to his home, his upbringing, and his calling, but actually when the occasion came he was found lacking in that decisiveness which made all the difference between success and failure. "The sting of life could do no more to his complacent soul than the scratch of a pin to the smooth face of a rock." Others of Conrad's characters, Allmayer, Jasper Allen, Willens, show the same sort of failure, and are all in striking contrast to the twenty-year-old youth making his first voyage as second mate on the ship "Judea, London; Do or Die," who endured his test and experienced the satisfaction and exaltation indicative of a personality that was in every way sufficient for the task in hand. There is something more to that than courage dependent on will-power or sheer determination; there is a subtle spiritual element closely intertwined with a sense of purposiveness and righteousness. Macaulay brings out what I mean in his description of the respective leaders at the Battle of Neerwinden—on the one side "the hump-backed dwarf (Luxembourg) who urged forward the fiery onslaught of France, on the other the asthmatic skeleton (William of Orange)

who covered the slow retreat of England." In contrast to their physical constitutions each of them had that quality of leadership which enables a man to stand out from his fellows. I have used the above digression into general literature to emphasize not merely the importance but the absolute necessity of keeping the spirit which outlines or determines the purpose in the forefront. R. L. Stevenson may have had that in mind when he interpreted the meaning of religion as a rule of life, an obligation to do well: "If that rule, that obligation, is not seen, your thousand texts will be to you like the thousand lanterns to the blind man." That is what I am striving to indicate by the term personality—something which is almost synonymous with religion as an obligation, as a rule of life which will never let us down, and which it is our duty to go on studying.

Day by day new problems and situations keep presenting themselves. All of them may be somewhat similar to those we have known before, but yet they vary according to the personality involved and the surrounding circumstances, and in consequence each person requires to be assessed anew. That is the reason why, in contrast to most other branches of medicine, we have no stereotyped answer, no infallible panacea. There is always a portion of the neurotic or insane mind which is almost impossible to assess. In consequence, irrespective of all the care we may take, we are constantly in the presence of the unexpected, the inexplicable, the destinies of those whose life's values we can only guess at vaguely. It is the above uncertainty which makes our work, to some of us at least, fascinating rather than irritating. But it should act likewise as a warning not to be too hasty in our judgment of such important issues as prognosis, diagnosis and treatment.

I am no advocate of procrastination, because I know there are many situations in which we must act with that power and promptitude which Dr. John Brown considered was dependent on what he called the "Nearness of the Nous" or presence of mind. While that quality is important for doctors in their work, it is equally important for people generally in the management of their own lives. Its absence may lead to disastrous results, and this is particularly true in the case of those who have never grown out of that feeling of omnipotence which constitutes such an important feature of our childhood days. The persistence of such a condition leads inevitably to that emotionally immature, self-sufficient, selfish state with a consequent lack of ability to profit by advice and experience which makes life a misery for the subjects themselves, and a heart-break for all those who are dealing with them. I do not believe that that concept has been sufficiently applied, but I have been interested to see that Tiebout makes use of it in his paper on "Alcoholics Anonymous" (*Amer. J. Psychiat.*, Jan., 1944), in which he describes the alcoholic—poor man—as suffering from "a narcissistic egocentric core dominated by feelings of omnipotence and intent on maintaining at all costs its inner integrity." Certainly the alcoholic brooks very little control from either man or God; he feels he can cope with his own destiny and manage his own life; he fights to maintain his supremacy. The "Alcoholics Anonymous" group believe that if such a one can be taught to accept God and religion, he may reach a state of submission and acceptance, and in so doing will cease to be an alcoholic. The

explanation almost seems to make it too easy. The cure of alcoholism under such circumstances becomes a form of religious conversion, but the principle embodied has a much wider significance, and is more generally applicable. A similar mechanism is in evidence in practically all of those who experience states of emotional conflict, in people who find it difficult to accept the guidance of others; and particularly in hypomanics and paranoiacs, and those who for one reason or another may have over-compensated their difficulties. A beautiful illustration was afforded by the case of a young man who had suffered from birth from a withered arm, and who in his psychosis expressed the most superior ideas regarding his condition, and consistently refused to accommodate himself to his actual life situation. All such cases must gain in "objectivity and maturity" before real betterment can be expected. The principle inherent in the above discussion is, I believe, a most useful working hypothesis. It is one which the psychiatrist, by his knowledge of human motives and mental mechanisms must, even although the symptoms are subjective and individual, be able to explain fully to the patient. To do this, however, the psychiatrist requires to be a good listener, a thoughtful investigator, and one who can formulate for the patient, in clear, non-technical language, the crux of the situation, whether it is dependent on deep-seated emotional conflicts or on physiological phenomena. I have mentioned the advisability of using clear, non-technical language, and I really mean it, for nothing does psychiatry more harm than the pseudo-scientific phraseology which is so constantly employed. Most of it is quite unnecessary, some of it is almost incomprehensible, and the result, not infrequently, is a hodge-podge which makes reading it a nightmare. Psychiatrists will do a great service to themselves and others if they will express their ideas so clearly as to be readily understood by the man of average intelligence. A case history is often hopelessly spoiled by the use of technical terms which have been neither clearly defined nor clearly understood. Psychiatry, as I have mentioned before, is completely dependent on longitudinal life studies dealing with all the cross-currents and backgrounds of the patient's life. If we have such studies, then we will never lay ourselves open to the charge of experimenting needlessly on those human lives which to every doctor constitute a sacred duty and a special privilege. We can only adequately protect ourselves by our ability to give a reasoned statement on the basis of all the facts. You may consider that I am over-emphasizing the factual basis of clinical observation and scientific method, but recently I have been supported in my view-point by a surgeon, W. D. Cruikshank, who has written as follows: "To all the sciences one method of procedure is common: (1) the collection of facts; (2) the selection of those facts which are significant; (3) the orderly arrangement of these facts in time sequence; (4) the contemplation of these facts until causal relationship becomes apparent; (5) the checking or control of the newly discovered causal relationship until its truth is established beyond question." The above statement may seem a simple formula, something which can be acquired easily, but I can assure you that it is not so simple and easy as it sounds. It requires great skill and understanding, which only comes from extensive and prolonged observation and experience.

In the beginning of this presentation I defined psychiatry as the science of understanding man in his social relationships with the object of reaching to that healthier and saner world of which we are all so much in need. I said further that this was far too big a task for psychiatry alone ; that it required the aid of all those educational, social and legal aspects of human life and work which inter-digitate with our particular specialty. But while we call for and welcome the aid which all other sources may provide, yet we as psychiatrists must take a far more prominent part than we have ever done previously in leading and directing public opinion in relation to those problems which are vital to the health of the nation. We must be in the van, we must have the courage of our convictions, and must learn to express our views fearlessly in relation to all those social evils which do so much to impair the efficiency of mankind, and with which we as doctors are probably more familiar than anyone else. Some of these matters, however, will form the basis of our programme at this meeting, and I feel sure that constructive proposals and suggestions will be forthcoming.

Meantime, however, I believe we can be a shade more optimistic and positive than Clark Kennedy (*The Art of Medicine in Relation to the Progress of Thought*, Cambridge University Press) when he writes : " Unless human nature changes, perfect environmental conditions, even if they ever can be achieved, are not likely to persist. Nevertheless, we can work for improvement in moral and intellectual standards on which the maintenance of satisfactory conditions of life ultimately depend, and in the meantime more could be done to maintain a higher average level . . . life can be too comfortable to promote health and too soft for the development of personality." He suggests the difficult feat of " striking a balance between those who look for a perfect heaven on earth, and those who look for a perfect earth in heaven." It is surely our job to strive for our ideals, and to attempt, however difficult it may be, to promote those changes in human nature which a healthier world demands. Much more, I am sure, can be accomplished if we and our successors will continue to meet the challenge of the unfit, if possible, before they are born, and at least in those early formative years while conditions are still modifiable. We must always maintain the positive outlook which has enabled us to be the foremost and most active exponents of the principles of what is now called social medicine. The Psychiatry of the future must be a form of mental hygiene which will become part and parcel of the lives of the ordinary members of the community. To effect this the principles governing psychiatric work, the philosophy of psychiatry, must come to occupy a much more prominent place in the education of the medical student than so far it has attained to. The emphasis must be placed on the principles of mental hygiene and prevention. Every year of conducting professional examinations confirms my belief that no student should be allowed to graduate as a practitioner of medicine until he has had a satisfactory training and passed an adequate examination in the principles of mental health. My experience tells me that students of medicine should become interested in causes, in the biological response of the individual as a whole to those causes rather than in the differentiation of stereotyped clinical types. Above all, I would ask you to

remember the phrase "Experientia Docet," and to balance your enthusiasm with patience and presence of mind.

One word more in conclusion, and then I have done. My late colleague and friend Robert Dick Gillespie emphasized more than once that it was important for any presentation to have an appropriate ending. As I thought of this, and turned it over in my mind, certain lines (from Euripides' *Alcestis*) came back to me, lines which, while pointing out the uncertainties and possible disappointments of life, yet at the same time have always conveyed to me a triumphant message of hope and encouragement :

" A thousand shapes our varying fate assumes,
And oft those things for which we fondly hoped
Come ne'er to pass ; but God still finds a clue
To guide our steps through life's perplexing path,
And thus does this great business end."

THE LEGAL ASPECTS OF PSYCHIATRY.

CRIME AND PUNISHMENT.*

By W. NORWOOD EAST, M.D., F.R.C.P.,

Formerly H.M. Commissioner of Prisons, etc.

INTRODUCTION.

DISCUSSIONS on crime and punishment frequently bring into relief two fundamental facts: one that everyone is dependent upon his fellows; the other that the physico-chemical, biological and psychological or spiritual worlds are, as J. S. Haldane pointed out, only the same worlds at different planes of interpretation.

Legal, executive and administrative authorities are constantly concerned with problems relating to the punishment for crime and the treatment of criminals, and frequently consider what modifications and alterations of the authorized penalties are applicable to modern conditions. Others, less directly associated with the administration of the law, occasionally apply themselves to the same problems. But the community as a whole is little interested in the subject, and ideas regarding punishment are often ill-advised and presumptuous. They tend, however, to become less arrogant as the observer learns that those who are best informed have no illusions as to the complexity of the subject.

Respect for the law is essential if the latter is to be effective; law cannot advance far without the moral support of the society it serves. It often lags behind the anticipation of those who fail to realize that their views must reach the public and become incorporated in civic understanding before action can be taken.

Perhaps the delay is advantageous in a world which is to-day more concerned with its rights than with its duties, for it affords an opportunity to consider fully the possible implications of controversial proposals. Such, for example, as the assertion that a person can only gain self-realization if he is able to exercise his emotional tendencies more freely than society will allow—a view which disregards the fact that the treatment of crime must be considered from the position of those who respect the law as well as of those who break it. Further, a democratic government is not static, although by appealing to reason it may appear to operate slowly when compared with the decisions of the dictator, who incites his subjects to action or submission by emotional appeals.

It has been said that the savage sentences of former times, and the brutal manner in which they were carried out, were due to the intellectual starvation of the people. But it is also to be remembered that character is not merely a

* This paper, in abstract, was read at the afternoon session of the Annual Meeting of the Royal Medico-Psychological Association on Thursday, July 18, 1946, in Edinburgh.

matter of intellect, and may be of outstanding importance in maintaining the law. There can be no doubt that by arousing the public conscience a higher standard of social rectitude can be attained, and this is sometimes more closely related to the emotions than to the intellect. Moreover, in modern society the different classes tend to merge into one another, whereas formerly the transitions were abrupt and understanding between the classes distant.

It is a matter for speculation whether an improved attitude on the part of the potential criminal towards society is a more important contribution to social security than the changed attitude of society towards the criminal. At least this can be said: although the criminal fails in his duty to society, we are not thereby absolved from carrying out our duty to him.

THE NATURE OF CRIME.

Jeremy Bentham seems to have looked upon crime as a prohibited act from which there resulted more of evil than of good. Professor Kenny considered that the definition of crime was "a grave—if not indeed insoluble—difficulty . . . For it consists of the fundamental problem '*What is Crime?*' Clearly, the criminal law is concerned with crimes alone, and not with illegal acts in general. But how are we to distinguish those breaches of the law which are crimes from those which are merely illegal without being criminal. . . . Crimes are wrongs whose sanction is punitive and is remissible by the Crown *if remissible at all.*" (Italics in original text.)

W. A. Bonger wrote: "Crime is a serious antisocial action to which the State reacts consciously, by inflicting pain (either punishment or correctional measures)." J. Michael and M. J. Adler state: "The most precise and least ambiguous definition of crime is that which defines it as behaviour which is prohibited by the criminal code." They use the word delinquency for the criminal behaviour of a person below some age prescribed by law. B. A. Wortley, still more recently, declares: "A crime is an offence against the law, and it is usually also an offence against morality, against a man's social duty to his fellow members of society: it renders the offender liable to punishment."

In medical literature, as well as elsewhere, crime is often referred to as antisocial conduct. The imperfections of this description are obvious, but it does stress the fact that injurious social consequences follow certain kinds of activity.

Juries are sometimes told that a criminal court is not a court of morals. When this statement has been made during trials in which I was concerned it seemed to me to refer to the quality of virtuousness. Stephen declared that "the great difference between the legal and the popular or moral meaning of the word crime is that whereas the only perfectly definite meaning which a lawyer can attach to the word is that of an act or omission punished by law, the popular or moral conception adds to this the notion of moral guilt of a specially deep and degrading kind." He added: "The criminal law must from the nature of the case be far narrower than morality. In no age or nation, or at all events, in no age or nation which has any similarity to our own, has

the attempt been made to treat every moral defect as a crime. . . . Criminal law, then, must be confined within narrow limits, and can be applied only to overt acts or omissions inflicting definite evils either on specific persons or on the community at large. It is within these limits only that there can be any relation at all between criminal law and morality." He pointed out that this relation is not the same in all cases: "The two may harmonize, there may be a conflict between them, or they may be independent." In our own time Lord Hewart stated: "It would indeed be a poor and starved morality which depended upon the provisions, positive or negative, of law, and it would probably be an intolerable law which sought to give legal effect to all the dictates and exhortations of morality."

Morality is so closely interwoven with social conduct and immorality with criminal conduct that it seems desirable to pursue the matter a little further.

In early times the operation of the law between subjects was not so much to punish as to assess the compensation to be paid to the injured individual or to the Crown. J. W. C. Turner points out that: "As time went on the idea gradually developed, probably under ecclesiastical influence, that the infliction of punishment was necessary. The same influence seems to have led to an agreement that liability to punishment should depend upon moral guilt."

In spite of the cruel sentences imposed by the ecclesiastical courts, it would appear to their credit that the adoption of moral standards introduced the necessity of taking into account the mental functioning of the offender. As Turner points out, in that way lay the recognition of the doctrine of *mens rea*, as a subjective ingredient in the assessment of criminal responsibility, although moral guilt was measured by strictly objective considerations.

There can be little doubt that the ecclesiastical courts were satisfied that what they considered to be immoral and wrong was so in fact, and it is almost inconceivable that they could do otherwise than attach a religious significance to their assessments. It is perhaps instructive that whatever words they may have used in declaring their awards, the only occasion in which an appeal is made to the Deity by the judge to-day is in pronouncing the sentence of death.

As I see it, a crime arises if voluntary conduct results in the commission of an unlawful and punishable act (*actus reus*)* or omission, which the offender must have foreseen was likely to cause certain consequences. And here a discrimination must be made between intention, recklessness and negligence. Turner puts the matter clearly: "*Intention* denotes the state of mind of the man who not only foresees but also desires the possible consequences of his conduct. . . . *Recklessness* denotes the state of mind of the man who acts (or omits to act when it is his legal duty to act) foreseeing the possible consequences of his conduct, but with no desire to bring them about. . . . *Negligence* is the state of mind of a man who pursues a course of conduct without adverting at all to the consequences of that conduct: he does not foresee those consequences, much less desire them."

* Such result of human conduct as the law seeks to prevent, that is to say, a specific crime (J. W. C. Turner).

These considerations are commonplaces among lawyers, but are not necessarily in our minds when psychiatrists engage in discussions on crime and criminals. We all recognize that in human society prohibitions must be enforced lest harm result to all, and that a degree of intelligence, wisdom and control is required before the fundamental standards of behaviour subserve the basic needs of the individual as well as of the society in which he lives. Taboos and regulations are introduced in order to ensure the preservation of society and the propagation of its members. Hence the manner in which an individual urge is regulated and controlled will gain approval or disapproval according to its conformity with an authorized code. So it comes about that approval and disapproval are terms which involve morality and immorality and express the possibility of success or failure in social adaptability. But the presence of the criminal in our midst proves our adaptation to be far from universal.

The criterion of immorality seems to depend upon the fact that the conduct in question is injurious to society when it is generally practised. And because the consequences are usually harmful, the term is sometimes applied to activities in which the actor, an accomplice or the public are uninjured.

A criminal act must be considered, if possible, in association with its motive, and E. Mira points out that the highest moral conduct may result from motives which in themselves are immoral. He records the case of a soldier who, in an experiment undertaken at a military hospital, urged that the greatest quantity of blood possible should be taken from him for the benefit of his company commander. But under pressure he told his questioners that he had formerly suffered from syphilis and hated his superior officer, and hoped that he would thus be able to infect him with the disease.

Without entering into the realm of casuistry, it may be said that a crime may occasionally be the result of altruism; as when a doctor induces euthanasia at the request of a dying patient, or a parent steals food for his necessitous family. So, too, when an insane husband kills his wife in order to protect her from the vicissitudes and hardships of a world he believes he is about to leave.

Modern society is far from being single-minded in passing moral judgments, and the difficulty of establishing precisely a norm of moral behaviour and the many points of view which may be held on a hypothetical or concrete situation are matters of almost daily experience, and can be demonstrated by suitable tests. Mira found that in ten suggested courses of action to solve a problem of conjugal infidelity 578 married couples gave widely different answers. The preferences also differed markedly in six courses of action offered to 156 trained nurses in a concrete test on the ethics of professional conduct. In fact, in many situations the norm of moral behaviour is undetermined.

To some extent morality depends upon tradition, and the potential criminal, like other persons, is required to base his behaviour mainly upon that tradition. All will agree that in ordinary situations we are assisted in this matter as our reasoning capacity and emotional control advance through the prohibitions and penalties of egoistical childhood and credulous adolescence to the controlled activities of understanding maturity. The progress is gradual, but at

length prudence is dissatisfied unless social order is maintained in the forefront of our desires.

During this development it becomes important to distinguish, however simply and imperfectly, between sin and crime. The latter has been defined above. Sin may be regarded here as moral evil considered from the point of view of religion and regardless of its relation to civic law and ethics. Sin and crime, however, have certain common features. Both are opposed to the best traditions, both reject the golden rule of doing as you would be done by, and both in different spheres ignore the satisfaction of real or assumed security.

From the psychiatric point of view there is a significant difference between the two, inasmuch as crimes are acts or omissions which are scheduled by law and are ascertainable by the curious, whereas the declaration in the Pauline epistle that " whatsoever is not of faith is sin " * is of much wider import, and carries the speculator into the realms of mysticism. And here I am reminded that Dean Inge has said that " the real lesson of anthropology is that religion, science, ethics and aesthetics have all become differentiated out of the confused muddle in which they exist together in the mind of the savage." I am reminded, too, that the Dean feels with others that " since the psychologist has debarred himself from explaining mysticism by philosophy (in the older sense), he is practically obliged to explain it by pathology." At least this will be accepted, it seems useless to attempt to maintain the view that science deals with certainties and metaphysics with uncertainties.

Again, we should avoid confusion when using scientific terms, particularly if we are concerned with others in such practical subjects as crime and punishment. Bernard Hart reminds us that the psychologist, like the physicist, employs conceptions which cannot be demonstrated to have an actual phenomenal existence. The psychologist uses terms, as does the physicist and others, to explain observed phenomena. Hart refers to an unconscious mental process as " a phenomenal impossibility just as the weightless frictionless ether is a phenomenal impossibility. In both cases the conception justifies its claim to rank as a scientific theory because it serves to resume and explain in a comprehensive and convenient manner the facts of our experience, and because it satisfies the one great criterion of science, the test of utility." Unfortunately, in the witness-box theory is sometimes presented as fact in circumstances which are detrimental to psychiatry. Nevertheless, when the captious critic censures the psychiatric approach to crime he should bear in mind Hart's statement.

On the other hand, the psychiatrist will often fail if he approaches the subject of criminal behaviour in a monopolist spirit. If he accepts the fact that the understanding and treatment of criminals are tasks which require the efforts of different professions, the experts in those professions are also entitled to express their views. Our contributions differ, their values differ and their practical usefulness differs. We cannot doubt that the co-operation of many workers will surely take us further towards successful achievement in these difficult matters than a monopolist approach, however earnest and erudite its exponents may be.

* Romans, XIV, 23.

The danger of a monopolist approach is well shown in the eighteenth century *Essays on Physiognomy* by Lavater. No one can doubt his sincerity and industry, but he wrote: "A long, projecting, needle-formed, or a strong curled, harsh, rough hair, springing from a brown mole or spot on the chin or neck, denotes, in a most decisive manner, very great voluptuousness, which is rarely unaccompanied by great imprudence and indiscretion." His contemporary Gall, anatomist and physician, formulated his phrenological doctrine in a similar monopolist spirit, and might have reached other conclusions by a wider approach. Bernard Hart in his Goulstonian Lectures seems to have referred to the same danger. He pointed out that although the observations of Charcot and his pupils on hypnosis in hysterical patients were made with extreme care and accuracy, they were misapprehended and vitiated by the adoption of too narrow an angle of approach.

To look upon sin in the Pauline sense as behaviour which is mainly injurious to the individual, and crime as behaviour which is essentially injurious to society, stresses the fact that in crime self-regarding behaviour predominates over social behaviour, conscience and moral standards. Moreover conscience—character developed under moral guidance (W. McDougall)—is not infallible and morality is not static.* Both are acquired in contact with our fellows, and we must remind the uninstructed that our impulses and aptitudes can only be directed towards social behaviour by training and contact with those who are socially mature. In this process, reason, aided by knowledge and experience, balances one course of action against another, and the result is to some extent determined, of course, by inherited traits of character. If the impulses and aptitudes are socially acceptable, fresh situations will usually be met by appropriate action. And if the natural tendencies are controlled by the will, as well as by social conventions and habits, a satisfactory course of action is likely to be selected and maintained.

Apart from the difficulty arising from the fact that different persons possess different qualities, and that some have more difficulty than others in making social adjustments, there is the fact that we have little control over the biochemical factors which affect us.

Among the extrinsic factors which are important in this matter is public opinion. The collective approval or disapproval of our associates and of society at large undoubtedly exercises by its strongly pleasant or unpleasant effect an important restraining influence upon the activities of ordinary men, and many potential criminals. So strong is the desire for approval that examples are constantly presented in which the manner of a man's life subserves his desire for posthumous praise. At the same time some criminals willingly incur the disapproval of society if they can by this means gain the approval of their associates. It is clear that social behaviour based upon the fear of disapproval can hardly acquire a high standard if it is only concerned with avoiding wrongful acts. And well-doing for the sake of praise is not entirely commendable. For it is fundamentally selfish, and lacks the altruism necessary for social behaviour. This is relevant to my thesis, since the majority

* Whereas conscience in ordinary so-called moral persons is co-operative, altruistic and questioning, in habitual criminality it is unco-operative, selfish and unaccusing.

of criminals are not so much vicious or depraved as intensely selfish. Their self-regarding sentiment is exaggerated and misapplied.

As already stated, the law recognizes the fact that a criminal act involves a certain state of mind. As psychiatrists we often must insist that past events of psychological significance are related to present occurrences. Although a crime cannot be regarded in isolation, or understood unless a history of previous events and a longitudinal section of the offender's ordinary as well as unusual behaviour is studied, it is often necessary to introduce our view with care. In so doing the evidence in favour of determinism often seems opposed to the doctrine of freewill. But since controversy in this matter has been handed down throughout the centuries and the issue is still uncertain, it is unnecessary to pursue it. The psychiatrist can perhaps do no more than insist that a greater degree of determinism should be accepted in some cases. At the same time, if he thereby attempts to relieve an accused person of responsibility, it is relevant to regard the fact that in the ordinary affairs of life we are held accountable for our behaviour at home, at business, or in our professions, in spite of our constitutional disabilities and the force of circumstances beyond our control.

Both lawyers and doctors will agree that they exercise the power of selecting their course of action in the important affairs of life, and many will accept the view that their choice may be affected by past events which are not apparent at the time their decision is made.

The conduct of our fellows is usually judged on the assumption that they know whether their action is socially correct or incorrect, and exercise, or refuse to exercise, their self-control. An idea of limited liability has become associated with those who are unable to develop or exercise this power, and postpone an immediate gratification for a distant advantage. Unfortunately discussions on self-control are usually obscured by abstruse metaphysical speculations. Nevertheless, the power of controlling our urges and of guiding our desires is very real and of the utmost importance. We all accept this, and the fact that control can be developed by use and weakened by disuse, as well as the fact that one of the earliest lessons taught children is the necessity to compel themselves to do what must be done although they may wish to do otherwise. It is even more important for an offender to force himself to submit to social requirements by the exercise of his will power than it is for the patient, suffering from a minor mental abnormality, to assist his recovery by compelling himself to follow the fundamental principles of mental hygiene and control his emotional habits.

This much is certain: the treatment of criminals must be sometimes qualified by taking into consideration events in their lives which may reach far back in their personal history. Among still more distant factors we cannot disregard the inherited traits which influence character and the careers of reputable persons as well as of criminals. Indeed, he would be a poor legal or medical therapist who neglected to do so in his efforts to help the offender towards rehabilitation.

Our inherited antisocial tendencies, like other constitutional qualities, may be modified by training, and it will be agreed that social adaptation depends

upon the qualities of the trainer as well as of the trainee. But as children and young persons do not select their monitors, they may have reason to protest that their faults are largely attributable to the ineffectiveness of others.

As we faithfully observe our associates, and have opportunities to study their thoughts and dream phantasies and compare them with our own, we are driven to the conclusion that most of us are potential criminals. And just as we have come to realize that prolonged psychological stress produces abnormal mental reactions in persons who have previously been regarded as normal, so must we accept the fact that environmental stress may cause crime in those who are potential criminals. The important thing to remember is that crime may result if the tendencies of the individual and the environmental conditions together outweigh the resistance which can be opposed to them. These factors being variable, and as a rule the environmental factor is the most easily altered, it follows that whether crime results or not often depends upon the degree of variation present in one direction or possible in another. Nevertheless, the primary concern of society, and the first duty of its legal instrument, is the protection of the majority from the misdeeds of the fractional minority, and we simply cannot afford to discriminate always between the variables which go to make up criminal behaviour. Rather must we often deal with results, and act upon the assumption that although some dispositions are socially acceptable, and others are antisocially inclined, all must be subservient to the general welfare. Society must be jealous of its rights if it is to survive, and therefore is not always very ready to accept with equanimity the irresponsibility associated in a criminal court with insanity and some forms of mental defectiveness, or the lessened culpability which is apparent in some forms of minor mental abnormality.

Here I may add that, although I have seen it somewhere stated that we shall not progress in medico-legal understanding as long as we use the term insanity, it seems well to remember that our duty is to present our views in the criminal courts as clearly as we can. The term insanity has a legal significance which is generally understood by juries. Are we satisfied that the terms psychosis or mental disease will be better understood by laymen ?

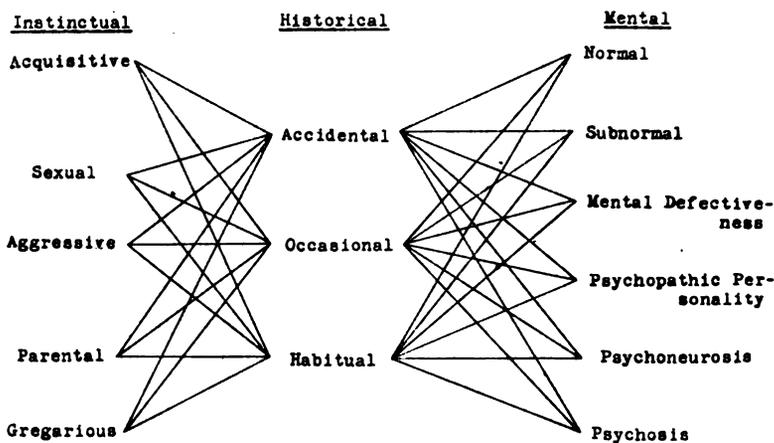
At the same time, when we refer to the association of insanity and mental defectiveness with criminal behaviour, we must avoid the tendency to lead others to attach too much importance to the intellectual factors, and too little to the emotional qualities which so profoundly affect human behaviour.

CLASSIFICATION OF CRIMINALS.

The legal and executive authorities in the past seem to have been more concerned with the classification of crimes than of criminals, and because of the many difficulties the classifications have met with a considerable amount of criticism. The classification of the administrative authorities has been practical and free from doctrinaire influence. But I am here concerned with the medical aspects of crime, and need not delay to present the classification used by the Prison Commissioners for general purposes.

Towards the end of the last century, and during the earlier years of the

present, criminals were frequently said to belong to one of three groups—accidental, occasional and habitual or professional. This classification represents a high, medium or low breaking-point, and is still useful as a partial assignment. It may be advantageously combined with a reference to the causal instinctual activity at fault in terms of acquisitiveness, aggressiveness, sexuality, and parental or gregarious anomalies of behaviour. The classification is completed by including a reference to the mental condition of the offender. The result enables the psychiatrist to form an idea of the individuality of the person who is described as an accidental aggressive schizophrenic, as an occasional sexual constitutional psychic inferior, as an habitual acquisitive normal, and the like. Briefly, I suggest that the most satisfactory medical classification of offenders is tripartite: historical, instinctual and mental. It may be set out diagrammatically thus:



Medical Classification of Criminals.

Hitherto legal and executive, as well as administrative authorities have been chiefly occupied with offenders whose mental condition was normal, mentally defective or insane. Looking back one is impressed by the advances that have been made in the methods of dealing with crime associated in modern times with these conditions. Although the legal method of dealing with accused persons who are insane is criticized by some—usually those least informed—many believe that it is in practice as equitable as is possible in the present state of medical knowledge. There is, however, reason to think that the punitive treatment of some subnormals, psychopathic personalities and psychoneurotic offenders can be carried out more intelligently than is the case at the present time if the public will accept psychiatric guidance in the matter.

THE NATURE OF PUNISHMENT.

It is not always remembered that criminals to-day are sent to prison as a punishment and not to be punished. Punishment is provisionally defined by B. A. Wortley as "the totality of the legal consequences of a conviction for a crime." It seems clear that Jeremy Bentham regarded punishment as an

evil, for he said, "the evil of punishment must be made to exceed the advantage of the offence." But he does not say how these variables are to be standardized and measured, though he added, "the proportion between punishment and offences ought not to be so mathematically followed up as to render the laws subtle, complicated and obscure."

Punishment may be looked upon as an evil when it prevents an offender from providing for his dependants, when his work in the outer world is more valuable to society than his occupation in prison, when his family suffer because of his conviction, and when he leaves prison more hostile and embittered than when he entered it. The first three results may be irremediable. It is the duty of society to prevent the fourth whenever possible, not only for the sake of the offender but also for the benefit of society.

Bentham considered that the evils of punishment were: The evil of coercion—that is to say, a more or less painful privation; the sufferings caused by the punishment; the evil of apprehension—that is, the fear of prosecution; the derivative evil suffered by the offender's parents and friends. It is, however, pertinent to remember that pain, which forms so large a part in the evils described by Bentham, is not necessarily evil. The religious significance of pain has been acclaimed by churchmen, and has recently been discussed in simple language by C. S. Lewis.

Eighty-five years ago John Hilton, the eminent surgeon of Guy's Hospital and President of the Royal College of Surgeons, taught that pain had a beneficial effect. He showed that it called attention to the presence of injury or disease and the necessity for rest. In other words, pain is valuable if it demonstrates the importance of ascertaining its cause and of applying the appropriate remedy. Even the constant pain of an incurable disease may not be wholly evil if it has a good effect upon those who bear witness to the fortitude of the sufferer. Again, the feeling of guilt and its partner pain is relative to the traditional standards of the offender's associates, and it is hardly necessary to add that the importance of the fear of pain and the desire for pleasure is easily exaggerated where normal people are concerned. Moreover, the intensity of a painful or pleasurable emotion is transient.

It is important to stress the fact that the subject of punishment is surrounded with difficulties. For example, many considerations modify the turpitude of a crime—the age and previous record of the accused, the motive for the offence, its danger to the community, the amount of premeditation exercised, the provocation and temptation to which the accused has been subjected, and so on. These variables are, for the most part, imponderable, and it by no means follows that different judges and juries will assign to them similar values. And although provocation is not taken into account in determining the guilt of the accused, it may be a factor in estimating his degree of turpitude and in modifying the sentence.

The prevention of crime is perhaps more important than its punishment, and prophylactic measures may be direct or indirect. Among the direct may be mentioned the deterrent effect of punishment, police action of a preventive character, the activities of societies such as the Prevention of Cruelty to Children and the Prevention of Cruelty to Animals, and of organizations dealing

with the after-care of discharged prisoners. Among the indirect may be added confidence in the integrity of the judicial and police authorities, the maintenance of a high standard of civic responsibility, improvements in social conditions, and the activities of social and religious organizations. Nevertheless, our complex human nature is woven into the fabric of our lives, making a crimeless state a Utopian dream, and discrediting the belief that our choice of action is as simple as that of the amoeba engulfing its prey.

Retribution, deterrence and reformation are the usual aims of punishment to-day, and it is generally accepted that their relative importance varies with circumstances. The armchair critic sometimes appears to support the principle that in dealing with criminals self-regard should be given more freedom. Those with first-hand knowledge usually believe that increased self-discipline and not greater licence is necessary if we wish to preserve social security and promote the amenities of communal life.

An eminent American psychiatrist* has stated that in the United States of America only a relatively few persons who commit homicide are ever apprehended, only a relatively small number of those who are apprehended are ever convicted, and of the latter a lesser number—for the most part defenceless youths—are finally executed. How do these facts compare with the position here? In the ten-year period 1929 to 1938 there were known to the police in England and Wales 880 cases of murder of 1,001 persons aged one year and over. In 340 cases the murderer or suspect committed suicide, and 5 died before trial. Of the 504 persons arrested 222 were found to be insane and 154 were sentenced to death. Of the latter 73 were executed, and in 81 the sentence was commuted to penal servitude. In addition 2 persons were arrested and dealt with abroad, and 2 youths were sentenced to be detained during His Majesty's pleasure, being under the age when sentence of death is passed, namely, 18 years. The results do not include those cases in which murder was reduced to manslaughter. In all cases the accused is afforded legal aid, and it is evident that punishments in any country must be considered from the manner in which they are applied.

The armchair critic who opposes the *retributive element* of punishment sometimes seems to forget that it has a deep-seated biological significance. In a cultured society it may be necessary, and advantageous if it preserves a correct relation between the turpitude of the offence and the severity of the award. At the same time justice must be dispassionate, and stress the need to restrict our abhorrence and disgust to proper proportions as well as oppose pusillanimous sentimentality by vigorous understanding. Moreover, we must not confuse retributive justice with vindictive punishment; revenge may be an evil to the avenger as well as to the object of his vengeance.

In the present context *deterrence* may be regarded as the effect upon potential criminals of the legal treatment of actual criminals. Unfortunately we lack the means of assessing its importance. But it is not merely an intuitive speculation, and its practical value cannot be denied. Mercier's statement still deserves consideration: "If punishment is to deter from crime, it need not be severe, but it must be enough to render the crime unprofitable. It

* Dr. W. A. White.

need be no more than this, but it must be certain, and it must be speedy." He added: ". . . all that is necessary to deter the criminal from committing crime is to deprive him promptly of the fruits of his crime. If this is not done, punishment will be inefficacious. If it is done, punishment will be unnecessary." However true this may be where acquisitive offences are concerned, it must surely leave one in a state of pessimistic bewilderment if the crime immediately relieves the emotional tension which was its purpose, as in sexual and many non-sexual aggressive crimes.

Finally, *reformation* may be considered as the result of purposive treatment directed towards the mental, moral and social rehabilitation of actual criminals. Here again is a complicated problem, but unlike that presented by deterrence, it can be measured with some degree of accuracy by appropriate follow-up studies. Reformation may be transient in some cases of mental defectiveness as well as in some cases of psychopathic personality and psychoneurosis. It is probably most enduring when it arises from within the offender, and it cannot be attained by severity on the one hand or sentimentality on the other. It is sometimes suggested that deterrent and reformative aims are opposed to one another. I believe that they can be more truly regarded as supplementary to a common purpose—the prevention of crime.

CLASSIFICATION OF PUNISHMENTS.

Punishments may be considered under four heads:

1. *Punishments which cause pecuniary loss to the offender.*—In courts of summary jurisdiction fines are a frequent and convenient award. The retributive element is stressed when a substantial fine is added to a sentence of imprisonment.

2. *Punishments which cause loss of prestige.*—This is mainly brought about in this country by the publication of criminal proceedings in the press. It may be double-edged if publicity at any cost satisfies the vanity of the offender or that of his relations. In a recent case of murder, with which I was concerned, the mother of the homicide was reported to be mentally defective or very backward. She was delighted when told that her son had been arrested for murder, and said that "she never thought he would be clever enough to get his name in the papers." Curtis H. Clay, Managing Editor, *Daily Post Tribune*, La Salle, Illinois, has stated: "Since crime was banned from our page one offences committed by local residents have been few and of a minor nature." In 1909 Judge H. T. Hulbert, Head of the Wayne County, Detroit, Juvenile Court, persuaded the editors of four papers to cut out entirely, or tone down, the notices of crimes in which juveniles figured. J. N. Baker reports that delinquency was reduced so much that "the court practically went out of business." Section 49 of the Children and Young Persons Act, 1933, declares that no newspaper shall in future reveal the name, address or school, or include any particulars calculated to lead to the identification of any child or young person concerned in proceedings in a juvenile court, or to publish any picture of him. Further, all other courts are given discretionary power to prohibit newspapers from publishing similar particulars in regard to Children

or Young Persons in any proceedings which arise out of any offence against or any conduct contrary to decency or morality (Section 39).

On the other hand, whilst formerly all proceedings under the Punishment of Incest Act, 1908, were heard *in camera* (s. 5), this provision was repealed by the Criminal Law Amendment Act, 1922, thereby inviting publicity.

Loss of prestige the result of publicity may be unjust if it is continued after the legal punishment has been satisfied. No doubt the pillory, the stocks and the public whippings of former times caused loss of prestige, and it is interesting to note that public whippings may still be inflicted in Delaware State, although this method of punishment is said to have declined in recent years.

3. *Punishments which cause physical suffering.*—In this category punishments are based upon fear, and include death, quartering and corporal punishment. Death is usually restricted to cases of murder and treason, but may be inflicted in certain cases of piracy and arson. The Crown may still order quartering, or the beheading of a traitor (by 54, George III, c. 146). Corporal punishment was considered by a Departmental Committee in 1938. It was decided that the weight of evidence favoured the view that this form of punishment was not essential for the interests of society, except for the prison offences of mutiny, incitement to mutiny or gross personal violence to an officer of the prison. The Criminal Justice Bill, 1938, adopted this recommendation.

4. *Punishments which cause social restrictions or loss of liberty.*—Although outlawry has not been abolished, it is obsolete, and the punishments in this class are limited in practice at the present time to probation, sending the offender to an Approved School, or to a Borstal Institution, or to a sentence of imprisonment, penal servitude, or preventive detention. It is unnecessary to consider them in detail here. It will be remembered that the Criminal Justice Bill proposed certain alterations to the present practice, and that some bear upon the medical diagnosis, prognosis and treatment of offenders. If these modifications are introduced, a better understanding of the criminal by extra-mural psychiatrists and a wider conception of punishment as a method of treatment will be required.

PSYCHIATRY AND PUNISHMENT.

When a crime is committed the processes of criminal justice should be directed to the fact. But this does not always follow, since in some cases—for example, occasionally in bigamy and incest—the victim is an accomplice; and in other offences also the crime may not be reported to, or may baffle, the police. The detection of the criminal is the next process, and if followed by his arrest and conviction, leads up to considerations which decide whether punitive or non-punitive methods shall follow.

The two great professions of Law and Medicine offer a parallel when the former deals with law-breakers and the latter with patients. The magistrates who adjudicate upon 99 per cent. of the offenders and the general medical practitioners who attend the great majority of persons who are ill frequently see the results of their decisions, and if necessary adopt alternatives on future

occasions. It may be otherwise in cases of serious crime or illness, as the High Court Judge may never see or hear of a prisoner after the sentence has been declared, nor the medical consultant his patient after he has left the consulting room. The former may remain ignorant concerning the result of the legal decision, and the latter of the medical treatment. But unless a person is informed he may be convinced that the result of his award is satisfactory when it is not so. The medical consultant endeavours to check the correctness of his diagnosis, prognosis and treatment by follow-up studies when possible ; and it is rather surprising that no remedy has been devised to place the judicial authority in a similar position, since it is frequently declared that the determination of the sentence is his most difficult task in a criminal trial. To act upon the assumption that the usual form of punishment will be suitable in an individual case may be unsatisfactory, and almost seems to promote a possibility to the status of a certainty. The practice takes us back to the days when retaliation and deterrence were the only factors considered, and the reformation of the offender was scarcely contemplated. As I have already stated, public safety must take precedence, but justice is concerned with the three aims of punishment, and since reformation benefits society as well as the offender it cannot always be denied.

A psychiatrist recently stated that the Law still nourishes certain superstitious beliefs in the virtue of punishment. In this appears the germ of the idea that criminals ought not to be punished by the usual legal measures, but should be dealt with in some other way. It disregards the fact that the legal and executive authorities are constantly using methods in which punishment and treatment are associated, and that in the ordinary affairs of life we have to pay for our mistakes. The view maintained by prison psychiatrists in this country, that punishment may be a valuable adjunct to treatment in selected cases of criminal behaviour associated with a minor mental abnormality, appears to be gaining ground.

Let us have no illusions. Judges cannot always accept the psychiatric and psychological interpretations of criminal conduct advanced by some enthusiasts. It cannot be denied that psychiatric views are sometimes directly contradicted by the known circumstances of the crime, and that these do not always receive from psychiatrists the consideration which is their due. Above all, let us remember that society rightly refuses to hand over to doctors the powers of the courts to decide the punishment. We must also accept the fact that our punitive measures have been evolved by the wisdom and experience of highly skilled legal and executive authorities and meet with a large measure of success.

We have only to study the practice of the criminal courts to be convinced that the training of a psychiatrist cannot compare with a legal education when the accurate estimation of facts and their correct interpretation in complex situations are concerned. And Sir Roland Burrows, Recorder of Cambridge, has stated that "lawyers were sometimes able to appreciate the nature and bearing of evidence because it was a matter with which they had to deal, and he had occasionally been driven to the conclusion, from what he had seen of medical men, that the appreciation of the significance of facts and of the

hearing of the evidence was not yet sufficiently a part of the training of the medical man."

The relation of psychiatry to punishment, as I see it, is concerned with diagnosis, prognosis and treatment.

Diagnosis.—The ascertainment of the mental condition of a person who is mentally ill is usually a straightforward application of psychiatric knowledge to the circumstances and indications of normality and abnormality present. If mental abnormality is suspected in criminal cases the position is more complex. The offender has often an undisclosed motive for his criminal behaviour, and secret reasons for the manner in which he presents himself to the psychiatrist for examination. It is clearly necessary for the diagnostician to be well experienced in the more unusual motives of normal persons as well as of psychiatric patients, and to have practical knowledge of the boundaries of normality.

Looking back, say, twenty-five years, one recollects that many exhibitionists were said to be moral imbeciles and later moral defectives. To-day they are often assumed to be psychopathic personalities or psychoneurotics, without taking into consideration the fact that some are no more abnormal than the greedy man who overeats. Indeed, the term "sexual appetite" may be particularly appropriate in a criminal court if it refers to a man who leaves home to seek a sexual adventure in a country lane, just as another sets out to satisfy his gluttony at his favourite restaurant.

It would lead us too far to recall the many difficulties in diagnosis which may arise in cases of alleged mental abnormality and crime. But highly technical laboratory methods, whose value is at present undetermined, sometimes add obscurity to the problems before the court and confuse the evidence. It must also be admitted that we are often on dubious ground when certain psychoanalytical views are introduced as diagnostic aids, and psychoanalytical terminology, as well as theory, often arouses opposition. This is sometimes because of the manner in which it is presented. A jury may be shocked when told that sexuality is present in infancy. But their hostility may be moderated if they are reminded that we frequently see evidence of acquisitiveness and aggressiveness in infants, and that it would be a strange biological anomaly if so important an urge as sexuality was entirely omitted from infantile expression.

An unfavourable impression is introduced if a satisfactory psychological explanation for a crime is presented in order to excuse the offender, regardless of the fact that it would not absolve him from responsibility for, say, a bankruptcy connected with his business or profession.

There is perhaps an unavoidable tendency for the psychiatric diagnosis in a criminal case to become so involved in the course of a trial that it lacks the precision which the administration of justice requires. The difficulties of presenting a precise diagnosis increase when different types of mental abnormality overlap, and if—as is not uncommon—they are in an initial stage of their development. For the most meticulous accuracy on the part of the expert witness is essential, and in cases where the diagnosis is uncertain it is well to bear in mind that Sir Travers Humphreys, the eminent judge of the

High Court, discussing Science and Justice, said : " The best witness is the one who is not afraid to say upon occasion, ' I do not know ' . "

The differential diagnosis and classification of the sub-groups in some forms of mental abnormality, for example psychopathic personality, may be matters of opinion when first studied. We must accept the fact that psychiatry, like other branches of medicine, is too dynamic to be often dogmatic. Nevertheless, crisp terms should be our aim in the diagnosis of the mental condition of an offender. The careful exclusion of abnormal mental states will go far to establish normality, although circumstances connected with the crime may seem to be unusual.

Prognosis.—Lawyers and administrators are intimately concerned with prognosis—that is, the chances of an offender's rehabilitation—and psychiatrists may be asked to predict the probable effect of legal and medical treatment. Ordinary assessments may be of little value when either normal or abnormal mental states are related to criminal behaviour, and experience of criminals as well as of psychiatric patients is important even for an approximate forecast. The problem often presents insuperable difficulties, but something is gained when this is recognized, and also the fact that the most reliable medical opinion may be that which is least assured. The psychiatrist, however, is often in a position unhesitatingly to declare that legal punishment alone is hardly likely to effect the desired result.

Hornell Hart, in 1923, appears to have been the first person to suggest the possibility of applying to punitive measures the methods used in the field of insurance for predictability. Since then prediction techniques have been advanced by E. W. Burgess, Sheldon and Eleanor Glueck, G. B. Vold, E. D. Monachesi and others. The Gluecks, in 1930, stated that " legislative prescription of penalties and judicial sentencing are founded upon considerations almost wholly irrelevant to whether or not a criminal will thereunder ultimately be a success, a partial failure, or a total failure. " They constructed a prognostic device based upon the offender's industrial habits preceding sentence, the seriousness and frequency of pre-reformatory crime, arrest for crimes preceding the offence for which sentence to a reformatory was imposed, penal experience preceding reformatory incarceration, economic responsibility preceding sentence to reformatory, and mental abnormality on entrance to reformatory.

In a recent study M. Hakeem, using the Glueck method, considers that " it is possible by statistical analysis and an actuarial technique to utilize the experiences of paroled subjects to establish a scheme of predicting future criminality or parole outcome of subjects before their release from penal and correctional institutions. " And the Gluecks in a more recent volume state : " The possible value of predictive devices to judges in sentencing offenders cannot be over-emphasized. . . . Prognostic tables, based as they are on the actual results of treatment in hundreds of cases, would induce judges to individualize in terms of *objectified experience* " (italics in original text). It is legitimate to doubt whether objectification might not tend to supplant the individualization which is of such great importance, and for which moderns have striven so hard, in their dealings with criminals,

Treatment.—The modern penal policy in the criminal courts as well as of the legislature has gradually brought about in this country changes which are directed towards making punishments more humane and more lenient. Perhaps the most important of the many factors which have forwarded this policy is the absence of an excess of crimes likely to cause alarm—which Bentham suggested might vary from disquiet to terror—in society, and the infrequency of serious organized criminality. We are here concerned with the medical aspects of punishment, and in passing it need only be mentioned that probation orders have come to play an important part as alternatives to detention, and the tendency has increased for the order to be accompanied by a direction as to supervision. The very short and ineffective sentences of imprisonment in former times have ceased to be regarded as desirable forms of punishment; and prolonged sentences of imprisonment or penal servitude are comparatively infrequent. Moreover, training, education and rehabilitation are primary considerations during the period of detention.

The appropriate punishment for offences committed by mentally normal offenders does not particularly concern the psychiatrist. The awards declared in cases of insanity and mental defectiveness are for the most part established, and there can be little doubt that our most useful contribution to the problem of punishment, at the present time, is in connection with offenders who are subnormal, psychopathic personalities or psychoneurotic.

Since subnormality approximates to mental defectiveness on the one hand and to mental normality on the other, the effects of punishment may vary. It may be effective or non-effective. The lower the grade of subnormality, the more important generally will be the after-care and occupational placement of the offender. That is to say, the subnormal offender will be likely to become a recidivist unless he receives more than the usual amount of help and guidance when he is at liberty. For although his constitutional disability will handicap his efforts, he may adjust himself to social life if he is emotionally stable and if his occupation is within his capacity.

I believe that psychiatric assistance in the treatment of psychopathic personalities and psychoneurotics who have committed crime is likely to be most impressive if precise views are held concerning the clinical limitations of the groups under consideration. Otherwise the psychiatrist may fail to convince those who have to deal with the offender as a social unit. I have suggested elsewhere that for practical purposes it is convenient to consider the offender who is a psychopathic personality as belonging to one of the following groups: Psychic inferior personalities; aggressive egocentric personalities; ethical aberrant personalities; alcohol and drug addicts; sexual perverts; schizoid, cycloid and paranoid personalities. The usual grouping of the psychoneurotic reaction types into neurasthenia, anxiety states, hysteria and compulsive-obsessive states enables the psychiatric position to be clearly expressed.

Bearing in mind the fact that the moral and emotional abnormalities of psychopathic personalities are largely the result of psychological immaturity, and that the psychoneurotic reaction is regarded as an indication of mental conflict and faulty response to the stresses of life and is more or less associated

with a constitutional factor, it is not surprising that the ordinary methods of punishment sometimes fail to rehabilitate offenders who are so affected. The psychiatrist may usefully submit that in these cases punishment may be more effective if accompanied by psychiatric treatment as an alternative, or as an adjunct, to a sentence of imprisonment. At the same time we have to remember that as psychiatrists we are mainly interested in individual offenders, and that the judicial authorities are obliged to consider their awards from a wider point of view. We must also make it abundantly clear that the result of psychiatric treatment, even in selected cases, may be disappointing. It will be less so when a special penal institution is established and administered on psychiatric as well as disciplinary principles, and as our researches advance.

More generally it may be said that the function of the psychiatrist in relation to subnormals, psychopathic personalities and psychoneurotics who have committed crime is to ascertain the extent to which their behaviour is attributable to unusual psychological causes, and to determine whether psychiatric treatment is likely to be advantageous. It is to be remembered that although psychopathic personalities and psychoneurotic patients may profit by the adoption of such measures, additional difficulties arise if the subject has committed crime. Moreover, the psychiatric treatment of crime is still in its infancy and forecasting is often fallacious. The most that can usually be said is that it is worth a trial in some cases, and ordinary punitive measures may fail. The psychiatrist may also be able to give advice concerning the placement of the offender on release, and give suggestions as to the style of life he should aim at.

The subject is too large to consider here. It may be said that prison experience shows that certain factors favour medical treatment during a sentence of imprisonment of sufficient length for the purpose. The desire for cure is then more insistent, and the offender, perhaps for the first time, is brought face to face with the reality of his position and with the "black beverage of Remorse." There is also in prison an unusual release from the distractions, cares and temptations of the outer world, there is time to think, and the offender leads a regular life under medical supervision.

Caution is necessary and overstatement harmful. When a psychiatrist declares that "*all* sexual offenders should be psychiatrically examined" (italic mine), one can only feel amazed, and wonder why a bigamist, or a man who offends by committing a sexual act with a consenting girl who is under age but looks mature, should be examined. When, too, it is stated that "society is entitled to protect itself against acts of public indecency but is not entitled to punish psychological disorder," we can hardly be surprised if an opinion based upon a monopolist approach antagonizes those whose approval is necessary for our purpose. For even if they are willing to listen to the pronouncements of science, these must not be presented as the dictates of a cult.

One is reminded that W. MacNeile Dixon, in his Gifford Lectures, stated: "We speak, indeed, of weighty opinions, but how many millions of them will depress a balance to the extent of a pennyweight?"

Without doubt many sexual offenders require a psychiatric examination if their activities are to be understood and treated. At the same time we must

take into account the fact that this method of treatment requires co-operation, and many offenders object to psychotherapeutic intervention. Again, if we are realists, we shall admit the fact that society punishes the insane and mentally defective persons who have committed no crime, by segregating them in institutions which deprive them of their liberty and require them to conform to the rules of the establishment. And we also know that the great majority of offenders resent being regarded as mentally abnormal, and prefer detention in prison to segregation in a mental hospital.

In the diagnosis, prognosis and psychiatric treatment of crime there is scope for our best psychiatrists. I am also convinced that if the psychiatric treatment of offenders in suitable cases is made a condition of a probation order, only psychiatrists of wide experience and mature judgment should undertake the work.

CONCLUSION.

Crime is not a disease. It is sometimes attributable to mental disease and mental defectiveness. It occurs when self-regarding behaviour replaces social behaviour and threatens social security. In our present state of knowledge we cannot assume that character anomalies and mental disease are necessarily identical and co-extensive. The difference between normal and criminal behaviour is for the most part quantitative rather than qualitative.

Punishment—deterrent, retributive and reformative—is the instrument used by society for its protection. Equal emphasis on its different aims is not always practicable. The punishment of mentally normal offenders is not the special concern of the psychiatrist. He is already engaged in the treatment of insane and mentally defective offenders. He is coming to take a part in the treatment of offenders who are affected by minor mental abnormalities.

Some of these offenders will be suitable for medical treatment without imprisonment, and further provision will be required to carry this out if it is made a legal condition of a probation order. Some are a danger to society, and require imprisonment to ensure the protection of the public. To promote the medical treatment during a sentence of imprisonment we must face the fact that short sentences may be insufficient, and that a longer sentence than that usually awarded, but not necessarily the maximum authorized by law, may be required for the purpose.

Our responsibility in these cases is grave. The judicial and executive authorities have to decide whether they can accept the medical view. Theirs is the last word. Psychiatrists have to consider whether the mental abnormality present lessens the culpability—according to medical opinion—of the offender; and if so, they must not encourage him to believe that he is a mental invalid. Our aim is to assist him to carry out his social obligations to others.

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DISCUSSION.

LORD COOPER (Lord Justice Clerk) said: Dr. Norwood East has given us one of the most balanced and judicial surveys of this difficult subject which I have been privileged to hear.

My approach and my background are very different from yours. In six years as a public prosecutor and another six years as a Judge, one learns a lot. *Experientia docet.* But lest you should suppose that I belong to the crusted school of Rhadamanthus, let me add that in 1938 I was the Law Officer who assisted Sir Samuel Hoare, as he then was, in the Parliamentary promotion of the Criminal Justice Bill, and I then heard all that could be said on the psychiatric treatment of crime.

You and I have only one prime object in view—the better service of our fellows. Together we can accomplish much. We can do little apart. I regret to say that in recent years I have seen the lawyer and the psychiatrist drifting apart. The paramount need at the moment is to interpret the one to the other. How has this come about?

Mine is a very old job. Zeus came before Aesculapius, and, as Dr. Guthrie has reminded us in his recent book, Zeus ultimately felt obliged to slay Aesculapius with a thunderbolt! The problem of controlling and repressing anti-social conduct, whether in the form of crime or just of simple sin, is older than civilization, and its solution has been central to all the religions and philosophies of mankind since Confucius and Moses and Plato.

Against that put Dr. Norwood East's pregnant remark that the psychiatric treatment of crime is "still in its infancy."

Next, please observe that in all other aspects of the art of healing what the physician does by way of curative regime is a matter for himself and for his patient alone. Within the walls of his consulting room or hospital ward the doctor is undisputed master, and subject only to his professional traditions. But when the psychiatrist ceases to be content with curing his patient and enters the wider field of delinquency and criminal administration, he forfeits the privileges of his profession and abdicates his sovereignty by becoming in essence a politician,

seeking to mould and alter the public law in matters vital to the existence of every organized community. He cannot then complain if those responsible for public administration of law and order examine his credentials with care, and subject his arguments to exactly the same tests as would be applied to those of anyone else. The psychiatrist is not used to having his opinions questioned, and the lawyer is not used to accepting other people's conclusions unexamined. Hence the conflict.

Great harm has been done to the cause of criminal reform and to the closer co-operation of law and medicine by the exaggerated and unproved claims which have sometimes been made by the extremist devotees of psychiatry. I heartily agree with Dr. Norwood East that these problems require the widest experience and wisdom; but there are psychiatrists and psychiatrists, and on occasion I have myself been presented with the very contentions which he regarded as unjustifiable—that all crime is pathological, and that the bare fact of the commission of a major crime of violence or a serious sexual offence is, *ipso facto*, proof of psychopathic personality or something worse. Believe me, for the last fifteen years it has been a recognized point of advocacy that if there is not a real defence to a grave criminal charge the accused's advisers must get a psychiatrist—at least to support the Scottish defence of "diminished responsibility."

What has been the result? For a time it worked. In Scotland we did not have a single death sentence for about a dozen years. But it has been overdone; and I am sorry to say that judges and jurors alike have come to regard such evidence with growing suspicion. Can you wonder? The person you have to convince is the man in the jury box, who is apt to apply to such matters the yardstick of a robust and vigorous common sense, and who feels in his bones that you cannot convert a criminal into a patient by the simple expedient of describing the age-long characteristics of the typical criminal in words borrowed from ancient Greek philosophy. Indeed, I have sometimes wished that the psychiatrist would borrow a good deal more from Plato than his terminology.

Note this. You see the criminal wrapped both literally and metaphorically in a white sheet. We see him in the dock—but we see more than that. We see the weapons he used and the bloodstained garments of his victim. We see and hear the victim, or more usually the widow of the victim, or the mother of the ravished child. After that it is not easy to accept it on the *ipse dixit* of any medical man that the perpetrator of some outrage should be sent to a nursing home, and encouraged in the belief that he had no responsibility for the misery he caused or might cause again. The lawyer is not yet ready to accept the principle that there is a section of the community chosen by medical men whose members are free to commit crime with limited liability, or perhaps with no liability at all. The object of criminal law is not to make a world safe for criminals to live in.

The two fundamental difficulties which are now threatening to part the lawyer and the psychiatrist are (1) the extremist psychiatrist view which concentrates too exclusively upon the rehabilitation of the offender and subordinates, if it does not wholly ignore, the retributive, deterrent and protective aspects of punishment, and (2) the not infrequent attempt of the psychiatrist to justify his diagnosis on the simple assertion of his own conclusions, without adequate verification of his data or the production of reasons convincing to the instructed lay mind of the validity of his inferences. There is no room in this field for purely authoritarian pronouncements. Anyhow, ample proof of my thesis that the psychiatrist and the lawyer are latterly drifting apart is to be found in our legal journals, in a number of recent judicial decisions, and in a succession of jury verdicts in which psychiatrist evidence has been repeatedly rejected—not, I fear, without justification.

May I, greatly daring, urge upon you the need for independent verification of all the data on which your conclusions depend, and for greater efforts to produce by reasoning conviction in the minds of judge and juror, rather than to invite submission to an opinion which is rested mainly on specialist knowledge and experience? Cases are not unknown where the data on closer investigation proved to be incapable of verification, if not actually disproved; and I sometimes feel that the psychiatrist tends to underrate the ingenuity and cunning of the ordinary criminal, who knows well how to pitch a tale to a sympathetic listener.

I am all in favour of greater efforts by means of psychotherapy to rehabilitate the convicted criminal and to help him to adjust himself to his social responsibilities. More power to your elbow in that work! Especially amongst first offenders there is much to be done. But it is another question altogether when the medical man

intervenes to prevent the offender being convicted or subjected on conviction to a just penalty.

It may interest you to know that one State in the British Commonwealth has just legislated on this question following an investigation by a commission. It is Queensland, Australia; and there provision has now been made for examination and treatment of sexual offenders and other subnormal persons by a body of psychiatrists; but it is significant that the ordinary penalties for sexual offences have been doubled or trebled, that the habitual offender code has been applied to sexual offences, and that the power is expressly conferred on the court to postpone the psychiatric treatment until appropriate sentence has first been served. That model is worthy of study in connection with the proposed revival of our own Criminal Justice Bill.

I have felt compelled to assume in this speech the unpopular role of the candid friend. But the friendship is as real and sincere as the candour. As your President said last night, you must take the lay public with you; and it is in the earnest desire to bridge the gap which threatens to part the lawyer and the psychiatrist that I have underlined the points which I have briefly summarized.

Dr. W. M. McALISTER said: No branch of medicine has more intimate contact with the law than psychiatry. All our administrative duties are performed in conformity with the requirements of the Lunacy Acts, and even our clinical work (using that term in its widest sense) is to some extent similarly conditioned. Such matters as divorce on the ground of insanity, the management of the property of insane persons, testamentary capacity, and, occasionally, criminal responsibility, are examples of those common concerns in which law and medicine are called to interest themselves. Most of these matters are not now regarded as contentious. True, when the Divorce Bill was introduced, there were some in our ranks who disapproved of its provisions, fearing lest the interests of the insane spouse might be prejudiced. When the Bill became law it was accepted in all loyalty even by those who had opposed it most resolutely. Now it may be said that the Act works smoothly, and everyone must, I think, agree that the vigilant eye of the Court never loses sight of any possible safeguard to which the insane spouse is entitled. The interests of those unfortunates are obviously safe in its hands.

Perhaps the only controversial subject among those mentioned is the question of criminal responsibility in relation to murder, and even that is less frequently canvassed nowadays than it used to be. In Scotland one seldom hears an echo of the controversy except when some particular case momentarily excites public interest. In England, where the criteria of responsibility are still those laid down in the McNaghten Rules, enterprising barristers try—without much success—every now and again to shake the law's reliance on these century-old formulae. And sometimes one hears medical men tilting at them. But in neither country can it be said that there is widespread dissatisfaction with the existing practice. It is, of course, an anomalous situation that the doctrine of partial responsibility should have been judicially defined and regularly applied in Scotland, while being stoutly repelled in England. In Scotland we accept the anomaly with complacency. In England, everyone knows that justice is done in the long run, and that, if need be, careful investigation is made of the psychopathological factors, if any, in every case after conviction. That is of far more concern to the public than a theoretically perfect system which might yield in practice less satisfactory results.

In Scotland the doctrine of partial responsibility is relevant only when the charge is murder. It goes a long way towards meeting the common criticism that the McNaghten Rules are too narrowly drawn. On a broad view the Scottish practice certainly appears to fit the facts of experience more adequately. On the other hand, it does nothing to justify the fears of those who think any break with the McNaghten tradition must open wide the doors to abuse. That has certainly not been the result in Scotland since in 1923 the then Lord Justice Clerk stated the criteria of partial responsibility and gave the doctrine a firm footing in our criminal procedure.

The improbability of abuse becomes apparent when one considers the nature of the tests to be applied. These are:

- (1) Aberration or weakness of mind.
- (2) Mental unsoundness.
- (3) Great peculiarity of mind.

Negatively the position was put by Lord Alness in these terms:

"It will not suffice in law for the purpose of this defence of diminished responsibility merely to show that the accused person has a very short temper or is unusually excitable and lacking in self-control. The world would be a very convenient place for criminals and a very dangerous place for other people if that were the law."

The criteria are necessarily drafted in general terms, and are applicable to a wide variety of circumstances. It may be of interest to examine the record of one particular case where this plea was proffered and failed, and where several issues of medico-legal interest emerged, and to contrast it with others in which the plea was sustained. In passing I would say that of the last thirty cases of murder in which I have examined the accused, thirteen were held to be insane, three were grossly defective, twelve were of sound mind and two, though they could not be described as insane, suffered from such a degree of mental disability as seemed to the Court to justify applying the doctrine of limited responsibility. In these two cases the accused were found guilty of culpable homicide and sentenced to 15 and 7 years' penal servitude respectively.

In the case where the plea was repelled, medical evidence was led to show that the accused was a psychopathic personality. In his summing up the judge carefully sifted this evidence and finally, using the words of the medical witnesses themselves, reduced it to this formula: "Psychopathic personality is a condition in which there is an inability on the part of the person affected to adapt himself to ordinary social conditions. It is usually less than insanity which is certifiable. It is associated with emotional instability." This by itself may not have done full justice to the medical evidence, but the remainder of the charge to the jury made good any deficiencies.

The jury rejected the plea and the accused was sentenced to death. No expert evidence on the accused's mental condition was presented by the Crown, but even without such rebutting evidence the jury reached their decision unanimously and without unduly prolonged deliberation.

An appeal against the sentence was heard by the Court of Criminal Appeal and was unanimously dismissed. When Counsel for the Defence pleaded that psychopathic personality always involved diminished responsibility, the answer from the Bench was to reiterate the remarks already quoted about the danger to the public if that were accepted as the law. And surely it is a reasonable proposition that unless the accused person is certifiably insane he must needs answer for his misdeeds, and the merits of his individual case must be thoroughly probed. It is interesting to note in passing that the Appeal Court declined to exercise its powers under the Criminal Appeal Act of 1926 to call in a medical assessor to assist in defining the appellants' responsibility. That is really the province of the jury, and the Court viewed with disfavour any attempt to substitute a procedure which conflicted with that dominant principle of criminal law. The Court ruled that the questions raised by the appeal were purely matters of law on the determination of which a medical opinion could not properly be asked to assist. Whether in other circumstances the Court would follow the same line is presumably an open question.

The hearing of the appeal was not the end of the matter. Owing to the absence of countervailing evidence as to the mental state of the accused at the original trial, the Secretary of State, confronted with a petition for reprieve, ordered a fresh medical examination.

That, by the way, is a comforting indication of the extreme care which is taken by the law to ensure a fair deal for the individual, however depraved his record may be.

Those who reviewed the medical evidence and examined the prisoner afresh could not agree with the diagnosis of psychopathic personality. That by itself may not mean much as the condition is still far short of exact delimitation. But the divergence of view went much deeper. It concerned almost every individual feature of the case on which the diagnosis rested. These were (a) a criminal record extending over almost half of the prisoner's life, and embracing an appalling list of crimes ranging from theft to assault to the danger of life and finally murder; (b) an alleged attempt at suicide; (c) alcoholism; (d) the accused's incorrigibility and apparent inability to profit from experience; and (e) his defiance of those commonplace obligations without which an orderly, decent society becomes impossible.

Now a criminal record *per se* is not necessarily indicative of psychopathic personality, or indeed of any other form of mental disorder. In a broad sense the criminal may not be normal, whatever that may mean. But unless it can be shown that the criminal's anti-social activities are accompanied by specific evidence of mental disorder, it is quite unjustifiable to adduce them as evidence of unsoundness of mind. The motivation of crime is as varied as it could well be, and we as medical men must keep that fact prominently before our minds. There are instances, of course, where the criminal act is the final proof of insanity, as, for example, in the insidiously developing paranoia when at last the pot boils over. But there the criminal act is only an episode. It is not the whole story.

In this particular case, the criminal record related for the most part to crimes from which the accused hoped to gain some personal advantage. Something of a ne'er-do-well, his acquisitive and gambling instincts were highly developed, just as they are in thousands of others who live by their wits. His later and more serious crimes were committed usually when under the influence of drink, and out of loyalty to the gang of like-minded ne'er-do-wells with whom he associated. On the question of alcohol we ought to be clear as to the law, so often and so clearly reiterated from the Bench, viz. that "drunkenness never excuses or palliates an offence unless it is so extreme as to deprive the man who is drunk of the capacity to form an intention to kill or to do bodily harm. The man must be incapable of forming an intention to kill or to do grievous harm before drunkenness can ever enter into the picture as affecting guilt of a crime." Before this test the accused was obviously guilty, for before setting out he had armed himself and hinted to bystanders what he meant to do with his weapon. In a more general way it was contended for the accused that drink would be likely to have a far more deleterious effect on a man of his mental make-up than on a normally endowed person. That contention, though true of many unstable people, is far from meeting the legal test. However much a man drinks and however much he is affected by what he drinks, he is responsible unless he becomes so intoxicated as to be incapable of forming the intention. In most instances, of course, such a degree of drunkenness might well paralyse any effort to carry out the intention—fortunately for both parties.

Suicide as an alleged symptom of mental disorder has been raised, as it was raised here, in several recent cases. Its significance must be interpreted in each individual case, before its value as evidence becomes clear. The accused, while undergoing a term of imprisonment had inflicted on himself a nasty-looking wound, which, however, did not endanger his life. Self-mutilation here followed on a serious outbreak of indiscipline and insubordination in the prison, to cope with which the warders had to resort to force. The accused had taken an active share in fomenting the trouble, at the same time taking care not to expose himself to the risk of punishment. In the course of a round of inspection the warders found the accused lying on the floor with a superficial wound which looked worse than it really was.

Now there are many and various reasons for attempting suicide. It is surely going too far to say, as lay observers sometimes suggest, that every attempt at suicide necessarily implies a serious degree of mental abnormality, and therefore modifies responsibility. The dock at Nuremberg is not so crowded as it might have been but for the suicide of Hitler, Goebbels and Himmler. One cannot regard their suicides as other than a conscious and deliberate evasion of their approaching condemnation. And there are no doubt several in the dock at this moment who, foreseeing the inevitable end, would choose to make a speedier exit if the chance arose.

In this particular case the faked suicidal attempt was one of the few definite and concrete incidents referred to in support of the plea. There is no doubt, however, that the attempt, far from conforming to the impulsive, reckless and apparently meaningless outburst of the psychopath, was a frigidly calculated device to ward off the consequences of his own misdeeds.

In any discussion of psychopathic personality stress is laid, quite correctly, on the constitutional aspects of the condition. It is all the more surprising that in a case like the one under review the question was never raised, although the accused was often examined, till the capital charge was preferred against him. Now, my personal experience of the psychopath is that he presents one of the most baffling problems in management in the whole range of psychiatric work. Wherever he is, and whatever his circumstances may be, the tendency to give his antisocial propensities free rein is a constant menace to the community in which he lives. Yet

this man had served several long terms of imprisonment under the eye of an experienced prison doctor (who agreed there was such a clinical entity as psychopathic personality), and in the doctor's words, "had never put a foot wrong."

Whether we take the view that the diagnosis was good or bad does not matter much. The crucial question is whether the evidence disclosed mental disorder of such severity as to justify a plea of reduced responsibility. The judge and jury at the initial hearing and the Bench of five judges in the Criminal Appeal Court were unanimous in returning the negative answer, and most, if not all, reasonable people would, I am sure, subscribe to that verdict.

The case focused the searchlight on the whole question of psychopathic personality, and showed the need for a much clearer definition of the condition. In particular, it showed the need for differentiating the psychopath from the habitual criminal. Both have obvious traits in common; what we want to define more exactly are the differentia. In the present state of our knowledge it is an unwarrantable assumption that a career of crime is a reliable indication of that degree of mental disorder that equates with partial responsibility. The case showed, too, that generalizations concerning the conduct of an accused person, whether represented as a psychopath or as something else equally abnormal, make no appeal either to the legal mind of the judge or to the native common sense of the jury. If the plea of partial responsibility is to stand, the medical evidence will require to be clear and specific, and must include some of the recognizable features of insanity. Evidence of lesser significance may properly be tendered when asked for, if for no other reason than that the medical witness is on oath and must tell the whole truth. But let us beware of overstressing the significance of such evidence. To do so does not help the accused, and it almost always casts a reflection on the reliability and good sense of psychiatric evidence in general. Let the facts be stated simply, and let the assessment of their significance in relation to responsibility be left where it should be—in the experienced hands of the Court.

Contrast with that case two others in which the plea was sustained, the charge reduced from murder to culpable homicide and sentences of penal servitude imposed. Here the doctrine of diminished responsibility applied because of the presence of definite and precise mental factors which, although not amounting to insanity, clearly indicated mental disorder. One was an epileptic with a history going back to boyhood. The seizures were infrequent, but were adequately vouched for, and there were other episodes which might possibly have been explained as epileptic equivalents. At the time of examination there were no signs of gross mental deterioration, and it was clear that when the crime was committed the accused had not been in a state of post-epileptic automatism. There were no independent witnesses of the crime, and consequently apart from the accused's own statement, little information could be gleaned as to his condition at the time of the fatal assault. The other was a man who showed signs of cyclothymia; temperamental, volatile and unpredictable, with a long history of instability, including one period in a mental hospital and with a history of a head injury which was said to have made him even more unstable. Neither case could have been certified at the time of examination as insane, but there was indisputable evidence of mental disease at one time or another. These cases are quoted as an illustration of the sort of evidence required to support a plea of partial responsibility. My experience has been that if such evidence is put before the Court it receives a fair and judicial hearing. Nothing short of that will suffice.

All the thirteen cases deemed to be insane were placed on trial before a judge sitting alone and a plea of insanity presented. In every instance the plea was sustained and the accused ordered to be detained during His Majesty's pleasure. In practice the only question to be decided in such cases is as to the sanity or insanity of the accused. There is no nice question as to whether, if insanity is proved, the accused knew the nature and quality of the act. This procedure forms a radical departure from that required by the McNaghten Rules, but it seems to serve the ends of justice as effectively as the more elaborate inquiry.

The days of the old facultative psychology are over, and the newer conception of mind as an integrated, dynamic whole has taken its place. The McNaghten Rules, in so far as they are based on an antiquated conception of psychology, are certainly open to criticism. If they are to be amended, the system pertaining in Scotland seems to indicate one method by which the legal and the medico-psychological views might be approximated.

Despite all their theoretic shortcomings, it cannot be said that there is anything in the nature of a public clamour for the formulation of a new set of rules. Nor has there ever been anything like unanimity as to what should be substituted for them. When the Royal Medico-Psychological Association in 1924 submitted a memorandum to the Committee on "Insanity and Crime," it was suggested that the legal criteria of responsibility contained in the McNaghten Rules should be abrogated, and the responsibility of a prisoner should be left as a question of fact to be decided by the jury on the merits of the particular case. Accompanying this was the suggestion that the proper questions to be put by the judge to the jury when the mental condition of the accused is in issue should be :

- (a) Did the prisoner commit the act alleged ?
- (b) If so, was he at the time insane ?
- (c) If he was insane, has it been proved to the satisfaction of the jury that his crime was unrelated to his mental disorder ?

Although this represented the collective wisdom of our Association in 1924, it is doubtful whether it would command the assent of the majority of the members now. The main difficulty arises over section c.

It must be remembered that this section deals with persons shown to be insane. It would be difficult, if not impossible, to prove in any given case that a crime committed by an insane person was unrelated to his mental disorder, for when the mind is disordered to the point of insanity it is the whole mind and nothing less that is affected. It seems to me that the only safe course to follow, when an insane person is accused of a serious crime, is to assume that his crime is related to his insanity. That is implicit in the Scottish procedure. The extreme difficulty, if not impossibility, of proving to the satisfaction of a jury that a crime committed by an insane person was unrelated to his insanity would make the Association's plan just as unsatisfactory as the original Rules. There is a great deal to be said for the comparatively simple, straightforward view of an English judge who declared that "if a man is in a deranged state of mind at the time he is not answerable for his acts. The material part of the case is whether at the time the act was committed, the man's mind was insane." A former Lord Justice Clerk in Scotland put it this way: "In a strictly legal sense, there is no insane criminal: concede insanity and the homicidal act is not criminal. The act of the insane, which in the sane would be criminal, lacks every element of crime."

The administration of justice in England, as in Scotland, is so humane that it is only sporadically it meets with criticism. That the accused is hedged about with safeguards after as well as before his conviction was well illustrated in the True case. There is, however, one respect, and this again is brought out by the True case, in which the English practice compares unfavourably with the Scottish, for an insane person to whom no right-thinking person would think of applying the extreme penalty of the law may, in England, be subjected to the ignominy of the death sentence. If the accused, though insane, is held to know the nature and quality of his act and is, therefore, responsible, it may be assumed that he also knows the nature and quality of the penalty imposed on him. It is quite beside the point that the penalty may not be exacted. Even if not, the passing of the death sentence in such a case seems out of harmony with the essential decency and humanity of the law. As against that, there may be some risk that the Scottish system might result in a person innocent of the crime in question being adjudged insane and committed to a criminal lunatic asylum. I know of no case where that has happened, but there is at least a theoretical possibility that it might happen.

Generally speaking, the public are interested in the criminal and his responsibility only so long as these fill the headlines. When sentence has been passed and the prisoner passes out of sight he also passes out of mind, and there is the end of the whole matter. The public has had its Roman holiday and turns to more workaday interests with, perhaps, a hope that the next sensation will not be too long delayed. But neither medicine nor the Law can stop there. Not on humanitarian grounds alone, but on every concern for the maintenance of a decent social order, the lawyer and the doctor must pursue the matter much farther. Only by regarding crime and punishment in an inter-related way can we get to grips with this serious social problem. The interests of the two professions are not antagonistic—both are out for the betterment of society, and if mutual criticism were replaced by mutual trust, understanding and co-operation, it would be for the good of all.

There are certain obvious directions in which the existing state of affairs might be improved. For example, is there any good reason why the plea of diminished responsibility should not be acceptable in lesser crimes than murder, to which at present it is strictly confined? Logically, it ought to apply all round. Such a statement should not be taken as undermining the authority of the Courts or condoning criminal conduct. If given effect to, it would have an exactly opposite effect. It would mean the recognition by the Court of an abnormal component in the causation of a much wider range of crime—a result that would accord with the facts. If the Court were empowered in suitable cases, i.e. where the mental component was clearly proved and the risk of repeated offences reasonably established, to resort to the indeterminate sentence, not only would the individual prisoner benefit, but society would, at the worst, be given a breathing space, and at the best might be rid of a habitual offender. The futility of repeated short terms of imprisonment in many cases has often been demonstrated.

Good results could be expected only if adequate machinery existed for investigating and treating abnormalities when they are found to exist. In this connection we, in Scotland, have little to boast about. On occasion I have seen sexual offenders, for example, dealt with in two totally different ways. Some have been sent to prison; others, though they have been guilty of conduct just as repugnant to public decency, have been referred to a mental hospital. In those former cases the sentences may have to be served in a prison with a part-time medical officer with several hundred prisoners under his care. No experienced psychiatrist will assert that sexual offenders form a homogeneous group, but in those instances where medical opinion can show reasonable grounds for expecting a response to treatment, the facilities for treatment ought to be far more liberal than they are. Let the law, if it will, sentence such cases to a term of imprisonment, and so vindicate the rights of society. But in so doing, let us not lose sight as we sometimes do of the individual's right to be helped in what is often an intolerable situation, which the accused would give everything he possesses to have resolved. The statement that imprisonment of itself is adequate in such cases can hardly be accepted.

There is one comparatively small change that might be made in Scotland and doubtless elsewhere without entailing too much cost, and without disturbing unduly the present arrangements. The psychiatric side of prison work is badly in need of reinforcement, and I go so far as to say that every prison with a large enough population should employ a whole-time medical officer, trained in psychiatry and with some specialized training in criminology. Let us not forget that the trained psychiatrist is trained in physical medicine too and might, without undue difficulty, cope with any of the ordinary physical emergencies likely to arise in prison. He has thus two strings to his bow. On the other hand, the prison medical officer who is not a trained psychiatrist may, in the course of time, acquire some interest in the psychiatric side of the work, but that is never likely to become the dominant interest it should be.

Means might be found, too, of overcoming the isolation of more remote prisons so as to make possible the transfer to the larger prisons of those cases who for one reason or another seem to require special investigation. Freer use also might be made of consultants' services. Even if it costs money it will in the long run pay good dividends. In Scotland we have barely touched the fringe of this perplexing problem. Let us hope that in the new heaven upon earth which is always just round the corner the builders will not forget to put in one of the foundation stones. We have too long been fed on pure assumption as to the causation of crime and the effects of imprisonment. We must get down to a systematic study of it along scientific lines before we can even begin to build the New Jerusalem.

It has long seemed to me that with its small population, the greater part compactly assembled within 20 miles on either side of the Edinburgh-Glasgow line, Scotland offers an excellent field for such an experiment in social hygiene as we are considering. Yet in all broad Scotland there is one whole-time psychiatrist in the prison service. So long as that policy persists, so long are we doomed to go on piling failure on failure. Let us hope that something may come of the proposal in the newly issued Russell Report on the Lunacy Acts that a special State Institution for certain types of offenders should be set up. That would be a most desirable accession provided it is adequately staffed.

I need not mention what must leap to everyone's mind—the need for great expansion of Child Guidance and the Psychiatric Clinic movements, and the further

development of these beneficent institutions, the Approved School and the Borstal system. These are but the beginnings of a rational attempt to cope with the vast amount of juvenile crime in our midst. Let us carry that beginning into our prisons, and make them not merely prisons but also, without interfering with their penal character, centres of scientific study and treatment. And let us encourage by all the means in our power these beneficent organizations which have come into being since the last war, and which aim at directing youthful energy into useful channels.

While one does not wish to over-rate the contribution psychiatry can make at this stage to the elucidation of criminal conduct, it must be remembered that its opportunities for study are limited. Only a frank recognition of the importance of the mental aspects of crime and a determination to study the make-up of the criminal and the effects of punishment will put us on the track of worth-while results. We, as psychiatrists, need not be deterred from further effort by the uncompromising attitude of those who pin their faith to the efficacy of a stiff sentence as a remedial measure. There are too many cases in which the remedy does not work. In any event the mere fact that after punishment the offender may not reappear in court is no proof that punishment has had the desired effect. Not every second or third offence is detected and the offender brought to trial.

In the last analysis, however, the public must face up to its responsibilities. In a democratic country we are supposed to get the Government and the laws we want. It is a waste of time criticising those whose function it is to interpret and apply the law. If there is to be progress the social conscience must be roused to the point where it will not bar experiment for no better reason than that it breaks with age-old tradition.

Col. A. A. W. PETRIE said that no doubt a knowledge of the criminal was at least as essential as a knowledge of psychiatry, and he would say frankly in response to Lord Cooper's remarks that although he was a psychiatrist, when he heard some views expressed he felt sympathetic towards the lawyers. He had seen a number of cases of psychopathic personality recently and had been trying to draw from them their own feelings with regard to their responsibilities, and he found that they held varied views. A generally held attitude was: "Well, I am responsible now, but I am not quite so sure that I was responsible at the time." He thought that had held good possibly in the case of certain cerebral dysrhythmics. He had had a number through his hands, and the EEG had proved that they had undoubtedly a very considerable state of dysrhythmia. These arguments were successfully applied in a case in England when a jury broke away from the judge and acquitted the prisoner.

Dr. McAlister had said that alcohol could not be taken into account unless it deprived the person of his ability to control himself. As he saw it, these people were thoroughly responsible for their actions. It was dangerous to allow a number of people to go about with a sense of diminished responsibility; even the genuine psychotics realized that if they committed offences the law would tend to protect them owing to their previous history. That had happened, and psychotics put forward their history as a justification of their crimes committed when their psychotic condition was not present and when they were undoubtedly responsible. He thought the law would probably protect the genuine sub-epileptic. They were faced with new facts with respect to these psychopathic personalities. In Prof. Henderson's classification there was a type with emotional abnormality and anti-social trends who were often creative and artistic. One learned to recognize the type: they were not very normal; many of them had a number of crimes to their credit, they were a social problem. On a strict reading of the law they might have been dealt with as cases of moral defectiveness or moral insanity, but where they showed no intellectual defect the law and those who administered it were frankly not willing to allow them this degree of irresponsibility. Once it was allowed that they were less responsible, then it seemed that they had to be segregated, so that those individuals who were definitely less controlled and less responsible would have to realize that they could not have it both ways. They were responsible or not, and if they were responsible they must suffer the penalties of their crimes, and they usually appreciated that fact.

Dr. J. R. REES said that early in the war when efforts were being made to get some regulations in the Army which would stop the sending to prison of men who

were imbeciles, as some of them were with an extremely low level of intelligence, a legal luminary wrote to him saying, "Whatever else you do you must not interfere with the inalienable right of the lawyer to secure convictions." Lord Cooper said just now that there were psychiatrists and psychiatrists, and he would like to point out that there were also lawyers and lawyers. There should be a great deal more of interchange of opinion. As he knew from experience, very much could be learnt from the lawyers, and the lawyers could learn from psychiatrists. They learnt a great deal about a sense of social responsibility as to what happened to their charges which they did not always have. Until such time as psychiatrists could be called in as experts for the Crown to give evidence to the court, not evidence as for the prosecution or the defence, could they not themselves adopt such an attitude? In the British Army during the war that was done; no psychiatrist was allowed to be briefed; all his evidence was given to the court. That would give a greater sense of responsibility. Their first job was community medicine, not individual medicine, when dealing with cases of crime.

Dr. BACK said that, with all due respect to Lord Cooper, it was not quite correct to say that psychiatrists saw the cases in white sheets and ignored the victim. It would be a very superficial psychiatrist who accepted the statement of the accused as to the infidelity of his wife.

The PRESIDENT wished to make one or two comments in regard to this problem which was so difficult. It was very enthralling, but it was necessary that they should try to get to a combined or as near combined viewpoint as possible. Dr. Rees was referring to the Briggs Law of Massachusetts which was introduced a good many years ago, and which he thought in that State had worked reasonably well. It always raised the question, of course, of whether it could be practical politics in this country to have such a body appointed whose reports would be accessible both to the prosecution and to the defence, and where the court would find on the basis of those reports. There was a further statement which emerged from the American laws which had always been interesting to him, and here, again, it might not be possible; that was a suggestion that the trial should be divided into two phases, the guilt-finding phase and the sentence phase, that under these circumstances the guilt-finding phase would be an entirely traditional procedure, whereas the sentence phase might be a question of consideration between the law, the psychiatrist perhaps, and someone else interested in social reformation and rehabilitation. That might not be practical, but it was an interesting suggestion, and showed a point of view which all should carefully consider.

There were other points which had occurred to him. Week by week he visited, on the instructions of the Procurator Fiscal, the prison in Edinburgh to make a psychiatric examination of a varied group of offenders from minor offences to all sorts of more dangerous and serious crimes, and he had been very much impressed by the responsibility laid on him in regard to matters of this sort where one had to come to a fairly quick decision, often not with enough time to get adequate evidence. The evidence which was submitted was not very satisfactory; to examine a person under prison conditions was not a very easy thing to do, and he had found time and again that it was quite impossible, particularly in cases of sexual offences, to find the amount of evidence which would enable him to go into a court of law to submit a report that the person was irresponsible for his actions. That was very striking, yet one felt that one was dealing with a group of people who were urgently in need of help, and who failed under the prison system as it existed to get that help which was necessary for their condition.

On the question of limited responsibility he thought that in the case in which Lord Alness accepted the plea of limited or partial responsibility he himself had given evidence, and was very much impressed by the fact that Lord Alness expressed himself as he did. He thought it was a step in the right direction, but recognized that it was a step which one would have to consider very carefully indeed in reference to the type of person coming within the scope of this limited responsibility. He had felt more and more that he had a certain responsibility to justify the attitude he took at that time and which he still maintained, as he supposed he was partly responsible for the current use of the terms "psychopathic states" and "psychopathic constitution," and for bringing that conception of mental disorder more into current psychiatric thought. He would still maintain that it was impos-

sible in certain cases to understand them thoroughly, or to thoroughly impress a judge or a jury regarding something which psychiatrists nevertheless felt and recognized as motivating a person's disordered conduct. But there was this difficulty which Lord Cooper had stressed between the lawyer's point of view and the medical point of view. The lawyer thought in terms of reason and free will, and the doctor knew that conduct was so largely determined by unconscious motivation which it was very difficult to put on paper or to explain, but which the person, in many cases, could no more control than the epileptic could control his fit or the malarial patient his attack of ague. There was a group, a definite group, a real group, in which that unconscious motivation played a part, and in which it was very difficult to impress a judge and jury that it existed in a particular instance. He agreed wholeheartedly that people before they went into court or expressed their opinion in such matters should have had a long experience, so that they could answer reasonably questions put to them and could take a fair-minded attitude in relation to this very difficult problem.

There was one other point which he would like to mention. He had always been a believer in the indeterminate sentence. He thought it was a pity it could not be put into practice, because he took the same attitude towards the indeterminate sentence as he took to the discharge of a patient from his care in a mental hospital. The patients came to the hospital because they were ill; if they required to be certified they could only be discharged when they had reached the stage of social adaptability where they had a reasonable chance of getting along in society once more. He would like to see the same sort of situation carried out in regard to penal procedure. To sentence a man to six months or a year's imprisonment did not make any difference; time was not the factor; the factor was the delinquent's ability to acquire a sense of responsibility, and none of his doctors, lawyers, or anyone else was in a position to state arbitrarily how long that process of rehabilitation was likely to take. He would put this view as strongly as he could, in Lord Cooper's presence: that he would like to see a system built up where with careful medical treatment under prison conditions it would be possible to keep such people until one could say that such and such a person now had a fair chance to live at an infinitely better social level than he had ever reached or acquired before. That would really be a step in the way of progress, and something which would enable adequate treatment to be carried out in individual cases.

Dr. NORWOOD EAST, in reply, thanked Lord Cooper for the way in which he put the legal points, which he did not think were contrary to anything he said or even thought. One or two points had emerged in the discussion to which he would like to call a little further attention. Always at the back of his mind was the fact that doctors must certainly do all in their power to prevent the world being made safe only for criminals and unsafe for law-abiding folk. When he spoke of criminal responsibility and medical culpability he meant two very different things. By criminal responsibility he meant what was generally meant by the law, but he agreed wholeheartedly with Prof. Henderson that there were in the criminal world a body of people who could be well described as psychopathic personalities. There were also some psychoneurotics who were not irresponsible, but whom every medical man of experience would feel were not as culpable from the medical point of view as the ordinary person. That was not putting the psychopathic personality or the psychoneurotic in a favoured position over other people. On the contrary, such persons should receive longer sentences, which would enable medical treatment to be thoroughly carried out. They should not be allowed to impose on the public without some reasonable prospect of their being less harmful than they were before.

Prof. Henderson also mentioned the guilt-finding and the sentence-finding duties of the court. The speaker believed, at any rate as far as England was concerned, that the judicial authorities would probably object to having the sentence taken out of their hands. What he thought and what he always put forward whenever he got the opportunity was that the remedy in this particular class of case, and perhaps in all cases where the sentence was a considerable one, was that the judge and jury not only found the person guilty but would pass a minimum and maximum sentence for the same offence. This was very much like the tribunals under the Prevention of Crimes Act with regard to preventive detention. Recommendations could then be made to the Home Secretary when the right time had arrived both from the medical, social and economic point of view when the person should be

released within the limits, both minimum and maximum, prescribed by the judge. In that way a step further would be taken which would be of real advantage.

He was quite ignorant as to the Scottish procedure, but as far as England was concerned he did not think it was realized how frequently the Secretary of State ordered a statutory inquiry under the Criminal Lunatics Act, 1884, to be held on men who had been sentenced to death, and in whose case there might be some doubt about their mental condition. If the proceedings of the Court of Appeal were studied it would be frequently found that the judges said that they had no reason for altering the verdict of the jury, but that this was a case in which the Secretary of State had power to order an inquiry, and the judges of the Court of Appeal frequently put that view forward—very much more frequently than in former years.

It was mentioned that an approach between the medical and legal professions was heartily to be desired. In England there was the Medico-Legal Society which had meetings many times a year in which all sorts of cases, not only criminal cases, but other cases, were brought forward. He was sure that the doctors derived much benefit from their contact with lawyers in understanding the legal approach to many problems, and he hoped that the lawyers received benefit from the doctors as well.

SOCIAL ASPECTS OF PSYCHIATRY: THE IMPORTANCE OF STATISTICS.*

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THE social impact of mental illness, like that of other diseases which are covered by public health organizations, is governed by quantitative considerations. Two cases of typhoid fever are worse than one, and the same applies to schizophrenia. A principle, complementary to Bentham's doctrine of the greatest good for the greatest number, is the foundation of mental hygiene. The object is to try to reduce the total quantity of discomfort in the community due to mental illness. The effort is not expended only on people recognized to be ill enough to need hospital care. It includes those cases in the community who are less acutely ill and the members of the normal population, who have to tolerate the burden of mental illness in their relatives or associates. The basis of the whole activity is clearly quantitative. In order to comprehend the problem or to evaluate results of effort, adequate statistical data must be collected. It might be thought that to labour this point was unnecessary, and some may even consider it dangerous. Nothing is duller than the compilation of unnecessary statistics, official or unofficial, and nothing can be more misleading than numerical data collected or interpreted without proper forethought. I will therefore first draw attention to some erroneous conclusions, which have been sometimes drawn from statistical data in the psychiatric field.

The proportion of people who are certified mentally ill or defective in any given population is a figure fairly easily obtained. An American authority dignified this ratio by the name of the "asylum coefficient." The facts are unequivocal and, from the technical point of view, the measurement is a good one. Interpretation, however, is another matter altogether. In England nearly 5 persons per 1,000 of the general population are under certificate. In New York State, however, the corresponding figure is of the order of 7 per thousand. Are we to infer, as some people have done, that mental illness is commoner in New York State than in England? If a high institutional incidence of mental conditions were taken as a measure of poor mental health in the district concerned, we should be obliged to acclaim conditions in Japan, for instance, where only one person in 6,000 is in a mental institution. Some years ago I observed that in European countries there was generally an inverse ratio between the number of serious crimes committed in a country and the number of people certified (Penrose, 1939). I think there can be very little

* A paper read at the Annual Meeting of the Royal Medico-Psychological Association held in Edinburgh on July 18, 1946.

doubt that, after corrections are made for age-group distributions, the proportion of certified patients is a positively favourable index of mental hygiene in the general community. Social work does not tend to reduce the number of cases under treatment; it increases the number. It does so in more ways than one. First, by providing channels of communication between hospitals and patients in need of treatment; secondly, by removing the stigma of mental illness; and thirdly, by stimulating public enthusiasm for the development of mental health services. Eventually all these roads lead to the necessity of providing more beds in mental wards and the saturation point is still a long way off. We must accept the paradox that more mental beds imply better mental health.

There are some gross errors, which can be supported by the misinterpretation of statistics of mental illness. A fantastic figure known as "discharge rate" is calculated in hospitals all over the world. The annual number of patients discharged is divided by the annual number admitted. The figure usually varies between 40 and 80 per cent., and is supposed to indicate whether or not the hospital is doing good work. Sometimes a refinement is introduced, and the patients discharged are graded as "recovered," "improved" and "unimproved." In the interests of honesty, the grade "worse" should also be used, though I have never been able to find an administrative psychiatrist who would admit this. The major absurdity, however, is that if the same patient is discharged recovered and readmitted repeatedly the "discharge rate" approaches 100 per cent., although no tangible benefit is being derived from treatment.

Another persistent fallacy derived from statistical data is the illusion of anticipation in familial cases—progressive degeneration of the stock in succeeding generations. This idea was strongly upheld by Mott, but its basis is undoubtedly an artefact due to selection of parent and child pairs with approximately simultaneous onset and is not a biological phenomenon (Heron, 1914; Paterson, 1932).

My main purpose is not to dwell upon all the possible fallacious uses of statistics, but to point out some of the benefits which can be obtained from sound compilation and interpretation. There are two fields of study: (a) cases treated in mental hospitals or psychiatric wards; (b) cases in the general population, seen at home or in out-patient clinics. Obviously, to obtain a complete picture of the magnitude of the whole problem both types of records are necessary.

The two sides of the problem are, however, quite different. Out-patient clinics contain, or should contain, a preponderance of neurotic case-material, and in-patients are predominantly psychotic. In the field of mental defect there is another peculiarity; idiots and imbeciles are much more strongly represented both in institutions and clinics than would be expected from a knowledge of the number of low-grade defectives, as compared with the number of feeble-minded, in the general population. Total population surveys of defectives are quite feasible, though they can usually only be undertaken by sampling methods, as in the investigations of Lewis (1929), or by group psychological tests of children (Roberts *et al.*, 1935). Population surveys of mental

diseases are much more difficult, and will remain so until reliable tests for neurosis and psychopathy have been invented. In order to understand the natural history of mental illness or mental defect, however, the primary need is to obtain data on the most severe cases, namely, the institutional ones. These records can be accurate and complete.

It is not fully realized by the general public how large a percentage finds its way sooner or later into wards for mental cases. Pollock, Malzberg and Fuller (1934) estimated that this applied to $4\frac{1}{2}$ per cent. of the population in New York State. Pre-war German estimates were of the same order. In England a similar figure might be found if we had the data upon which to calculate. A crucial datum is the length of stay of a given patient, not merely on first admission but on each subsequent admission also. I have little doubt that in England (as Dayton (1940) found in New England) statistics would show that the mean duration of institutional life (for all patients) is more than ten years, that is, one-sixth of the whole duration of life.

If 5 people per thousand are to occupy beds each for one sixth of their lives, 30 people per thousand (i.e. $\frac{6 \times 5}{1000}$), or 3 per cent. of the population, must be certified at one time or another. This is a quick way of obtaining a rough estimate, and does not allow for the peculiar distribution of duration of stay in mental hospitals. This distribution itself is of great interest for the evaluation of the results of therapies, but is very little known. If we imagine 100 patients admitted simultaneously for the first time, we may assume that at the end of one year 50 of them would still be on the hospital books; the other 50 include those who died and those who have been sent home. At the end of the second year, however, some 40 would be left on the hospital books, and at the end of 20 years we should still have a residue of about 20 left (Penrose, 1943). A large part of this residue is formed by patients admitted more than once.

Statistics show very clearly that psychosis is essentially a chronic disability, with exacerbations and remissions. As a medical problem, it resembles gout, psoriasis, allergy or diabetes rather than an infectious disease. For this reason we should be extremely cautious in evaluating the effects of therapy except in terms of very long periods of time. For instance, if the stimulus of electrically induced convulsions induces remissions earlier than we would otherwise have anticipated, what assurance have we that relapses may not thereby also be facilitated? The results of such treatments are often dramatic when considered in terms of weeks or months. Statistical inquiry, however, convinced me that, when a long range view is taken, with a minimum of five years since treatment as a standard, these methods hold no advantages over less violent procedures (Penrose, 1945). Again, we used to hear a great deal about the value of early treatment of mental disease. Indeed in some organic diseases, like G.P.I., early treatment can be shown to be essential. I doubt, however, if there is a shred of real evidence that the early special treatment of schizophrenia by insulin, for example, has any merit. Recent admissions have, in any case, better prognoses than patients who have been in hospital for years. Any treatment will have a better effect on recent cases

than on chronic cases, just because nearly half of the recent cases are going to recover within a year or thereabouts with good ordinary hospital care. The chronic cases, on the other hand, are likely to react poorly to any treatment. I would make an exception, however, in respect of leucotomy. This appears to cause a permanent emotional alteration and, if the result is favourable, recurrence of the same type of breakdown is therefore unlikely. On purely statistical grounds it is easy to show that, after leucotomy, patients have been discharged and have remained at home for a long time who would otherwise have had very little expectation of ever leaving hospital. It is beyond the scope of statistics to determine whether such leucotomized patients have been cured, or have merely developed socially acceptable forms of psychoses.

Many of the clinical differences between the various types of mental diseases, though they may be constant sources of irritation or of fascination to the psychiatrist according to his type of mind, are useless for the research worker. We cannot yet distinguish between schizophrenia and affective psychosis with any certainty. At some hospitals the patient who, after three or four years' institutional life, retains an initial diagnosis of manic-depressive insanity is fortunate. Here, strangely enough, statistical inquiry has a great deal of useful information to give. First admissions tend to be given diagnoses which are very characteristic at different ages. A good guess at the correct diagnosis can be made if only the age on first admission and sex of a case is known. For example, a case certified below the age of 20 years is most probably a defective. Schizophrenia in male first admissions has a peak frequency at about the age of 25 years. Schizophrenia in the female has its peak ten years later in life—at 35 years. Affective psychosis in the female has its peak of frequency at 45 years, and for the male the corresponding age is 55. Statistically, therefore, it is comparatively easy to distinguish the two main diagnosis groups in males by first admission age, but more difficult to do this in females. The age-grouping of pure paranoid psychoses indicates that they are more closely allied to affective than to schizophrenic reactions. In the age-groups around 65 and over, almost all first admissions are diagnosed senile or organic. The number of cases in these late age-groups is large, and is gradually increasing as the age-group, in the general population from which they are drawn grows larger. It is of extreme interest to know how many beds will be required for such cases in the future and only accurate statistical inquiry can determine this.

From the point of view of genetical research the age of onset of disease is a more useful fact than a changeable diagnosis. One reason for this is that any mental disease, when it is of early onset, is a potent factor in reducing the subject's fertility. The fertility of psychotics in general is of great eugenical significance but we need a census of their children to find out the exact biological trends.

A great many quite simple inquiries on the aetiology of mental diseases can be aided by statistical records and some inquiries are impossible without them. It is valuable, for genetical studies, to know as nearly as possible the population frequencies of different diseases, especially when such diseases are rare. Moreover, as a preliminary to detailed study of any given condition, it may be extremely helpful to have a record available of where such cases can

be found. For example, in linkage studies carried out with a view to refining eugenic prognosis in Huntington's chorea or in phenylketonuria, it would be of immense advantage if the investigator could quickly ascertain at what centres the case material could be found. Another important line of inquiry is the detection of recessive abnormalities or predispositions by the method of identifying types of cases whose parents have a high consanguinity rate. This method was the basis of successful inquiries initiated by the Medical Research Council on patients both in general hospitals (Bell, 1940) and in mental hospitals (Munro, 1938). The ascertainment of relationship between the parents of the mothers of cases is also of interest if rare antigenic factors similar to Rh are suspected of being aetiologically significant. Facts about consanguinity are very easily obtained if asked for in routine inquiry, but otherwise their collection involves immense labour.

Finally, I may mention the intriguing problem of assortative mating. Is there any evidence that people of weak mental stamina tend to marry one another? Statures of husbands and wives are positively correlated to the extent of about 0.20, for instance. Levels of intelligence of married couples are much more closely similar than statures; the correlation coefficient is about 0.40. If we examine husbands and wives in cases where both partners have had the misfortune to be certified we will find, first of all, that this occurrence happens more often than could be attributed to mere random chance (Penrose, 1944). We may also find that, both with respect to diagnosis and age of onset, the type of disease is extraordinarily similar in both members of the pair. The correlation coefficient for age on first admission is of the order of 0.60. One must not, however, overlook the environmental factors, which may tend to produce illness in one partner at the same time as in the other partner. In fact the likeness of husband and wife in respect of first admission age is absurdly high in comparison with the brother-sister correlation, 0.50, estimated in the same manner. The great similarity of type of mental illness found in husbands and wives must, therefore, be attributed in a considerable degree to environmental influences, but a significant tendency for persons of like potentialities for mental breakdown to marry one another also seems clearly demonstrable. To check and to amplify this result it is necessary to keep records of all cases of certification of husband and wife over a sufficient period of time.

I have pointed out a few examples of the uses of statistical data in psychiatric research which have occurred to me. They only scratch the surface of the ground, which could be productive in a great variety of ways. The examples have been brought forward to emphasize the need for the orderly collection of facts, so that they can be used later in statistical inquiries. Most of the data needed is not of a highly technical nature, and it might well be one of the duties of the trained psychiatric social investigator to collect the greater part of the material. I feel that it would be well if social workers were trained to realize that each individual case forms part of a community problem, which is essentially a branch of human biology. It is usually impossible to understand the individual case properly unless the base line of the normal average has been first determined. To determine this base line and the range of variation

requires the systematic collection of statistical facts, an occupation which will often appear quite futile until the material has been assembled and analysed.

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REPORT ON ONE HUNDRED FEMALE PATIENTS TREATED BY PREFRONTAL LEUCOTOMY.

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[Received July 25, 1946.]

THIS report concerns 100 patients treated by prefrontal leucotomy. The technique employed has followed that of Freeman and Watts.

In the case of the 47 manic-depressive patients treated the prognosis without operation was considered very poor. The majority (34/44) had failed to respond to electric convulsive therapy, which was contra-indicated in the remainder by reason of physical health. Seven out of these 47 cases had been in hospital under two years, but there was a history of many years' poor social adaptation or recurrent mental illness. The average duration of illness in the recovered cases of this manic-depressive group was 31 months. That of the failures 45 months.

Of the 47 cases of this group 41 were melancholics, of whom two died as a result of operation, one of haemorrhage into the site of section, one a senile patient with marked arteriosclerosis, in whom some bleeding had tracked above the corpus callosum (these represent the two deaths of the series of 100 cases).

This leaves 39 melancholics in whom the effect of the leucotomy on their mental state could be assessed. Thirty of these recovered, 3 relapsing up to date. One of these relapsed patients remains well in hospital, but cannot manage at home. She was previously one of the most acutely agitated and suicidal patients in the hospital.

Of the 9 melancholics who failed, 2 were senile and in one other the mental symptoms were probably associated with organic heart disease.

Even in the failed cases the depression, anxiety and restlessness were removed or relieved. One of these who had a second leucotomy became manic, another was relieved entirely of her depression, but was too noisy and abusive to relatives (though well behaved to friends) to remain at home.

Of the remaining 6 of the 47 manic-depressive cases, 3 showed episodic attacks of mental instability. Of these 3, one had classically alternating phases of mania and melancholia, one had periodic manic phases, with normal periods of some length.

The third was of particular interest, as she had been in hospital some ten years, during which she had every three weeks, periods of acute manic excitement, lasting about six weeks. Since leucotomy nearly twelve months ago, she has had no further attacks. She has been put on parole, and is making good progress towards complete recovery. The other 2 cases have both been discharged.

The remaining 3 of the 47 manic-depressive cases never showed melancholic features, and were operated on in the manic state. They remained unchanged.

It may thus be said that in 44 cases of manic-depressive psychosis, the operation of leucotomy apparently removed or relieved the symptoms of depression, agitation and restlessness almost without exception.

Thirty-three cases of schizophrenia were treated. Ten of these recovered, 3 relapsing. Three of these recoveries had affective tainting to their psychosis. The 10 recoveries were made up of 3 paranoid, 3 catatonic, 4 hebephrenic. The 23 failures included 3 paranoid, 14 catatonic, 6 hebephrenic. Amongst this group were two patients who, every few weeks, had periods of acute excitement, during which they were violent and impulsive. Since operation nearly twelve months ago, neither have had such outbursts, and they have become usefully employable. One is already on parole and the other is likely to be paroled soon.

The average duration of illness in the recovered schizophrenics was 25 months and in the failed cases 85 months. In a few of the other failed cases of this group there was certainly some improvement, but the majority showed no change.

Nineteen cases of paranoia and paraphrenia were operated upon. Five cases recovered, two of whom soon relapsed. Two of those still well were cases who had considerable depression attached to their persecutory ideas. In general most of these patients became less suspicious and rather more pleasant individuals than before operation. The delusional ideas have, however, persisted, though in most cases, appearing to concern the patients less than before the operation. The average duration of illness in recoveries in this group is 35 months and in the failures 62 months. This indicates that the early cases respond better.

The final case which makes up the 100 of this series, was a chronic hysteric who had for ten years been in and out of different mental hospitals. Her symptoms took the form of suicidal attempts, narrowly missing real success. No form of treatment anywhere had been successful in curing her illness. After leucotomy she appeared more stable and has been home twelve months. She still develops minor hysterical symptoms, which gain her attention. There has so far been no recurrence of the suicidal episodes or of the wanderings from home, formerly a great trial to her parents.

The personality changes in the recovered cases of all types have been similar to those described by Freeman and others, namely, a tendency to consider less the effect of their remarks and to say what they think—a tendency to be placid and inclined to laziness. These changes have not been usually very marked or unsatisfactory in degree.

Foresight is not necessarily lost, and insight is often profound. One patient, a paranoid schizophrenic, before leucotomy had for years a male friend who wished to marry her. She was, however, more ideally attracted to another, who was not particularly interested in her. After leucotomy she decided to marry the nice but not so romantic partner. On her own decision she wanted twelve months between recovery and marriage, to feel sure she was well. She

said she thought her fiancé a very brave man to take her on in view of her illness. She was concerned as to whether it was advisable for her to have children in view of her illness. The marriage is so far very happy.

The recovered patients are usually very conscious of the relief they have obtained and very grateful for it.

Apart from the two operative deaths, there have been no serious complications after operation. Epileptiform seizures are fairly common in the first 24 hours, but we have had no reports of permanent epilepsy.

One case who had a second operation became manic, but her present condition is probably preferable, both to herself and others, than her previous acute misery.

Dr. E. R. A. Cooper, of Manchester, kindly examined four brains from patients who had had prefrontal leucotomy. Two of these were operative deaths, one dying a few hours after operation, the other dying five days after operation. The other two patients died some months after operation of natural causes. Dr. Cooper has sent a preliminary report as below :

Here is report of A. K—, lived five days after leucotomy.

Left hemisphere.—A large blood clot 1 in. by 1 in. was found in the white matter of frontal lobe. Another clot in supra callosal region compressing the corpus callosum. The pial veins were all congested.

The tissue all around the massive frontal blood clot was necrosed and limited and demarcated from the healthy white matter by a line of glial activity—it resembled an infarct.

Examination of all regions of the corpus striatum, thalamus and internal capsule did not reveal anything abnormal. I examined also the subthalamus, but found it normal.

Right hemisphere.—A cavity filled with blood clot was found in the frontal lobe and an area of haemorrhagic infiltration surrounded it and penetrated into the frontal lobe. There was haemorrhage into the lateral ventricle and above the corpus callosum as on the left side.

Sections through the corpus striatum, thalamus and internal capsule have not revealed any degeneration or gliosis.

I have been carefully through all the cases, but cannot add anything. In each case there was a cavity resulting from the leucotomy. This was surrounded by a prolific area of neuroglia; microglia (scavengers) clearing away debris and large-sized astrocytes in the nervous tissue around. I have not detected any change in the neurones of the thalamus or corpus striatum; nor can I trace any degenerating fibres.

As far as I could tell, there did not appear to be much change in the cells of the frontal cortex.

I suggest that any further specimens would be best cut serially and examined by Weigert Pal right through to the brain stem. Those I did do did not show any response.

It will be noticed that degeneration of the thalamus as reported by Freeman was not observed in these cases.

SUMMARY.

1. Experience of 100 cases of prefrontal leucotomy has shown that symptoms of true melancholia can be removed by the operation in an extremely high percentage of cases, even in old standing cases and after failure of other methods.

2. In schizophrenia, paranoia and paraphrenia it is doubtful whether leucotomy is more efficacious than other methods of treatment.

3. Personality changes after operation are less gross than might be feared, and the personality may even be improved. It is thus possible that if more serious effects of the operation do not develop after some years it may be considered advisable to employ it earlier and before other methods of treatment in cases where there has been a long history of poor social adaptation.

One of the most important questions we wish to know about prefrontal leucotomy is to what extent it leaves the patients suitable persons to take their place in society. For practical purposes the opinion of relatives and friends gives us useful information. With this in view, relatives of discharged patients with whom we were not otherwise in contact, were written to. Below are the replies received.

Reference to the question letter sent out will explain the replies where they answer the question letter point by point.

The following letter was sent to the relatives of patients operated on.

COUNTY MENTAL HOSPITAL,
WHITTINGHAM,
PRESTON.

Re LEUCOTOMY OPERATION.

Patient's name.....:.

DEAR SIR (MADAM),

We are very interested to know how the above-named patient is now. We would be glad if you would kindly reply to the following :

1. An account in your own words as to how the patient has been since discharge.
2. Very particularly, in what way if any, is she occupying herself, either at home or on outside employment.
3. Can you describe her personality compared with how she used to be before she became ill.

I enclose a stamped addressed envelope for your reply.

Yours faithfully,
A. R. GRANT,
Medical Superintendent.

1. D. H—, aged 41. Operation : 8.x.44. Letter : 21.iii.46. Discharged : 24.xii.44.

History.—Admitted 20.ix.40. Always “highly strung.” No confidence when mother died. Feared the future. Alcoholic hereditary. Duration of illness : 4 years 1 month.

Report before operation.—Depressed ; anxiety ; hallucinated—voices told her she was a burden. Ideas of unworthiness.

DEAR SIR,—

I am writing to you as regards my sister, D. H—. I am her youngest brother and she came to live with me when she came out, and not with my brother F. She seems to be getting along quite well, she stayed with us for about 4 months and then decided to get a little house of her own, and she seems to enjoy it better because it keeps her busy. She has not started work yet, but she goes out a lot and seems to take plenty of interest in everything she does. I cannot thank you enough for all you have done for her, she has not been back to see her employers at Ballon Street, because I don't think she would like to go back there, she seems

to want to get a job nearer home. I thought she would have written to you to thank you for all you did for her, but she does not seem to be good at writing. Also she has got out of the habit of thinking everybody is talking about her and I think she is more interested in the life of other people than she ever was before.

3. S. H—, aged 49. Operation: 25.vi.44. Letter: 8.iii.46. Discharged: 28.viii.44.

History.—Admitted 30.ix.43. Illness commenced prior to 1942. She had electric convulsive therapy and improved for a time, then relapsed. She failed to improve after a second course of E.C.T. Duration of illness: 2 years.

Report before operation.—Very depressed, restless and agitated. Believes she is unwanted and God has forsaken her. Says her head is empty, she has no brain. Reiterates this continually.

DEAR SIR,—

Re S. H—.

She was discharged August 28, 1944, and until December, 1944, was perfectly normal, then a relapse occurred, she went away to her sister's for 3 weeks and then came home much better for another 3 or 4 months, then she complained of a queer feeling in her head, when she awoke each morning, although she had slept all night she was still tired and did not want to get up. This feeling persisted, and she has eventually turned lazy, her excuse being that she is tired, the peculiar thing of this is, she must and can go and talk with someone (no matter who) until this feeling leaves her. At first in about 2 hrs., now it lasts nearly all day, when evening comes she is more often than not normal.

There has been a return of delusions during the last 8 wks, the main ones taking the line that she has no brain (due to operation) and she can't think or do any work. I have been at home ill, and a fortnight ago she came downstairs undressed, she could not dress herself properly, putting her corsets on after her skirt, she got all mixed up and I had to show her what to do, when she was dressed she said "Come on T., we are going to be late for work." I asked here where she was going, and she mentioned a place she worked at when we were first married 24 yrs. ago. She became normal in about half an hour and did her housework better than she had done for months past. Since then she has just been as she was before the attack.

Question 2. She is really trying to occupy herself in housework and says she "wants to do it but can't." She is very afraid of having to come back to hospital and will not see a doctor.

Question 3. From a nice peaceable disposition to a nagging and worrying one.

She is just saying "Oh dear, I don't want to go back to *that* place, whatever has made me go like this." "I have never been spoiled, I have always had to do work when I was young."

By the way her weight has kept increasing. She is now 15 stone dressed, height about 5' 3".

4. E. H—, aged 51. Operation: 10.ix.44. Letter (undated). Discharged: 29.xi.44.

History.—Admitted 17.v.39. Patient has always been highly strung and nervous. Was first in mental hospital sixteen years ago. Never been well since. Admitted here in 1939. Duration of present attack: 5 years 4 months.

Report before operation.—Depressed, agitated, ideas of unworthiness. She believes she is unclean and not fit to mix with others. Very apprehensive. Hallucinated.

DEAR SIR,—

Re E. H—.

Since she was discharged there is certainly an improvement but she is very unbalanced. She has spells of depression and nothing we can say or do makes any difference. Then after a month or so of being perfectly normal, she will suddenly decide that she owns the house. She expects us to ask if we may go out and tells us what time to come in. In short she thinks we are school-children again. Then she works herself up and she will decide to pack her things and go.

About a month since she started insulting my husband and friends, and when told about it she packed her things and stayed with some friends who keep a boarding house. The charge was 7s. 6d. a night. When I went for her she told them she would send the money on. She has her 10s. pension and she thinks it is a fortune. After that spell she was all right for about a fortnight then she got very depressed, worrying about how we would manage, money, food, coal, etc.

When in a balanced state she is very active, doing household jobs and helping with the children, going to a variety or cinema or going for a walk. When depressed she will *muddle* through for a day or two then retire to bed and stay there for days on end. "It would take a fire to move her."

The worst state is when she is on the top waves (as we call it). She spends her time being as awkward as she possibly can be. I have asked relations and friends their opinion of her and they consider her true self is when she is what I called her balanced state.

She was never given to be insulting and awkward, but always pleasant, obliging and generous.

5. M. W—, aged 47. Operation: 9.vii.44. Letter: 7.iii.46. Discharged: 28.viii.44.

History.—Admitted 18.v.43. Illness is said to date from ten years prior to admission here. During this time she has been morbidly obsessed with ideas of bodily disorders.

Report before operation.—Miserable, depressed, fretful, never smiled. Her sole interest ideas of various bodily illnesses for which no organic cause could be found.

Strangely enough she has had true organic illness since discharge, and was in the General Hospital under the surgeon who performed the leucotomy. She was said to be a model patient, and have only a normal interest in her physical health.

DEAR SIR,—

In reply to your questions on other side, I have to state that:

1. Since discharge she has been much improved mentally. Though not in the best of health physically, she is much better in her mind.
2. At home she busies herself about the house and although not able to walk much, I think she does very well, considering how long she has been ill.
3. Compared with what she was before she was ill, she is much brighter and though she does get depressed occasionally, I think she is much better.

6. D. A. H—, aged 47. Operation: 10.ix.44. Letter: 21.ii.46. Discharged: 11.i.45.

History.—Admitted 26.v.42. Duration of illness: 2 years 4 months. Mother said to have died in mental hospital.

Before operation.—Patient lay in melancholic stupor for months. She refused to converse. She was sensitive and required everything to be done for her.

Within a few days of operation she began to speak spontaneously and rapidly improved.

DEAR SIR,—

I may say that I am working again at Bacup Shoe on my old job in the warehouse. Slippers and shoes, cleaning them.

I may say I am feeling very well at present. I only work from nine to four.

7. P. E—, aged 54. Operation: Jan., 1943. Letter: 21.ii.46. Discharged: 17.vi.43.

History.—Admitted 2.viii.39. Illness commenced four years prior to operation, when patient was a missionary in Burma. She was over conscientious and greatly over-worked for the climate.

Report before operation.—She was acutely depressed and agitated. She believed herself the wickedest person in the world, and that nothing could ever alter her.

DEAR SIR,—

In answer to your enquiry about my sister P. E—. It is rather difficult to say just how she has been, on the whole I should say it is just marvellous how different

she is. She is happy and enjoys everything, plays the piano a lot, reads good literature which she gets for herself at the Free Library, goes to Church regularly, and enjoys the services, but still will not take Communion. We play bridge most evenings and she can play quite a good game with the exception of over-bidding which she was always inclined to do.

She eats exceedingly well and everything seems to digest and she is now 10 stones in weight and looks well and bonny.

Now about work, she just won't do any kind of work at all, neither household or sewing or knitting, the only help I get from her is shopping and she can do that quite well, she will do anything she likes doing, but one cannot persuade her to do what she does not like.

Personally, she is much as she was as a little girl, very erratic only more exaggerated, flares up if anyone disagrees with her on any subject so we try to avoid argument, and on the whole we live quite happily with her.

She could not take any responsibility of any kind, but is all right living with me and my elder sister.

8. C. F—, aged 45. Operation: 6.v.45. Letter: 20.ii.46. Discharged: 30.vi.45.

History.—Admitted 9.xi.44. There is a history of recurrent attacks of mental illness since 1923. She is said to have been always strange in manner and always anxious.

Report before operation.—She was depressed, anxious and fretful. She talked incessantly in a fretful manner. She was restless and interfering. Periods of elation.

DEAR SIR,—

1. Very good, eats and sleeps well, health good.
2. At home, doing all household duties.
3. Quite herself in every way. Normal, would not think she had ever been ill.

9. R. C—, aged 35. Operation: 25.iii.45. Letter: 19.ii.46. Discharged: 28.v.45.

History.—Admitted 30.i.45. She was first in a mental hospital in 1940. Except for short periods she has been in such hospitals since. Present admission August, 1944.

Report before operation.—Continually weeping and moaning, with short periods of laughing and singing. Says God has forsaken her. Hallucinated, voices praying for her.

DEAR SIR,—

1. Very fit and well.
2. At home doing household duties.
3. Better in every way.

10. A. G—, aged 19. Operation: 22.iv.45. Letter: 20.ii.46. Discharged: 28.vi.45.

History.—Admitted 20.iii.44. First nervous breakdown aged 8. Wandered the streets at night. Been odd in her manner ever since and always solitary. Was violent prior to admission.

Report before operation.—Very shy, solitary and retarded. Has continually changing ideas of being gifted for great accomplishments.

DEAR SIR,—

1. Very well.
2. Domestic at home.
3. More normal.

11. D. M. R—, aged 46. Operation: 25.ii.45. Letter: 21.ii.46. Discharged: 20.vii.45.

History.—Admitted 17.xii.43. Said to have been always "highly strung" and to have had frequent attacks of uncontrollable temper. Present illness commenced five years ago with ideas against her husband.

Report before operation.—Extremely suspicious, retarded and solitary. Appears depressed. Accuses her husband of persecuting her and trying to do away with her.

DEAR SIR,—

I received your letter this morning, I am sorry to say that I am unable to give you any definite facts as to the condition of my wife, Mrs. D. M. R—, who, from the moment of her release from the hospital, refused to live with me. I of course make her an allowance which I send her every week and I receive an acknowledgment which is sometimes very bitter and mentions the supposed things I have done, which makes me believe that the operation wasn't quite the success I had hoped.

Mrs. R— is working and as far as I can make out is happy enough, for which I am thankful. My youngest daughter is living with her mother and I believe is also happy. The last time I saw my wife, she started to quarrel with me and I could see it would do no good for me to argue with her so I left, since then I have purposely kept away rather than excite her in any way. I am making discrete enquiries as to what she is like and hope as the years go by her attitude towards me may change for the better.

I should be deeply grateful if you could advise me in any particular way, that I may, in time effect a reconciliation, until that time I am prepared to wait even if it may take some years. If I hear anything which means an improvement I shall be only too pleased to let you know.

12. G. S—, aged 61. Operation: 11.vi.44. Letter: 24.ii.46. Discharged: 24.vii.44.

History.—Admitted 2.v.41. Duration of illness: 3 years 1 month. Thought to be due to air raids and rationing worries. Electric convulsive therapy not given because of physical health.

Report before operation.—Very miserable, depressed and extremely retarded. Solitary. Troublesome with food. Idle.

DEAR SIR,—

I am replying to your letter, on behalf of my father Mr. E. S—. With regard to my mother Mrs. G. S—, you will be pleased to know that she is just as she was before she was taken ill. When she came home from hospital, my sister-in-law and her child aged three, were living with us. So mother had company during the day, and thus gradually adjusted herself to the changed shopping conditions of war-time. The first week at home she went visiting her friends, at first with someone. Before her illness she belonged to a Chapel, and used to attend an afternoon meeting during the week. She commenced going again by herself.

My brother returned from overseas in January, so his wife and child left us to go to their own home. Since then mother has done the housework, shopping, etc., on her own, prepared meals for an adult family of 4 including herself. As you will judge, she is leading a normal healthy life. The only change in her personality, is that she doesn't worry to the extent she did previous to her illness. Her friends and neighbours say "she is just the same Mrs. S." The members of her family will never cease to be grateful to you for making it possible for mother to have the operation.

My brother said the biggest thrill he had when in Italy was the first letter he received from mother at home. As you will know, when mother was ill, she had no desire to write. In fact she didn't write once the whole time she was ill. The first letter she wrote was about 3 weeks after the leucotomy operation. She has also been to the theatre and pictures.

To the members of her family the operation was wonderful, and we will never forget.

13. A. C—, aged 52. Operation: 4.vi.44. Letter: 23.ii.46. Discharged: 24.vii.44.

History.—Admitted 3.xii.42. Duration of illness: 12 years.

Report before operation.—Extremely miserable, depressed, agitated, and said life not worth living. No confidence. Idle.

DEAR SIR,—

The writer is very pleased indeed to be in a position to give you an excellent report of his sister's condition.

1. A. has given no trouble at all since her discharge.

2. She is carrying out household duties, and needle-work, mostly floral designs on table-covers, etc., and will soon be carrying out clerical work in the writer's office.

3. Her personality is similar to as she was before her illness, maybe that she speaks a little more quickly, and a trifle excitedly.

14. E. P—, aged 29. Operation: 3.vi.45. Letter: 21.ii.46. Discharged: 27.viii.45.

History.—Admitted 14.v.45. Illness said to have dated from head injury nine years ago.

Report before operation.—Silly and childish in manner. Laughed and grinned foolishly. Hallucinated. At times elated and at other times depressed. Restless, idle and untidy.

DEAR SIR,—

I beg to inform you that our daughter E. has greatly improved since her discharge. She has returned to her own trade of Printing and Bookbinding.

Her personality is more outstanding, she does not allow trifling matters to upset her, she has a different outlook on life in general.

15. A. C. L—, aged 41. Operation: 20.v.45. Letter: 21.ii.46. Discharged: 23.vii.45.

History.—Admitted 1.iii.45. Illness dated from three years prior to admission here, with history of previous attacks of "mental disturbance."

Report before operation.—Very hallucinated (voices) and also troubled by electric waves which are being played upon her and which she can see running down the mirror.

DEAR SIR,—

In reply to your letter of the 19th inst., *re* my wife, Mrs. A. C. L—, I am happy to say that the operation appears to have been a complete success, as mentally she has been perfectly normal since her return home.

Physically also she has kept reasonably well excepting for a persistent catarrh, with suppuration of the ears, during the winter, for which she has had treatment from her own doctor, and also a susceptibility to tiredness after exertion with some pain in the right side of the head and spots before the right eye.

These latter I presume to be natural for the time being at any rate.

Mrs. L— carries out her home duties including shopping, etc., but has been able to obtain home help for the heavier housework. In addition, as formerly, she does sewing, knitting and fancy needlework.

Regarding personality I would say that there is little change from the time prior to her illness, she is perfectly happy in her home and amongst her friends. Her own doctor seems to be perfectly satisfied with her and describes her as a marvel.

16. P. V—, aged 33. Operation: 8.i.45. Letter (undated). Discharged: 10.v.45.

History.—Admitted 25.x.44. Duration of illness: 5 years.

Report before operation.—She is depressed, retarded and solitary. She believes she is being turned into a dog, and that a man has transmitted heart disease to her.

DEAR SIR,—

In answer to your enquiry about our daughter P. V—, when she came home at first she used to sit about and cry at times. But I am pleased to say she is improving now but not following any outside employment. She helps her mother in the house, but tires soon and does not seem to have the energy to keep it up for long.

As regards her personality before she became ill she was very quiet and reserved, but is now very irritable at times and uses swear words which she never did before, but is all right afterwards, she calms down immediately afterwards.

17. B. S—, aged 60. Operation: 25.iii.45. Letter: 23.ii.46. Discharged: 16.vi.45.

History.—Admitted 9.ix.42. Duration of present attack: 2 years 5 months. Previously in mental hospital in 1930.

Report before operation.—Very miserable, depressed, retarded and solitary. Idle. Very troublesome with food.

DEAR SIR,—

In answer to your letter I received dated February 19, 1946, regarding my wife, patient name, Mrs. B. S—.

1. An account in my own words, she is much better since her discharge.
2. She is occupying herself on home duties. Never worked for a long time owing to sickness.
3. Very proud and independent and also takes pride in her home.

18. E. J—, aged 26. Operation: 9.ix.45. Letter: 21.ii.46. Discharged: 26.xi.45.

History.—Admitted 1.xii.43. Illness commenced during pregnancy, 2½ years prior to operation. Her illness was considered to be schizophrenic.

Report before operation.—Dull, retarded and refused to converse. Hallucinated and violently impulsive at times. Mistakes identity. Often excited and mischievous. Faulty in habits, idle and untidy.

DEAR SIR,—

In answer to your letter regarding my wife. She has lived up to expectations even more than I had ever hoped for, considering the present conditions of house-keeping, and baby to look after, not to mention the rationing, she has proved to be more capable than before she took ill.

At the moment she occupies her time with house work, and is a regular book-worm, she desires to go back to her former job at the Co-operative Laundry, but that will come after we have had a holiday.

The only thing that has troubled her since her discharge is the spots on her body, and occasional bouts of biliousness. This, however, is rapidly disappearing.

Apart from the above mentioned, my wife is well and happy.

19. E. A. W—, aged 59. Operation: 20.viii.44. Letter: 22.ii.46. Discharged: 28.xi.44.

History.—Admitted 3.ix.40. She is said to have never been happy for a great many years. First breakdown was in 1906 after first baby. Duration of present attack: 4 years.

Report before operation.—Very miserable, depressed, apprehensive and agitated. Ideas of unworthiness. Solitary and idle.

DEAR SIR,—

1. The above my mother has been in the best of health since her discharge and on no account has it been found necessary for her to see a doctor. She is always cheerful and does not worry on any account, in fact to me her health, etc., is far better than I have known for some years and does not give me the least cause to fear that her old complaint may return.

2. On her return home in November, 1944, my sister lived with her until Easter, 1945, but since that date she has been living on her own and she is quite happy, doing all her housework, washing and shopping, and considering that she had not had any dealings with rations, points, and all ration short-comings, since early 1940, to me she has quickly picked these up. She spends her time sewing and mending and in the last six months she has commenced to attend Chapel, go to Mothers' Class Meetings, and Social events, also visiting the pictures. She does not go out to work, but nurses my sister's 2-year-old son two or three half days per week, and

visits my home quite regularly, although I live two miles away, and this means she must use two buses.

3. There has been a considerable change in my mother personally, she always had a tendency to worry over very small things, and was depressed on not being able to do her housework due to sickness. Since her return she looks on things quite differently and does not worry and she is always cheerful in all circumstances.

To give one instance whilst my sister was living with her, due to unforeseen circumstances, the chimney caught fire and was followed by a fall of soot whilst they were in bed. On seeing this on arising, my sister called my mother, who seeing the mess, just said, well I am having my breakfast first and will deal with that afterwards.

By this action you will understand the change which has taken place, and she just proceeds happily along.

She has been placed in charge of all her own affairs once more, and attends to all rates, taxes, etc., in the same regular and efficient manner without any assistance from me in any shape or form.

20. M. E. S—, aged 54. Operation: 19.xi.44. Letter: 25.ii.46. Discharged 26.ii.45.

History.—Admitted 14.vii.41. Duration of illness: 3 years 5 months. Worried about husband, who is blind.

Report before operation.—Acutely miserable, depressed and agitated. Very self-absorbed by ideas of bodily ailments. Solitary.

DEAR SIR,—

Mr. W. S—, one of our blind employees, has passed on to me your letter of the 19th instant, and asked me to reply on his behalf.

He reports that his wife is looking after the home quite satisfactorily, and does all her own shopping. In the mornings she is employed by us as a cleaner, and seems to be quite happy in her work. Mr. S— is at present working at home, so that she has his company in the afternoon. She appears to have no difficulty in going about by herself, and acts quite normally.

Mr. S— states that she is more cheerful now than she was before she was admitted to hospital. The only trouble is that she appears to be somewhat over-sensitive, and he has to be careful what he says to her, or he finds that she has been upset by something he has said without any intention of offending.

21. B. S—, aged 53. Operation: 8.x.44. Letter: 23.ii.46. Discharged: 10.v.45.

History.—Admitted 25.ii.43. Duration of illness: 9 years. After menopause began to worry over numerous things. This culminated in suicidal attempt three years ago.

Report before operation.—She was acutely miserable, depressed and agitated to such degree that she was considerably confused and at times rambled incoherently in depressed manner. Her habits were faulty and she was extremely troublesome with food.

DEAR SIR,—

I thank you for your inquiry of Mrs. S—, and glad and grateful for all you have done, thank you.

1. Mrs. S— now seems to be improving wonderfully, she is more understanding and helpful, will do little things for herself. For a few weeks we had Dr. L— from P— as she wanted some medicine to help her, complained of being hot and electric pains all through her, but now we never have the word mentioned.

2. Rests most of the day, but is more helpful in the house.

3. Not as she used to be, but has improved a lot lately.

22. M. M—, aged 51. Operation: 5.xi.44. Letter: 12.xii.45. Discharged: 19.xii.44.

History.—Admitted 5.i.44. There is a several years' history of recurrent breakdowns. She was several times in mental hospitals in Belgium.

Report before operation.—She was miserable, depressed, dull and retarded. Restless, resistive and troublesome with food. Lacking interest.

DEAR SIR,—

Do you remember the Belgium lady Miss M. M— that you have given treatment last year, and who has been operated on last December. I hope you will remember. Well I am glad to tell you that I am still in the best of health and that I am running our shop in Ostend.

Since I left the hospital I have never more seen a doctor, and my weight is now 9 stone. I do write you to thank you for the good treatment I have got in the hospital, and beg you to remember me to all the nurses who were in the same ward, especially to Nurse F—

23. E. J. C—, aged 22. Operation: 17.vi.45. Letter: 25.ii.46. Discharged: 29.viii.45.

History.—Admitted 7.v.45. The history of this case goes back into early childhood, originating in domestic difficulties between parents. For many years there have been repeated hysterical episodes with treatment in other mental hospitals.

DEAR SIR,—

Re your letter to hand for which I thank you regarding my daughter E. J. C—, and thanks ever so much, for your interest on her behalf.

She has not been very much different up to the present, I am sorry to say, for any length of time. However, this last couple of weeks, she has not been quite so unruly, so may be there may be hopes yet of an improvement.

She did, however, start working as a clerk, in October but she only worked 7 weeks, then came home and said she had got her notice, as she refused to work over-time. I did not believe this, as I had already got a note from her doctor here to say he did not advise her working long hours. She only worked 5 days per week, from 9 a.m. to 5.30 p.m. I went unknown to E. to see what had happened as I was so sorry she had to leave as she seemed to like her work. And was told they were quite satisfied with her work, and she was popular with the other girls only she had been acting strangely, and they thought it best to discharge her for their own sakes, but they were sorry to have to do this, and they were very pleased I had gone to see about things.

At home she is very nasty at times, she will not assist with any little household duties and she gets into tempers at the slightest thing. The only difference she has not attempted to run away, when I have had any words with her, as she has in the past. Whether this is because I had told her if she goes again, I will never have her back, I do not know.

24. E. M—, aged 52. Operation: 9.ix.45. Letter (undated). Discharged: 26.xi.45.

History.—Admitted 12.vii.44. Duration of present attack: 14 months. Said to have commenced as result of blitz in Liverpool. Previously said to have been always an anxious and worrying type of person.

Report before operation.—Very depressed and agitated. Restless and strips herself. Confused, due to her agitation. Crawled along the floor in her restlessness. Very troublesome with food.

DEAR SIR,—

In reply to your letter about my wife E. M—, I am pleased to say she is doing very well, she is doing her household duties just the same before she went to hospital, she goes about as if nothing had happened to her. She has plenty of things to occupy her mind, she still attends her doctor, the only thing I can account for her sickness was worry, but she has got over that, she does not sleep too well at night.

25. H. D. R—, aged 53. Operation: 11.ii.45. Letter: 2.iii.46. Discharged: 17.vii.45.

History.—Admitted 22.v.42. History of onset deficient. Interval between admission and leucotomy 33 months.

Report before operation.—She was very miserable and depressed, and troubled by ideas of persecution. Resistive. Retarded.

DEAR SIR,—

I wish to point out that I reside in the Isle of Man, and therefore very rarely see my sister.

1. I have visited her on three occasions since she was discharged from the hospital, and I have come to the conclusion that she is still mental, but probably not sufficiently so to be certifiable. She is living with two elderly women, one is 80 years of age, and the other is 77 years of age. The elder of the two has been with our family for over sixty years and during my sister's absence she has kept a home together for my sister to return to. But my sister shows very little gratitude for this service, she is domineering and rude to both these old people, and makes life very hard for them.

2. With regard to occupation she carries on with her household duties and occupies herself with knitting and sewing, etc. She also does a fair amount of reading, generally light fiction.

3. Since her return home she has put on a lot of flesh, I should think that she must be two stones heavier than when she was discharged from hospital. I visited her in the second week in Feb., and I was surprised to see how stout she had grown. This is probably due to the fact that she is eating a lot of starchy foods such as bread and potatoes. She eats voraciously and her table manners are bad. She is more aggressive than she used to be, and takes offence very easily in most cases at remarks that are not intended to be offensive. She is also self-conversational, generally when she is by herself, though occasionally she does lapse into this style when in company. I think this is about all that I can tell you, as I have had few opportunities of studying my sister. I should say that she is quite able to look after herself, and in my opinion, there are plenty of people at liberty, who are much worse than she is.

26. M. O. W—, aged 28. Operation: 3.xii.44. Letter: 5.iii.46. Discharged: 31.iii.45.

History.—Admitted 23.i.41. Duration of illness: 6 years. No known cause.

Report before operation.—Emotionally unstable. She listened and spoke to imaginary voices. She misconstrued actions and conversation of others as referring unpleasantly to herself.

DEAR SIR,—

In reply to your enquiry regarding your late patient, M. O. W— (my daughter).

I am happy and most grateful to say she is 100% normal in every way. Since her discharge she has adapted herself to her everyday life with all her old self-assurance and ability, doing everything and going everywhere on her own and using her own discretion with very gratifying results.

After three weeks at home she went to Labour Exchange with her first interview started work as a Hand Packer at a large Tobacco Firm. She does alternate shift work, fortnight days and fortnight nights. Her pay envelope always contains efficiency pay.

I must add that she is punctual, trustworthy and confident in her undertakings.

It might interest you to know that she had her hair permed in October and everything went off satisfactorily. She never complains of headaches.

27. M. J. P—, aged 49. Operation: 14.i.45. Letter: 27.ii.46. Discharged: 12.iv.45.

History.—Admitted 13.ix.44. Duration of illness: 4 years, following shock of a friend's accident.

Report before operation.—Extremely restless, agitated and depressed. Had ideas that she was "dirty" because she had been interfered with. Unable to concentrate on anything. Continually repeating incidents of her past life.

DEAR SIR,—

My sister M. J. P— is very well. She has improved all the time since she came home last April. At first she had spasms of temper and would not be controlled, usually through someone passing some remark that vexed her, however we let her have it out, then she was all right again. It is only very rare she is like that now.

She responds to encouragement.

She is not going out to business, but does nearly all the home duties and shopping, which we think is very good. Providing you do not interfere and let her have her own way she does things very well indeed, but she will not be dictated to (those are her words). She goes out quite a lot and is a good walker, which is wonderful for when she came to you, she would scarcely move her feet at all, of course that was during her illness, she walked all right before.

Her personality is very much like it was before she was ill. She always had a temper and if anyone upset her they knew about it, but she never sulked afterwards. I would say she is very much like herself, but much better in health, she has gained 2 stone and never complains of any pain, in fact she says she is 100% well. Friends are amazed to see how well she is, and to us it is a miracle. I would like to add our doctor is very interested and keeps asking her to call and see him, so that he can see if she retains the progress which he says is marvellous.

We cannot express our gratitude enough for what you have done for us and others.

DEAR SIR,—I think it is just about six months since I left the hospital and I feel that I would like to tell you how I am.

I am very well indeed, I think one hundred per cent. fit. I can do my work with pleasure and lead a normal, happy life like I did before. I have waited this length of time before telling you, to see whether I still maintained it, and I am glad to say that I am quite well and putting on weight.

I would like to thank you and the surgeon and all the members of your staff who helped me to regain my health. My hair has grown quite nicely.

I enjoyed a nice holiday in the summer and I can go to all the nice places as I used to do. I may come along soon to see some of the girls that I liked.

28. D. P.—, aged 52. Operation: 23.vii.44. Letter: 8.iii.46. Discharged: 30.ix.44.

History.—Admitted 21.i.42. Duration: 2 years 6 months, after death of employer, which caused her great grief.

Report before operation.—Very miserable and depressed. Believed herself wicked and unworthy. Very solitary and retarded.

DEAR SIR,—

I am pleased to tell you that my sister is much improved in every way since her discharge. She is quite happy, and more like her old self, a big trouble with her is her lack of confidence, but she has always been given a little that way.

She is not following any occupation, but is always very busy about the house, she washes dishes, makes the beds, sweeps and dusts, and irons clothes, but she cannot do any kneeling because of rheumatism, which is very bad indeed.

She does not do any cooking, or take on anything with any responsibility and worries over little things.

As regards her personality I should say she was very much the same as she has always been. One thing I have noticed, she does not always grasp things, she seems just a little dull sometimes, but as I have said before, she is very much better in every way.

29. M. W.—, aged 37. Operation: 22.viii.45. Letter: 5.vii.46. Discharged: 15.ii.46.

History.—Admitted 16.vi.41. Duration of illness: 4 years 3 months. Onset said to have followed being kissed by a strange man. She had worries in connection with her cleft palate, and also about her sister's death.

Report before operation.—She was mildly depressed, sullen, suspicious and retarded. Irritable and quarrelsome, and aggressive. Ideas that people persecute her in some way, causing her to lose her arms and legs. She is hallucinated.

DEAR SIR,—

1. On her arrival home she was rather highly strung at times and talked to herself, when alone; but in a month or so this got less but has not altogether stopped. Her health has been good. She retires at 7 p.m., sleeps well, getting up at 8 a.m.

Her appetite is excellent, eating I think rather faster than she should. You will be surprised to know she now weighs 11 stone 4 pounds. I get her out as much as possible and she goes herself and does the shopping, and with me to the pictures. Unfortunately I cannot persuade her to call and see her doctor in reference to her insurance certificate, and as she was slightly behind with her employment stamps she has been penalized because she has been ill and is now disqualified for sick benefit if necessary at any time.

2. On account of having a cleft palate her talking is bad to understand and she is therefore unable to take up any employment at present but she is doing most of the housework in a satisfactory manner, she is also interested in the garden and does it willingly.

3. At present she is quite normal in her ideas and appears to be quite happy and content, always speaking very highly of the treatment she received under your care. I think this is all that I can tell you at present, hoping this will meet your requirements.

I should like to thank :

Dr. A. R. Grant, Medical Superintendent, County Mental Hospital, Whittingham, for his advice and encouragement at a time when the justification for prefrontal leucotomy was by no means certain.

Mr. McKerrow, Hon. Consulting Surgeon to Preston Royal Infirmary, who performed the operations.

Dr. A. J. Gray, Anaesthetist, Preston Royal Infirmary, whose excellent technique contributed, I am sure, to the low mortality.

Dr. E. R. A. Cooper, Lecturer in Histology, Manchester University, for her histological report.

LAUGHTER IN EPILEPSY, WITH SOME GENERAL INTRODUCTORY NOTES.

By JIŘÍ ROUBÍČEK, M.D.,

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LAUGHTER, known to mankind as a physiological response to happy and comical events in general, is one of the most inviting guides through human life, but sometimes it may point to various morbid states of mind.

Physiological laughter has been studied by numerous psychologists and philosophers, the pathological part of the subject and compulsive laughter by many physicians, both clinicians and anatomists. Reading through the accessible part of the extensive literature on laughter one realizes that much has not yet been quite elucidated. In recent years we have had an opportunity of following a few most interesting cases of pathological laughter. This essay has been devoted to a review of the psychological, clinical and anatomical studies, and to an analysis of our five cases and their relation to epilepsy.

I. PHYSIOLOGICAL LAUGHTER.

The anatomico-physiological act of laughter consists of a deep intake of air, followed by short, violent expirations by means of which the air current is expressed through the stretched-out vocal cords. Variation, intensity and timbre of the sound are produced by the vibration of the vocal cords in the larynx and of the soft palate. To this succeeds the familiar expressive movements of the facial muscles, consisting in a synergic contraction with the characteristic facial expression of extended cheeks, contraction of the mouth-corners backwards and upwards, narrowing of the eye-slits and deepening of the nasolabial wrinkle. The extent of laughter ranges from a scarcely perceptible and inaudible smile to roaring laughter, when—apart from the muscles of expression—those of the trunk and limbs will also participate. Sometimes, when laughter is being prolonged or is too violent, even tears may appear. The quality and form of laughter are rather individual. Somebody will laugh more with his eyes. His sight will appear to brighten, the skin around his eyes being creased to minute wrinkles and the mouth corners raised up; another person will laugh chiefly with his mouth, cheeks and head; and finally there will be people whose laughter is conspicuous by a rapid rhythmic movement of shoulders—they virtually laugh with their shoulders, trunk and abdomen.

Laughter is an expressive manifestation, specially human. Rabelais says: "Le rire est le propre de l'homme." To Balzac also laughter is only man-

kind's privilege. Darwin describes laughter in monkeys produced by tickling, by their mutual tender affections and sudden joy. R. Francé heard that playing monkeys laughed aloud like children. According to Selenka, younger and female monkeys utter a loud, high-pitched laughter, which terminates in a quieter tone. We could not, however, confirm these observations, watching them in captivity in zoological gardens and in the specimens kept at our hospital. Nor did we observe in other animals an expression equivalent to laughter. Animal expressions of joy and mirth are undoubtedly frequent, the most familiar of them being a dog's wagging of its tail, but if these be equivalent manifestations, they are still too remote from our conception of laughter.

In laughter we can, therefore, differentiate a mechanism of facial muscles, a respiratory and phonetic mechanism, and finally a generalized muscular mechanism occurring in violent laughter. Regarding the respiratory mechanism the opinion now prevails (Raulin's) that the staccato expiration is dependent on the relation to the internal intercostal muscles, which check the enlargement of the thorax, and that the part played by the diaphragm, which was previously attributed the principal part (Darwin, Brissaud), is but secondary.

Most frequently laughter is brought about in a psychic way by various pleasant sensations or imaginations, i.e. wit, ludicrous situations; mechanically, by tickling; or chemically, for instance, by laughing gas. It means that laughter originates from central and peripheral impulses. Laughter is easier set free after small quantities of alcohol, opium, kawa, maté, or hashish have been taken. With regard to the participation of facial and respiratory muscles and occasional compulsiveness to laughter, Zutt compares it—apart from crying—to such other phenomena as yawning, sneezing, coughing and hiccup. Among these yawning especially is important as an expressive function, and like laughter and crying, is sometimes accompanied by lachrymation. Zutt put up the following parallel: Laughter—joy—tickling; crying—sorrow—pain; yawning—boredom—fatigue.

Laughter is an intensified sensation and manifestation of vitality, an expression of psychical youthfulness and freshness. *Vice versa*, the lack of laughter points out to a sort of psychic rigor. Absence of laughter in melancholy and the peculiar laughter of the debilitated and the demented are well known. Laughter brings in a mental refreshment. Should the listeners in the course of a serious lecture be given an opportunity to have a good laugh their attention will again be raised. Laughter can be set free in connection with various affections. In itself it is a manifestation of a preponderatingly affective nature, which does not originate in a mere sensation of contrast, but only on the basis of emotion, which is called out by this sensation. Laughter—be it expressing a good humour or resulting from a descendant contrast (which will be explained subsequently)—is felt as a pleasant agitation. Quite exceptionally the contents of laughter may consist in bitterness and pain. According to the way of expression and causes we differentiate laughter emanating from joy, happiness, naïveté; a good-natured, cordial, coquettish, sarcastic laughter; then laughter produced by embarrassment, knowledge of preponderance or derisive and desperate laughter. We know and can discern a forced, insincere

laughter. Laughter reflects not only the actual state of mind and the momentary posture towards the environment, but the whole character of the person concerned permeates it. People taking a positive attitude towards life not only laugh oftener, but their laughter sounds quite different from a bitter derision, a mocking outburst or the cold laughter of a pessimist. A certain relation seems to exist between laughter and the somatic constitution. The average pyknic will produce a different kind of laughter from (or to) a person of a leptosome type. Again, the difference consists not only in the quantity, but in the quality of the laughter as well. Laughter necessarily serves to balance the earnestness of everyday life and to mitigate various checks. Delight in art or wit is a delight in freedom of the spirit.*

History and literature teach us that even in times of oppression bantering from clever heads went on followed by laughter of those who understood. Laughter is one of the most beautiful capacities, by which man differs from the animal and through which he approaches the Divine. It is one evidence of the freedom of the spirit over the body.

Psychological explanation of laughter.—The problem of laughter is often confused with the problem of the comical. But it is obvious that psychological motives in laughter are frequent and not exhausted only by the comical. One can laugh without any sensation of ludicrousness, out of joy, euphoria, after agreeable tidings, or after good eating and drinking (laughter of the Homeric gods). Physiologically it is the same process, but psychologically there is a confluence of two very distinct sources. One laughs in reaction to a change from unpleasant surroundings into agreeable ones (in contrast after hours of tiresome uninteresting work or a sad experience), when looking at something lovely; unexpected meetings of dear friends are expressed with a smile. Children and savages laugh when presented with a new toy or a knick-knack. Acquired experience, however, makes people lose more and more of that reactive link for the perception of hilarity; they immediately and too critically take into consideration the opposite side of all actions. The more the cortex is developed and differentiated, the more extensive are these checking arrangements; the more numerous is their experience and knowledge, the rarer and more restricted is the laughter. Refreshing laughter is getting scarcer and scarcer. No wonder that children and primitives can laugh easiest.

Laughter out of the sensation of something comical, and the problem of what the comical really is, has attracted the attention of numerous philosophers and psychologists from Plato to Bergson. To Plato the comical is a painless ugliness. Hobbes developed Aristotle's notion of degradation. Laughter was attributed to a sudden feeling of triumph emanating from a state of superiority as compared with the inferiority of others or our own in time gone by. Bain

* Laughter is a form-casting and creative activity, which selects its subject according to plan from actions and men precisely as an artist in an elevated sphere of action would do. Laughter not only does not take notice of imitations, but it puts up parallels, is constructive, is a manifestation of imaginative powers. It is not beautiful just because it discovers vital automatisms, but because it creatively builds up artificial comparisons. The great art of laughing has a curative, regenerative, liberating power. Thanks to its bellicose arch-origin (see below) it is always a sort of weapon against convention in the name of imagination, which dramatizes the working-day and which in the name of social health sends it on its mission. Tartuffe and Goethe's priggish Wagner are examples of both curative and stormy hilarity (Frejka).

adds to this that the cause of ludicrousness lies not only in the degradation of the persons in question, but also of objects. This explanation, certainly fitting in many cases, because we do sometimes want to express by laughter, "We should not be capable of such a mistake or clumsiness," lags at other times behind. We do often laugh without a feeling of superiority and degradation of our surroundings, in a good humour, at a joke and so on. To Kant the comical is a suspension of expectation, and laughter is explained by him as a sudden relaxation of a strained expectation into thought. According to Sully it is just the expectation which dispels the waiting, the unforeseen in the behaviour, speech, deeds, which is the source of laughter. On the other hand, of course, we know that not everything unforeseen can call forth laughter. According to Schopenhauer the origin of laughter is to be looked for in a sudden discovery of a discrepancy between the conception and the actual fact. The greater the divergency, the more violent the laughter. As a matter of fact by laughter we oppose reality. Dumont believes that contrast and divergency are not sufficient to explain this, and that a logical contradiction between two contemporary notions is essential. Mélinand sees the origin of laughter in the oddness and absurdity of facts that suddenly turn commonplace or even vulgar. Decisive, however, is the sudden transition from the valuation of something being absurd to the fact that the matter is quite natural. Spencer supports the theory of contrast as well. He discerns, however, two kinds of contrast: from less to more, and *vice versa* from more to less. The contrast that brings about the laughter is only that from more to less. To make this theory generally valid it would in any case be necessary to ascertain the amount of the accumulated energy which then is discharged in the descending contrast. Lipps in accordance with the previous author holds that a comical effect arrives when one expects something great and by way of contrast there happens something insignificant. Then the redundantly accumulated psychic energy under accentuation of a tendency for the discharge of laughter is set free. Herbart says that laughter is "anaesthetic value" consisting in a disharmonious relation the degree of perplexity in which is subjectively relative in effect, once acting comically, at another time even tragically, there being a possibility of transition from the comical to the majestic. To Croce the comical is a psychological process of a purely organic or of a mental and organic origin, which puts the observer into such a position that when forecasting and expecting a certain phenomenon he suddenly discovers that his supposition has turned upside down, but the sense of unpleasantness and disappointment is immediately substituted by liberation, pleasure and their psychological equivalent laughter. Friend believes that in a joke there is a kind of permanent reserve, pleasantly accentuated, which is drawn upon in the laughter. Wit helps to overcome suppressed tendencies (for instance, by an obscene joke one takes the liberty of being rude). At the same time the internal discrepancies are being removed, whereby their internal psychical energy is saved. According to Bergson, laughter is forced upon man whenever there appears something stiff, mechanical, machine-like in the middle of a mindful, strained and expectant vital current. If man does not adapt himself to the situation but reacts like a machine, rigidly and mechanically, like an

automaton, a contrast will arise between him and the reality which will be perceived as comical. Bergson considers laughter to be a social process which acts in the social life like a corrective of automatism. Laughter is a penalty paid by those who betrayed life by their rigidity, laziness and machine-like ways. It is to bring them back to real life again. It is a remedy for paralysing man's tendency to automatism—a remedy which puts up conventionality on the pillory. Weltsch considers Lipp's and Freud's considerations as being too commercialized, holding that one cannot always talk about reserve "savings" which could be disbursed in laughter. He also objects to Bergson's view of explaining laughter, because a punitive social remedy does not seem to be satisfactory for the simple reason that laughter is not always a mockery, and a laughing person is not always equivalent to a mocking person, and cannot always be insensibly and objectively above the situation. He thinks that there are at least two lines of thought of a different category in respect of their contents and a link of surprise which happens to join them against all expectation, as an essential of the wit. Laughter brings forth an explosive disruption of this link. There is a disconnection of the chaotic linking up of the various currents of thought by an unexpected elucidation and comprehension of the connection and meaning—an acrobatic feat of the spirit. But even this elucidation, reminding us after all of Ebbinghaus' view, is obviously valid in some situations only. Dumas considers as most appropriate Spencer's conception. He holds that the latter's view of "the descendant contrast" approaches in substance the older theory of degradation, and stands in no essential conflict with Bergson's general theory when automatic reaction in place of an adequate and expected rational reaction is made equivalent to the effective contrast of "from more to less." In this way conceptions of laughter coming out of a sensation of something comical which can be taken for a phenomenon of a sudden alleviation could be brought nearer together, in the same way as the conception of laughter out of joy and exuberancy when it is understood to be a result of the decline from the previous exultation above the everyday's average, or from a suppression of anxiety. This results in loosening the tension and liberating the discharge after an intensified pleasant agitation. In such a laughter there is a certain gradation of human feeling of vitality. Although much ingenious theory has been written about laughter, still a uniform psychological explanation that would give an all-round satisfaction does not yet exist, even if it be admitted that Dumas's synopsis is remarkable.

The sociological side of laughter.—Generally speaking it is a well known fact that for an individual, collective emotions are always much more intensive than those which are quite private and personal. Let us recall the reactions stirred up in crowds by suggestive orators, in spectators at sporting matches and the like. So laughter in society is also a connecting linking element which in virtue of its contagious operation brings the individuals close together. Laughter amongst a theatrical audience belongs to the same category. It does not consist only in the concerted action of the comedian and the public, but also in that of the spectators in the auditorium among themselves. Bergson felt that laughter stood in need of an echo. Through his laughter the individual hastens to express his assent to the merriment of his environment, shows that

he is just a jolly good fellow like the others and of the same, fine, sensitive spirit. In a way laughter is evidence that the individual is capable of social life. Those who spread an atmosphere of mirth and laughter around are welcome to us and sought after by society. When alone we laugh, as a rule, neither so often nor so intensively as when we are in company. A person laughing during a conversation is not likely to incur displeasure and adverse interest, but if an isolated person begins to laugh louder, say over a book in a park, during a ride in tram or train, then he attracts the attention of the whole neighbourhood; and there will be people watching him with a questioning eye and even shocked. Those who burst out laughing at a recollection become the target of incredulous looks and may even be suspected of insanity. Crying pertains to solitude; laughter, however, is an emotion tending to society. Almost every branch of human activity exhibits its own, separate, singular kind of ludicrousness and jokes of a special character. Let us only think of the jokes of the medical men on the medical profession, of political jokes and anecdotes or jokes current in the theatrical world, etc. The diversity in laughter and jokes, however, is characteristic not only in individual professional groups, but often also in national units, showing a characteristic posture in this respect. We can easily discover the difference in French wit. Special features are betrayed, for instance, by Scotch or Irish jokes, by the humour of the Oriental people or in Jewish jest. There are, however, nations incapable of hearty laughter.

Laughter and human age.—Laughter accompanies man throughout his life, but there are periods when it appears more frequently and can be released more easily. In childhood and in youth good humour is chronic and laughter frequent. That is one reason why people revive in the presence of young folks. During puberty, especially where girls are concerned, laughter is always near at hand. That is one of the traits peculiar to this age. Such laughter bursts out from quite insignificant causes, sometimes without any apparent cause whatsoever and may even occur paradoxically. A connection with the incretorial changes in the organism seems to be unquestionable, so much so that the second period when laughter is more frequently occasioned is incipient old age. A strict differentiation, however, is essential as to what is due to psychological action—an old man's benevolent smile, emanating mostly from an experienced, ripe outlook on the surrounding strife, which in old age often appears to be trifling—and what, on the other hand, must be attributed to the sphere of pathological action, such as the compulsive laughter due to atherosclerosis of the brain vessels. During the discussion following my lecture on laughter at the Society of Czech Physicians in Prague in 1942 a controversy arose as to whether laughter is a mental manifestation phylogenetically recent or ancient. The point is difficult to decide. Autogenesis is an abbreviated phylogenesis. We can see that on the faces of few weeks' old babies a radiant smile can be called forth. Of course, in such a case a child's great imitative power must also be taken into consideration. The infant, as a rule, sees more smiling than frowning faces around. Laughter, in my opinion, is phylogenetically rather ancient; it is one of the earliest human emotions and it appears soon after fear and awe. Man on the earth feared earlier than he

laughed. There were so many things for him, so many natural phenomena which he did not understand and which he worshipped out of fear.

Fear is a matter of loneliness ; laughter, on the other hand, issues from society. The fact that somebody belongs to a certain group or caste is capable of initiating laughter ; derision of a man coming from another place, behaving in a different manner (Frejka). It might have been necessary for man to belong to a more advanced settlement, to enable him to laugh for the first time at his foe, beaten or killed, the foe from the backward village where such clumsy flint spearheads would still be made. Let us think of the first laughter at fashion and the fashionable man ! Just as to-day the newcomer from the great town would be laughed at in a society of the small town, dwellers of the town would laugh at the country man and the country-man again at the town-inhabitant treading clumsily across the country-side. Everyone of us bears in his mind a notion that he belongs to a clan, which fact makes us laugh at others and other things out of this clan self-consciousness, although they are no worse than ourselves, but simply come from somewhere else, are country-like, barbaric as the ancient Greeks would have it, not excluding even such an advanced culture as the Persian. The ludicrous; the barbaric would simply come from outside of one's own country, from outside the familiar—from outside one's own world.

Laughter and sexuality.—In the same easy way as bringing about laughter that originates in joy and euphoria, on receipt of pleasant things, after good eating and drinking in an engaging society, so the state of sexual emotion—which in itself brings in an intensified sensation of vitality—is followed by a pleasant state of mind, and apart from the internal joy there is also a more facile release of laughter. People longing and loving are always, as it were, in exalted spirits, happy and gay, and laugh oftener than usual. The misogynynes affirm that love and longing stupefy and impair higher psychological functions. Formulating this point of view in another way, we can say that sexual manifestations are, up to a point, a discharge from evolutionally more ancient centres placed in the mid-brain and interbrain into the functions of the cerebral cortex. In the same way, for instance, as by the consumption of a sufficient amount of alcohol, so by the sexual emotion a partial suspension of the inhibitory cortical functions can be effected in conjunction with the release of the centres which are placed in the extracortical basal grey matter, where also is placed the mimic centre of laughter.

There is no doubt that physiological laughter is often subservient to sexuality. Young people, especially girls when courting, laugh excessively for slight reasons, and for no reasons as well, the laughter coming out in quite unusual and unexpected tones, as if in affectation. In some women's laughter there is a downright gush of sexuality. This is characteristic not only of the "spoiled" inhabitants of towns ; in the country, laughter of the adolescent young people courting at night resounds far and wide. There is no wonder, either, that poets keenly perceived this close relationship between sexuality and laughter (as could be adduced from any nation's literature). Special attention has been paid by the psycho-analytical school to the relation of laughter to sexuality. The views expressed there vary. It is believed that

there exists a relationship between laughter and masturbation (Raitzin). Others consider compulsive laughter to be a symptom of defence against vanity, narcissism; according to Ferenczi there are cases of pathological laughter equivalent to erection. Bechterew described, in 1900, two patients who affirmed that their fits of compulsive laughter were due to masturbation. There are not infrequent references in writings and talk to the sensual smile of Gioconda, a smile suggesting and partly betraying the secret of perfect womanhood, longing and wise at the same time. H. Van Loon is of the opinion that this, so many times glorified expression, originated in Leonardo's mere artistic incapacity, as can be observed in numerous ancient statues. It is suggested that there should not have really been a smile, but that this was occasioned by the lack of technical skill of the sculptors in such places where we might expect an expression of profound grief. It is, however, difficult to agree to Van Loon's opinion concerning the sculptors, and especially a painter possessed of such anatomical and physiological knowledge as was Leonardo da Vinci. That smile of Mona Lisa bears a considerable resemblance to Leonardo's St. Anna, but not to that of other women that he had painted. Ebbinghaus holds that this archaic erotic smile represents a grimace displayed in erotics as a releasing laughter in the sexual act.

It is not altogether without interest that in the Bible the first allusion to laughter bears a close relation to sexuality. Sarah laughs at the prophecy of getting pregnant (Genesis, 18, xi).

The intimate connection between sexuality and morbid laughter is supported by an interesting case published by Wilder. The man concerned was a 44-years-old journalist who, since his childhood, was subject to baseless attacks of laughter, during which in later years he experienced a sensation similar to that in coitus; this, after the attack, was sometimes accompanied by orgasm, followed in turn by low spirits. For many years there was in the patient no derangement of the sensorium or amnesia. The journalist cleverly hid his fits by quickly improvised jokes, when in company. The attacks, however, gradually gained in intensity, were more frequent and used to occur in his sleep. At times the normal adequate laughter passed into an inadequate, intensified seizure. This, in later years, was coupled with headaches; there was a twinkle in his eyes and a curious sensation of smell of something burnt, and a tremor during which the patient bit his tongue more than once. In addition to this there were amnesic disturbances. In the end these seizures of laughter were followed by severe attacks of unconsciousness accompanied by fall, injury and complete amnesia. Sometimes this compulsive laughter passed over—without an apparent cause—into compulsive crying. On bromine and luminal being taken the attacks of laughter were markedly reduced and the major epileptic fits disappeared. For years the patient took a passionate interest in aviation. He also wrote numerous popular articles on flying. During the flight in an airplane which he often indulged in, he sometimes felt happiness as during coitus or in his fits of laughter. All that concerned flying rather excited him and at times even caused a fit of laughter. This sometimes was provoked by mere flying of a bee. When he got a fit of laughter whilst in bed then, instead of erection, there came a sensation of flying. That, how-

ever, never occurred while he was sitting or walking. I shall come back to analyse this case once more in the chapter on epileptic laughter; here I only wished to indicate how sexual experience blended with uncontrollable attacks of laughter, which in former years showed nothing suspicious of an epileptic basis. There is an easy comparison with the so-called "flying dreams" and levitations, which for a psychologist are a symbol of coition.

Taking into consideration the points of contact which laughter and sex have in common we can see that there is a certain "discharge" of the accumulated energy. If both these actions were illustrated graphically we should probably get a moderately rising curve which, on reaching the apex, would abruptly decline—just a picture of heaping up and discharge of the accumulated energy. Ferenczi reminds us of the comparison to the psychosomatic mechanism of the erection. Similar accumulations of energy and its discharge can be seen—apart from laughter—also in anger and rage. In all probability crying exhibits a similar curve with acme of growth and precipitous decline as well. Noteworthy is Raulin's suggestion; he draws attention to the psychological point of view and to some sort of warnings—sensory, vasomotor or motor "auras," which sometimes precede laughter. Furthermore, he recalls the exhaustion and fatigue following a severe dyspnoeic laughter, and so comes to compare the seizures of laughter to epileptic fits. Really, on casual comparison there is an initial coincidence, a warning of an impending paroxysmal mechanism, then a violently passing paroxysm itself sets in when in either case vehement contraction of muscles can be observed, and finally its termination—a similar termination in either of these mechanisms, viz. exhaustion.

Intruding character of laughter.—Normal laughter possesses some sort of autonomy, and apart from it a certain intrusiveness and persistency. One often bursts out laughing against one's own will, being conquered by it. Having started to laugh, then, contrary to one's will, one cannot quite stop it. There is, therefore, a mechanism which offers itself, intrudes, and when put in motion by an adequate stimulus it disperses and exhibits its own autonomy, which is not under the full control of our will. We may laugh so much as to be obliged to sit down, to lose our self-control. In such a case the decline of tonus is apparent and the collapse near. Now catalepsy, so frequently preceding narcolepsy, can be expected to set in. Similar states when after an adequately substantiated but persistent physiological laughter there was a breakdown were described by Oppenheim as "*Lachschlag*" (laughing fit). Hyperventilation may be participating here, to the study of which—a study of provocative method for bringing about epileptic fits—numerous pieces of research have been devoted. The participation of hyperventilation must not, however, be overestimated, as we know that even grievous emotion accompanied by crying may result in cataleptic phenomena. Of course, even in such cases we may observe, sometimes at least, prolonged sobbing which, in itself up to a point, is hyperventilation. In folklore also we can observe the relation of laughter to unconsciousness. Tickling that leads to the loss of consciousness and even tickling to death is discussed.

The transition to an expressly pathological region is often not clearly marked,

being gradual and sometimes hardly noticeable. Firstly, the intrusiveness and inducement to laughter may be more marked, but still the impetus appears to be adequate. The laughter, however, is exaggerated, more frequent and lasting, and less controllable by will. Anyhow it still remains a roughly normal phenomenon, and the transition to the pathological laughter is rather quantitative than qualitative. As a rule, this laughter still makes other people laugh. Secondly, the part played by the stimulus becomes diminished and the laughter is spoken of as inadequate. The compelling force increases to such an extent that the laughter irresistibly occurs in very awkward situations. Such laughter is incomprehensible for the entourage. The laughing person gets suspected and becomes the subject of attention from all his neighbours. At times the laughter may even break out under such circumstances that in a given situation or in respect of the general condition of the person in question it may produce a shocking effect. Laughter in this form completely loses its capacity as a common link; it lacks contagiousness for the neighbourhood. The conception of adequateness is certainly vast, its boundaries are elastic, and the personal point of view as to whether it be adequate or improper is rather relative. Many people would, quite naturally, laugh at what will not induce other people to laughter, but the laughter which the company concurrently considers inadequate may later on provide sufficient explanation of the causes which were previously unknown. At times we are forced to laugh in the most serious circumstances, for instance, at school, church, etc. Finally, there have been known pathological fits of laughter, when consciousness was impaired and partial or complete amnesia occurred. Here occurs an overwhelming burst of laughter without a psychologically comprehensible stimulus. It does not make the others laugh; the facial movements go over into a rigid grimace, which in itself produces horror in the company. There are cases when it is possible to observe all degrees of transition from physiological into pathological laughter in one and the same person. So it was, for instance, in the aforementioned case, published by Wilder.

II. PATHOLOGICAL LAUGHTER.

Apart from the attacks of inadequate, paradoxical, compulsive laughter occurring against one's will which presents one of the pathological symptoms in graver psychoneurotic cases and in patients suffering from obsessional states, we meet also with a non-physiological laughter, associated with various physical and mental maladies. In the majority of cases this laughter lacks the usually attendant perceptive sensation of internal joy and will not, as a rule, be coupled to any of the known impulses to laughter; it will be unfounded. There will be a certain dissociation of the outer (respiratory and vocal) mimic manifestation and the internal experience. This, however, is not always the case. Some patients will begin to laugh *only* after an adequate stimulus, such as a ludicrous situation or a joke. Only then the mechanism of laughter will pass over into the pathological region both in regard to form and duration.

As to frequency, mention firstly ought to be made of the morbid laughter which occurs in the more advanced atherosclerosis of the brain vessels in the

"*status lacunaris*" and in post-apoplectic states. Similarly, in disseminated spinal sclerosis accompanied by psychic euphoria laughing is nothing extraordinary. Its effect is sometimes cruelly paradoxical in severe paraplegias generally associated with a poor state of health. Grigorescu states that he has found compulsive laughter in 33 per cent. among his patients suffering from disseminated sclerosis. In this percentage, however, he includes also the stereotyped grimace in some of the sclerotic patients. Curtius describes a woman suffering from disseminated sclerosis who on the death of her husband burst out into compulsive laughter lasting ten minutes, and also during the investigation of the case burst out repeatedly laughing. In the year 1939 a 45-year-old clerk was receiving treatment in our ward. He was suffering from an advanced disseminated sclerosis and also used to laugh in an unnatural manner. Besides crying, compulsive laughter is one of the familiar symptoms of *amyotrophic lateral sclerosis*. Bodechtel believes that crying and laughing in such a case are not really organic symptoms, but that they are caused by lack of power which the patient comes to realize in the course of the malady. He will couple a consoling word with new hopes, which are immediately manifested by the change of mind—by directly passing over from crying to laughing. However, we should prefer to seek the reason in organic causes. In these patients we can frequently observe—apart from affective disturbances—other psychical derangements as well. The compulsive laughter is often a symptom of pseudobulbar paralysis (in the syndrome of the internal capsule). Violent attacks of laughter are known to exist in post-encephalitic states. They belong to those symptoms of chronic epidemic encephalitis which formerly were considered hysterical. In these conditions, termed by Rothfeld geland orgasmolepsy, one can follow the relation of epidemic encephalitis to narcolepsy. A breakdown and collapse of narcoleptic patients can sometimes be introduced by a fit of convulsive laughing. This consists of a sudden loss of general tonus. A short time ago we witnessed a spasmodic fit of laughter in an 11-year-old boy, suffering from acute disseminated encephalomyelitis; there were occasional attacks of crying and a special kind of rounding lips. Attention was drawn by Salmon to the antagonism existing between the active loss of tonus in narcolepsy and catatonic states that are known in catatonic schizophrenia. The fits of laughter, however, represent also one of the affective schizophrenic disturbances. Through its character of spiritless mimic expression,* in which, as a rule, no trace of sentiment can be detected, it differs from the fits of spasmodic laughter in some of the hysteric states, where the laughter is attributed to affective and respiratory cramps. So fits of laughter are regularly attendant upon mania, this being closely connected with the whole psychic condition of the patient. Disproportional laughter is frequent in some forms of general paralysis, perhaps as one of the manifestations of general mimic ataxy. Silly joking and uncritical laughter—so called *moria*—is known to exist in some of the organic brain lesions, such as in new growths, cranial trauma and so on. This symptom is considered important in localization in

* As quoted above, Raitzin comes to the conclusion on the strength of his profound studies that not even in schizophrenic laughter is there a casual, mechanical, psychologically empty expression of the spirit, holding that there is a close relationship between laughter and masturbation in such cases. This view seems to be acceptable only in some cases.

cases of injury to the frontal lobes. An early and considerable moria is really one of the fairly reliable symptoms of frontal localization. A merely indicated or late moria is, however, of little topical value. Fits of laughter after more serious alcoholic intoxications are a commonplace symptom. In delirium tremens attacks of portentous terrifying laughter may sometimes occur. Horror and anxiety of the patient diffuse and mingle with a euphoric state of mind. Compulsive laughter was also described by Embden as a symptom of manganism. Zutt draws attention to it as to a rare symptom of migraine. Anton observed it in a defect of the cerebellum, Infeld in pachymeningitis haemorrhagica, Oppenheim in tumours of the thalamic region.

It will be noted that the disturbance may come from the psychical region, as for instance in mania, atherosclerosis of the brain-vessels, paralytic dementia, etc. In the so-called "risus sardonicus" there is really no laughter at all, but only a spasmodic facial contraction in the region of the n. facialis as is frequently the case in tetanus.

Centres of laughter.—There exists a vast literature on the centres of laughter based especially on anatomical and pathological investigation of cases of morbid compulsive laughter. At least Bell's, Romberger's, Nothnagel's, Brissand's works ought to be mentioned here. In compulsive laughter most frequently a disorder in the thalamus has been ascertained, where most research workers place the chief mimic centres. Far less frequently an injury to the pons has been discovered. According to Sternberg mimic centres exist, apart from the pons, also in the medulla oblongata. Head believes the nucleus anterior and n. internus thalami to be the chief mimic centres. Monrad-Krohn holds that the thalamus contains the motor centre of laughter in the sensory, lens-like core.

Bechterew is of the opinion that compulsive laughter is derived from the disconnection of a link between the thalamus and the cortex. Constantini has found that in 65 per cent. of the cases of compulsive laughing the nucleus lentiformis was affected, in 20 per cent. the anterior armlet of the internal capsule, but without exception there was a lesion of the nucleus lentiformis as well. From the investigations of Mingazzini's school, which devoted much attention to the question of morbid laughter, we gather that most frequently the lenticular nucleus, especially the putamen or internal capsule, or both, have been affected. Rarely an injury to the thalamus, cortex or pons has been ascertained. Mingazzini considers the thalamus to be the most important centre of mimic activity, and believes that important routes run through the nucleus lentiformis. Apart from the peripheral auditory and visual impulses, the thalamus is being regulated through the cortex by way of the cortico-thalamic routes which pass in the anterior part of the internal capsule. The centre is connected by the thalamo-bulbar route with the bulbar core of the nucleus facialis. Whenever the restrictive links between cortex and thalamus have been severed, voluntary laughter and laughing on request are made impossible. On the contrary, there occurs, against the patient's will and without an adequate stimulus, an inadequate compulsive laughter. According to Mingazzini it is a psycho-reflex to a pathologically provoked automatism of the mimic centres as a result of their release from the inhibitive cortical influences.

Senise, who devoted a monograph to laughter written from the anatomical point of view, differentiates a fronto-thalamo-pontine route for the automatic involuntary laughter and a direct cortical-pontine route for the voluntary laughter. According to him the former runs from the frontal cortical area (F₁) through the anterior flexure of the internal capsule via the thalamus to the core of the facialis nucleus and then into the pons.

Laughter and epilepsy.—The relation of morbid attacks of laughter to epilepsy will now be examined more closely. Before Brissand first drew attention to it there were only isolated reports on epileptic laughter. Wilson described two patients in whom laughter sometimes represented aura, preceding a major epileptic attack. The aforementioned Wilder's patient belongs to the same category. His fits of laughter, of an obsessional character at first, changed in course of years so much that the laughter was often a prelude to a major epileptic fit. In this patient's family one brother was treated for severe epilepsy in an asylum. His second brother had been, since childhood, in the habit of laughing without any motive. In addition, this brother's son was suffering from a similar compulsive laughter. Here one may talk about an epileptic disposition of the brain, affecting the whole family, coupled with additional local inferiority of some definite brain section which played a decisive part in originating the attacks and their form. At first there was a sort of compulsive paramimia in the shape of laughter contrary to the patient's will under inadequate psychical stimuli; in the end the laughter became an aura of the familiar epileptic phenomena. In 1937 Rogal described attacks of laughter lasting about half a minute in a 14-year-old boy who had suffered from them since his second year. These attacks were always accompanied by severe impairment of consciousness and were followed by amnesia. In addition one typical epileptic fit had occurred. These attacks gained in intensity on sympatol being given. Wilder and Rogal hold concurrently that their patients were suffering from genuine epilepsy and consider the fits of laughter as epileptic equivalents. Wilder's case is, as remarked, evidence of an intimate connection between morbid laughter and sexuality. In 1942 Veraine described attacks of laughter in a young epileptic, originating from a trauma in the frontal region and considered them to be an epileptic equivalent. The mechanism of the inception is explained by him in the same way as that suggested by Senise, viz. the loosening of the subordinated centres after the disengagement of inhibitory influences.

In the years 1940 to 1942 we had an opportunity of observing five cases of pathological fits of laughter. Three of them were connected with epilepsy beyond any doubt; the other two were not quite so certain.

The first case was a chauffeur, aged 29, who was first received at the Neurologico-Psychiatric Department of the Bulovka Hospital on August 21, 1941. His father had been killed in the war; his mother had died in her 65th year of age of emphysema. Three of his brothers and sisters are healthy. There were no degenerative signs in the wider circle of his relatives. When six years old the patient had pneumonia. In 1933, during his work in the garage, he was forcibly hit on his head just above his left eye, but he did not become unconscious. In 1934 he contracted gonorrhoea. He did not indulge in alcohol and smoked only a little. In 1938, for the first time, he had an attack of unconsciousness, which he believed had lasted several minutes. He was unaware of there being any cramps as well. He did not

wet or hurt himself in any way, but bit his tongue. A year after he had the second similar attack, and at the same time there appeared other fits, which the patient described as follows: Suddenly I felt as if everything in my head got dulled, thinking and all mental activity ceased, my breath paused and I experienced a sort of humming. I began to laugh violently against my will. At the beginning I tried to suppress the laughter, setting my teeth together, but all in vain. In my fit of laughter I heard I was laughing. The laughter lasted from a quarter to three-quarters of a minute. It was a loud giggling and at times a sort of rolling laughter. In my laughter I never felt any hilarity and never quite lost consciousness. These fits kept on coming oftener, in the last period even several times a day.

On neurological examination no substantial derangement was discovered. The urine, the ophthalmic background, the blood-serum and the X-rays of the cranium yielded normal results. From the lumbar puncture a clear fluid issued under the pressure of 18/12 according to Claude's method. The fluid—apart from Pandy's positive reaction—was normal. The patient was a pyknic in habitus, weighing 78 kgm. and measuring 168 cm. On psychiatric examination a certain retardation of the cogitative processes was ascertained, the patient answering slowly, trying to formulate his answers with pedantic accuracy and pausing in conversation. Also during his stay in the hospital he behaved in a strange manner, was rather clumsy, slow in grasping other patients' jokes and irritable. He would stop the physicians in the corridor and again and again ask questions regarding his malady, and during the visiting hours he would always have some question to ask. At the hospital he at first had two to six attacks of laughter daily. We saw him laugh sitting or standing. When in a recumbent position he would first sit up and only then burst out laughing. When he had a laughing fit in his sleep he would not change his positions. The fits were initiated by sharply fixing the eyes on a spot, pausing if he happened to be walking. Then he would burst out into loud laughter, or chuckle in a rather sharp manner. His face would turn red. In his face there would not be a trace of warm infectious humour, his grimace appearing to the spectators insincere and strange, and at times there would be something almost terrifying in it. At the end of the attack the red colour of his face would turn light cyanotic. The patient would then utter a slight cough, breathe out several times, look unsteadily about him and begin to talk about his having involuntarily laughed again. When addressed or called after the attack, he would turn his head round, but would not answer. Being questioned after the fit as to what was going on in his neighbourhood during the fit, he would sometimes give a good description of everything; at other times his answers would be evasive, and one could see and prove that he was not quite so well informed. When addressed or disturbed during his fit he brought the half-a-minute's period of laughter to the conclusion without any interruption. We were never able to put a check on, or stop, the mechanism once it was set in motion. The patient did not react to treatment with 0.1 gm. luminal, behaved refractorily to psychoton, and only after injections of dormiral and on taking prominal was without a fit for several days. He had no major epileptic fit in the ward. The patient was discharged on September 21, 1941. He came back again in June, 1942. The immediate cause of his return to the hospital was a heavy fall from a 1 metre high stage in a fit a day before, when he broke his left wrist. He stated that he was being employed as an unskilled worker and that for about a month after his discharge from the hospital he had no fits of laughter, but then they reappeared and were coming several times a day, as a rule when he was moving or walking. He had wetted himself several times. There were no major attacks with fall, the last one excepting. He did not notice any changes and his appetite was good. Lately he was taking prominal, 0.2 gm. three times a day. When experimentally 0.05 gm. of ephedrin was added to the morning and afternoon dose of prominal the fits of laughter were enormously increased, the number having reached 50 one day and 30 the next. Then, having left off ephedrin and taking prominal with bromide and occasional injections of dormiral the fits became rare again. The patient left the hospital on July 30. When he was re-examined in 1942 and his case demonstrated to the meeting of the Association of Czech Physicians in November, 1942, he stated that his fits were not so violent. They would occur during his work two or three times a day; exceptionally there would be a break of a few days. It will be noticed on recapitulation that this 26-year-old pyknic was the subject of isolated epileptic fits, the basis being probably the so-called "genuine epilepsy." In view of the negative neuro-

logical evidence the injury of 1933 could hardly be attributed any substantial importance. A year after there appeared, independently of the epileptic fits, attacks of violent, compulsive and uncontrollable laughter. Even were there no major fits and psychic changes, the character of this patient's fits of laughter alone would suggest a diagnosis of *petits maux*. The fixed absent look, the striking and constant change of colour in the face, the impossibility of the patient's response in his fit and in the later period the micturition, indicate the epileptic character of the attacks. Lastly, the patient reacts positively to the anti-epileptic routine treatment. Thus, in this case we can take the diagnosis of epilepsy with fits of laughter as epileptic equivalents for granted.

The second case.—The epileptic fit was sometimes introduced by brief laughter and concerned an apprentice to a locksmith, aged 15. The patient came for treatment to the Neurologico-Psychiatric Department at the Bulovka Hospital in the months of November and December, 1942. His parents, brothers and sisters were healthy. His father's sister, however, was in an asylum with paranoid psychosis. Apart from measles the patient had never been ill. About a year before the above-mentioned date he developed fits, coming on two to three times during the day, sometimes also at night. He stated that his eyes would suddenly get blurred and he would not know what was happening to him. Those about him intimated that sometimes he would make a nasty grimace; at other times he would burst out laughing and then start muttering. He would answer no questions or only say something incomprehensible, inadequate. The fit would, as a rule, last not quite a minute. He would never get a convulsion or fall. Sometimes, however, he would wet himself in his fit. The attack would surprise him when he was walking, but he would not knock against anything. Often he would start running. There would be no other difficulties. He slept well, faeces and urine were normal, the appetite good. During the last year he lost weight (several kgm.). He had been attending an upper elementary school for three years and had showed good progress. He liked his trade. Recently, however, he noticed that he was getting vehement, wild and easily irritable, which he never used to be before. Objectively, he was a leptosome, weighing 60 kgm. and measuring 170 cm. Neurologically he was found quite normal and so was his urine; the fundi were normal and the result of X-ray examination and the W.R. in the serum and the fluid were negative. The result of the examination of the cerebrospinal fluid was negative. Encephalographical examination did not show any pathological changes. In the ward two fits a day were observed on the average and described thus: The patient got up from his bed and went to wash himself. He turned on the taps, and as soon as he put his hand into the water he burst out into a short, loud laughter. Then he turned away from the wash-basin, ran twice round the room and from there out into the corridor, hopping alternately on one and the other leg in the direction of the women's ward. When called, he did not respond. On reaching the women's ward he stopped, looked round bewildered, confused and asked how he came to be there, unable to understand how he could have got there. In his fit, which lasted about a minute, he turned red. The other fits followed a similar course, sometimes, however, without the introductory laughter, the patient only uttering a murmur or grumble. On getting 0.1 gm. of luminal three times a day the fits became very rare.

This was undoubtedly a case of the so-called genuine epilepsy with minor fits and already marked by psychological derangements. Some of this patient's *petits maux* were introduced by short loud outbursts of laughter. It was characteristic of the fits that the patient would start to run. The attacks were followed by amnesia.

The third case, a workman, aged 40, was examined at the Neurologico-Psychiatric Department of the Bulovka Hospital from February 22 to 25, 1943. He originated from a hereditarily affected family. His father was a drunkard; out of his seven brothers and sisters one threw himself under the train when 17 years old; the second one was suffering from paralysis of the limbs and constant headaches, since his 25th year; one sister was deaf. The other children and their descendants were healthy. The patient was divorced, his wife having left him on account of his infirmity and he had a 10-year-old daughter.

He recollected that in his childhood he had been hit on the head with a stone. At school he began to laugh strikingly often; not only in adequate, ridiculous situations, but quite improperly when other people would not laugh and would be wondering why he was laughing. This used to happen to him at school, at home, in the fields and woods. It sometimes occurred under queer circumstances; for

instance, he watched felling trees, and when a particularly beautiful piece of timber went down he started to laugh against his own will. At other times it was quite sufficient for someone familiar to him to pass by, walking or driving, and he would laugh irresistibly and ostentatiously, too. Having burst out laughing he would turn his face from the subject of the laughter, the laughter would soon cease and only a sensation of fatigue in his body, especially in the lower limbs, would remain. Later on, however, more and more often he happened to be unable to turn away his head by his own will-power, as if he had lost all control over his body and for a while would feel a strange undefinable levity in his limbs. He would feel like a bird, but when he was about to fly up he collapsed. As a rule he became unconscious for a little while only, had no convulsions, and shortly afterwards he would remain exceedingly pale. Sometimes he urinated and bit his tongue. These attacks of compulsive laughter, or laughter followed by fall and loss of consciousness, accompanied the patient since the school-years up to the time of his military service. The last attack was described by him thus: He moved in a waggon various things belonging to one of his acquaintances. Attached to the back of the waggon was a small cart loaded with casks. While making way for a motor car to pass, the little cart tipped over, the casks rolling in all directions and the car drove over them. Seeing this he got a violent fit of laughter, became unconscious and urinated. Since that time he had no such attack for 15 years. There were, however, periods of unconsciousness without any introductory laughter coming on every second month on the average. Besides, he often suffered from severe headaches, so severe that he would run away from his home because of them. A year before coming to the hospital he went for treatment to an asylum at a country town. It then occasionally happened that without any reason whatsoever he started crying. Tears would begin to run down his cheeks; he would sob, not knowing why. He would very much like to overcome this, but all in vain, crying went on. He admitted that he always used to be exceedingly sensitive, easily burst out crying when he met a funeral procession or when he saw somebody maltreating animals and the like. In the year 1936, during a seizure of unconsciousness he fell down from a height of several metres in a quarry. At another time he received grave injuries in a fit during a bicycle ride. Since the pains were felt most severe at rest, he was working whole days and nights. At the paper-mill, where he was employed at that time, he preferred to take night turns. There he would work for 12 hours and during the day he would work in a sand or stone quarry. He would sleep three to four hours a day. At night he would be subjected to wild dreams—flying above the woods, being chased, frequently seeing himself under horses' hoofs, riding at a break-neck speed in a car or boat. Often, when he woke up, he found blood in his mouth.

He made a good progress at school, never failing at examinations and getting average marks. He was bad at drawing but the best at mathematics in his class. He was possessed of a satisfactory general knowledge, was well informed as to place and time. When questioned he used to reply willingly and appropriately; often, however, he would enlarge upon the subject, his voice would sometimes tremble sorrowfully or he would start crying; at another time he would boastfully emphasize his enormous strength and earnings.

Somatically he was an athlete, weighing 82 kgm. and measuring 185 cm. He looked unusually young for his age—some 30 years. His skull showed an indication of *luricephaly*; on sounding the patient intimated that he felt a slight diffused pain. On the right edge near the apex of his tongue there were two short tough scars; one above the right supraorbital arch, one on the abdomen and one on the left thigh. Neurologically there was nothing pathological. Blood-pressure 140/80 mm. Hg. The result of the internal examination was normal. The patient had peculiar long upper limbs, superbly developed muscles of the trunk and limbs. His strength was enormous. His callous palms pointed to a hard manual work. His urine was normal, so were the fundi. W.R. in the serum was negative. X-ray examinations of the skull showed no pathological changes. In the ward the patient was rather uncommunicative and reticent but willing towards those round him. On getting 0.05 gm. of luminal in the morning and at noon, and 0.01 gm. at night, the attacks ceased, the patient slept well, the pains in his head became substantially less severe than they were at his home. He left the hospital at his own request, saying he longed for work. He refused to have his cerebrospinal fluid tested.

Thus we see that at first the patient was subject to fits of an adequate though exceptionally intensive and long-lasting laughter; then to seizures of inadequate

laughter lacking a proper stimulus. Further on, the fits became coupled with fall accompanied by loss of consciousness. Sometimes the patient bit his tongue and passed water. In the end these fits of laughter disappeared altogether and the patient was only getting fits of unconsciousness with fall, often at night. On his body there were numerous scars resulting from injuries sustained in the attacks and his tongue was bitten. Psychiatric investigation disclosed a certain striking discursiveness, affective instability and infantile boastfulness.

This is probably the so-called genuine epilepsy in an emphatically athletic habitus. At the beginning there were only attacks of morbid laughter; later on the laughter was followed by fall and loss of consciousness (analogy with Oppenheim's *Lachschlag*). Finally both the independent attacks of laughter and the laughter introducing epileptic fits disappeared and only epileptic paroxysms occurred at day and night. In this case the laughter was either an equivalent to epileptic seizures, or in the later stage an aura of major epileptic paroxysms. It will be noticed that, as in Wilder's case, the laughter, which at first was adequate only longer, and which in its course got out of the control of the will-power, later on was replaced by fits of laughter coarsely inadequate and in the end undoubtedly epileptic.

In the three patients that have just been described diagnosis of epilepsy could safely be made. In the following two cases our patients did not exhibit up to that time any emphatic, familiar, epileptic manifestations.

The fourth patient, a magistrate, aged 36, appeared for the first time at our Neurologico-Psychiatric Department on March 24, 1941. His father died in his 50th year of apoplexy; mother was healthy; one brother died in infancy, the cause of death not being known to him. The family was in no way tainted. The patient had suffered from scarlet fever, and in 1928 from cholecystitis. He was a teetotaler and non-smoker. His wife and a 3-year-old daughter were healthy. The patient intimated that for about a year he had observed that he would, either for no reason at all or in moderately comical situations, burst out laughing quite loudly and could not manage to suppress the laughter by his own will power, the laughter lasting against his will for about one minute. Since Christmas, 1940, this happened to him fairly frequently, in the last weeks almost daily. It would come on at about noon. In vain would he make up his mind beforehand that he would suppress the compulsion to laugh. In his laughter he used to think to himself: "Well, man, why are you laughing so stupidly!" He would be overcome by laughter even during the proceedings at court. His laughter would be provoked, for instance, by an employee of the local workhouse—a ridiculous figure, with deflected ears and a stupid expression in his face, who would often attend at the court. Only once—for a while at least—did he succeed in suppressing the compulsion to laugh. At that time he was in attendance at the Ministry in his official capacity. During the proceedings he suddenly felt that he would burst out laughing. He managed to bring the business to a conclusion and ran to the lavatory, where he had a hearty go at it. When subsequently he was telling his friend in a café about it he had a fit of laughter again. His laughter would then come on more frequently, *sine causa*, more inadequately than if caused by ludicrous situations. In general the patient was attacked by the fits quite unexpectedly; exceptionally, as for instance at the Ministry, he would have a feeling of being hot. It is not possible to ascertain whether this sensation did or did not originate in his endeavour to suppress the fit. Originally his laughter was more of a barking sort; then it appeared to him to be almost such as when he laughed in the normal way, only louder and louder. In his laughter he would sometimes manage to speak out or answer a question. Having passed through the fit of laughter he felt quite all right, was not tired or exhausted. After the attack there would be no amnesia.

Somatically he was a pyknic, weighing 110 kgm. and measuring 175 cm. Neurologically no pathological deviations were discovered. W.R. in the serum was negative, the urine normal; so was the ophthalmic fundus. Glycaemia registered only 180 mgm. per cent. The skull, after being X-rayed, showed a normal configuration, its bones were relatively strong, the structure undisturbed, the gyrification normal, the exostoses in no striking way developed, the cranial sutures were not separated. The sella was of a conspicuously small size. The dorsum sellae and processus clinoides were prominent. There was a light haziness in

the right frontal sinus (Dr. Polland). Otherwise, psychically, the patient was quite ordinary and intimated that he always used to be jolly and sociable. During the first day in the ward he was seized with a fit of laughter, laughing noisily for about a quarter of a minute, turning red in his face. Having been questioned as to what he was feeling during his laughter he said he thought that at home they had much better sausages—that day sausages with tomato purée were being served for dinner in the ward. At the hospital he had two more attacks, both in the afternoon—one while reading a novel by Dickens, the second when reading reviews in a newspaper. At first he was given 0.05 gm. luminal three times a day and before noon a tablet of psychoton. Later he received an injection of pervitine with scopolamine in three successive daily doses. Thereupon for several days no fits were observed. According to his communication, dated end of May, this medication proved successful at home; in April there were three attacks only, always in the afternoon, lasting 30 to 40 seconds. The prolonged taking of psychoton, however, brought forth headaches and at times he was not able to fall asleep for a long time. Following the advice of his physician he stopped taking the medicine for a fortnight and immediately he had four seizures of laughter, viz. much more frequently than when he was making use of psychoton, but no longer daily as used to be the case before. The headaches, however, persisted. The examination for glycaemia at that time showed a normal result (105 mgm. per cent.) and the course of the glycaemic curve was also normal. When psychoton was replaced by ephedrine and when in the afternoon amidopyrine with caffeine was added, the headaches diminished in intensity and became rare. In August and September there was only one attack each month. These were reported to have lasted only a few seconds. Later on he tried taking jastyl for a fortnight, but owing to increased headaches he returned to the previous medicine. Then there were no fits for two whole months. In February, 1942, he came for re-examination. There had been no fits, but his headaches increased again and the troubles with sleeping got worse. He was advised to take ephedrine in the morning, luminal with caffeine and amidopyrine at noon and eldoral at night. On further re-examination in March the patient intimated that after a 5-months pause he laughed once again vehemently and without an apparent cause, adding that he was working hard at the time and worried by various family troubles. In September we received a note from him saying that he had one fit in May and two more in August, invariably towards 8 p.m. in the heat of the kitchen. He was advised to take, in addition to the usual medicine, 1-2 tablets of ephedrine at 4 p.m. Since the time when he appeared at the hospital for the last time the patient had fits once or twice a month on average, mostly in the afternoons or evenings, without any apparent cause whatsoever. In February, 1943, following an attack of influenza there were several fits of laughter provoked by persistent coughing (hyperventilation?). One fit occurred after an excitement. On the whole, however, no immediate cause of these fits could be recognized. Apart from that the patient was still suffering from recurrent severe headaches. His sleep was relatively satisfactory.

Before summing up I wish to mention the fifth case, observed by Prof. Janota in a student of theology, aged 22, who came to consult him on October 4, 1940. He complained of suffering during the past year from an occasional irresistible laughter. The more serious the situation the easier the laughter broke out—as for instance during prayers, lectures and on similar occasions. His laughter would infect the others and there would be trouble. He struggled against it in vain. Sometimes he would laugh shortly, at other times even several minutes. He was being seized by it at varying intervals, several times a week or even a day, at other times after an interval of several weeks. He recollected having made a bet when about 12 years old with other boys of his age as to which of them would desist laughing longest. He won the bet and was proud of being the most serious of them. He was told that in his infancy, when about one or two years old, he used to get unconscious, suffering from convulsive seizures. In later periods of his life he enjoyed good health and had no fits of unconsciousness or cramps. There was nothing unusual in his dreams. Psychically there was, during the examination, nothing remarkable about him, and psychogenetically nothing substantial could be discovered. Somatically he was an asthenic youth, with slightly enlarged thyroid gland without any symptoms of its hyperfunction and with a slightly dropped left eyelid. He was prescribed hysteps three times a day, one tablet. Then he was lost sight of.

Easy as it was to ascertain the diagnosis in the first three patients, the decision as to the origin of the fits of laughter in the fourth and fifth cases was difficult. The fourth patient, the magistrate, never became unconscious, and we were never able to recognize any emphatic psychical changes. The fits of laughter could not be influenced by luminal; they yielded, however, to psychoton, and ephedrine, and they responded well to a combination of pervitine with scopolamine, that is to say, to remedies which bring the best curative results in narcoleptic phenomena.

The patient never had a breakdown, and he himself decidedly denied having ever felt exhausted after the attacks. These are certainly not narcoleptic states of an affective loss of tonus after the laughter.

The results of the neurological examination, like those of the accessory investigation, were without pathological deviation (the diminished sella of the skull shown by the X-rays excepted). Zutt described fits of laughter in migraine. Our patient's headaches, however, were not of the migraine type and, as a matter of fact, appeared only in conjunction with taking a substance of the β -phenyl-isopropylamine and ephedrine groups and were accompanied by sleeplessness. They are a familiar complication of this remedy. On the other hand, cases of epilepsy have been known where treatment by barbiturates failed completely, and it is most frequently in cases where *petits maux* prevail that luminal brings no relief, just as in cases of *pycknolepsy*. In 1939 Janota drew attention to the old experience that in some cases of epilepsy a combination of luminal with caffeine* was rather beneficial, and he recommended at that time to try ephedrine or psychoton in some persistent forms of *petit mal*. Since that time we have made good use of this idea in several cases. On the strength of the pharmaco-therapeutic experience it is not advisable to exclude the possibility of an epileptic origin of fits of laughter even in this patient. At the same time we are quite aware of the objection that could be raised that it is just the remedy which had increased the number of fits of laughter in the first case that appeared to work curatively in the fourth case. In considering this one could imagine that the outset of the epileptic mechanism might be disturbed once by damping (with barbiturates and bromine) and at another time in exceptional cases by excitation (with ephedrine and substances of the beta-phenyl-isopropylamine group). Important and decisive will, in all probability, be a certain deflection of the threshold of irritability upwards and downwards. The question of pathogenesis of the fits of laughter cannot be decided with any degree of certainty. Apart from epilepsy—let us remember that Wilder's patient did not exhibit any obvious epileptic symptoms for a long time—one could think of some relatively fairly stationary affections in the region of the diencephalon (tumour). Given the patient's improving state of health we did not recommend ventriculography. Nor was there any ground for considering epidemic encephalitis.

Finally, in the last case, that of the student of theology, we saw violent compulsive fits of laughter, originating paradoxically during prayers and

* Caffeine operates either that by enlarging the vessels it facilitates the penetration of a larger part of luminal into the brain, or, according to Vondráček, works as a pharmaco-dynamic catalyser, making more potent the effect of other drugs (which, of course, holds good for small, centigram doses only).

instruction. The attacks were not followed by amnesia and there were no psychical disturbances. Although convulsive seizures do not yet imply epilepsy, we have to recollect that in his infancy the patient was subject to fits coupled with unconsciousness; but epileptic ground can in no way be proved. It is a pity that he did not reappear for examination and was lost sight of, so that it was not possible to make a detailed clinical investigation of the case.

So much is certain that in the fourth and fifth case we should not by any means think of an epileptic ground were it not just for Wilder's case. There at first it would certainly be odd to think of an epileptic ground. The fits were very similar to those of our magistrate, but in the further course epilepsy emerged beyond any doubt.

In the two latter cases one could in the extreme think of a certain analogy with *tics*. These appear as synergic movements of several (seldom one) muscles. The movements are rapid, ungrounded and evenly repeated. These are states partly automatic, only occasionally influenceable by will, and imperfectly at that. The patient can overcome the compulsion for a short time, but never for long, and in the end he invariably succumbs. Tic differs from voluntary movements by its relatively limited scope, but especially by its violent characteristic course making an impression of a jerk, and finally by its quite ungrounded repetition of innervation of the same muscles or of groups of muscles. Besides tics that are mostly psychogenic, the existence of other tics, caused organically, especially in later postencephalic stages, is also admitted. Pilcz, describing fits of laughter in a 15-year-old student, speaks of a "*lach-tic*" (laughter tic). Previous to this, however, his patient went through a severe attack of influenza (encephalitis?). Pilcz further refers to a similar case in which *lues cerebri* had been ascertained on clinical examination.

We know that some otherwise healthy people are occasionally inclined to laugh in the most serious situations. The more they try to suppress the laughter the more violent the outburst will be in the end. Many of us have probably experienced something similar. Such compulsive laughter, just as other compulsive states and ideas, will mostly be based on indecent and blasphemous motives. The dynamics of affectation in these spheres, in general, will be more powerful.

There is a certain relation between tics and obsessional states.* In our

* An innkeeper, aged 48, was treated at the Neurologico-Psychiatric Department of the Bulovka-Hospital in Prague from May 10 to June 9, 1939. He was apprenticed to a bootmaker, but owing to his malady he left the trade. His father was said to have been a drunkard and an ill-tempered man, who cut himself with a saw in his face. The patient fled home at that time, chased by the idea that it was himself who had done it. Since that time he started to bite his lips and the inside of his mouth, and was impelled to scratch his face (always with his right hand). When he started to work at the shoemaker's shop with the cobbler's knife he was in constant temptation to cut his face, the hand holding the tool approaching as if attracted to his face in spite of his will, moving rhythmically before it in movements similar to cutting. His face was really hurt on several occasions (witnessed by scars). He was forced to leave the trade and to start work at an inn. At that time he used to scratch his right cheek with his nails or he bit the inside of his mouth. For that reason he had his teeth extracted. Finally the violent rhythmical movements of his right hand attained such an intensity, the hand approaching the face in movements similar to those of a tic, to which movements the patient was constantly and irresistibly impelled. To protect himself he put a boxing glove on his right hand and so he came to the hospital.

The patient was subject to many other compulsive manifestations. Already at school during the most profound silence in the hours of lessons something made him whistle. During the world-war he used to repeat compulsively in public, "The Emperor is a silly ass." I choose this case to show the close reciprocal permeation of tics and obsessional mechanisms.

patients Nos. 4 and 5 it was impossible to get at any substantial psychogenesis. No intrusive ideas of blasphemous or other such sort were present. Were it possible to discover some obsessional traits in them, even then it would not quite exclude an epileptic ground, because similar phenomena have been known in epileptic patients. Fits of laughter as epileptic phenomena are a rarity in the world medical literature. They are much less frequently mentioned than crying. In the larger monographs, such as those by Delasiauve, Bouché, Voisin, Vogt, Redlich, no mention of them has been made at all.

Binswanger holds that violent laughter can provoke an epileptic fit in predisposed people. One might add that violent, long-lasting laughter can in reality operate as hyperventilation. In 1924 Foerster recommended hyperventilation, deep breathing for several minutes, as a means to provoke epileptic fits for diagnostic purposes. Although this method proved a failure to many authors as a reliable means for provoking fits when applied to an extensive material (Janota, Toulouse, Marchand), it is certain that hyperpnoea can in exceptional cases provoke a fit. That has been confirmed by Binswanger's patients. The essence of hyperventilation probably consists in upsetting the acid-base equilibrium and in a movement towards the alkaline side. Of course the mechanism through which the laughter could provoke an epileptic fit does not, in our opinion, rest merely on hyperventilation; powerful vegetative irritation and an ascending wave can assert themselves when the tension of the accumulated energy will in certain cases be capable of sounding the wave of the epileptic mechanism.

In Czech literature, so far as I know, no mention has been made of the relation of laughter to epilepsy. In the world literature there are—as remarked above—only isolated reports. For these reasons, and also owing to the fact that we had had a few notable cases in our hospital, I decided to devote more attention to this chapter.

Pathological outbursts of laughter are surely an interesting neurological syndrome, just as physiological laughter is so far not quite a solved but always an attractive chapter of psychology. The study of morbid states has contributed much to clarifying the conception of its localization. Now it appears certain that motor co-ordinative centres for so many paratactic mechanisms participating in the act of laughter are in the subcortical grey matter. It is impossible to make an exact decision as to the place, and whether there be a unique or a divided centre in this region so heavily charged with various endeavours for localization.

It is well to bear in mind the difference between physiological, genuine laughter, accompanied by a feeling of joy and mirth, and the motor phenomena, similar in outward facial expression but lacking adequate psychic contents, the laughter that originates inadequately and very often against the will of the person concerned. One speaks of the laughter, the compulsive laughter, the involuntary laughter, the fit-laughter and so on. From the general point of view it is all laughter; it is in principle the same mechanism, originating in the mid-brain and interbrain, including mimic, respiratory, vocal and generalized muscular constituents, though we are aware that a participation by Psyché and consciousness is absent.

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SLEEP-WALKING AND SLEEP ACTIVITIES.

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SLEEP-WALKING, which is a fairly frequent symptom in children, is less common in adults, and, though fascinating, this subject has not yet received as much attention as its importance deserves. In the *Text-Book of Medicine* edited by Price there is no mention of this symptom. In the medical and legal literature one often comes across the same case-histories quoted by successive writers, some of whom consider somnambulism a hysterical dissociated state, while others maintain that it is an epileptic phenomenon. A correct diagnosis is essential not only for the purpose of treatment, but also for assessing criminal responsibility. Unfortunately, the features stated to be characteristic of somnambulism would seem really to be due to more than one condition.

CLINICAL MATERIAL.

This paper is based on clinical observations and on investigations made from every practical aspect on 117 out of 1,853 male adults suffering from neurosis who were under my care during the war period. Sleep-walking and sleep activities were predominant symptoms in these 117 patients, whose ages ranged from 18½ to 37, the average age being 23.6. As they formed a highly selected material and did not represent a fair cross-section of the general population, and as circumstances which led to their admission were extraordinary, the conclusions recorded here should be considered as tentative.

TABLE I.—*Chief Findings.*

Diagnosis.	No.	No. with neurotic traits in childhood.	No. with history of sleep-walking in childhood.
1. Psychogenic causes	1. Anxiety state	71	23 (30%)
	(a) Acute	18	18 (100%)
	(b) Chronic	8	2 (25%)
2. Physiogenic conditions	1. Post-epileptic	2	nil
	2. Post-infective	9	2 (22%)
3. Hystero-malingering states		9	1 (11%)

Two striking features emerge from this Table: (1) That psychogenic causes are responsible for the majority of the cases of so-called sleep-walking, and (2) every one of those suffering from chronic anxiety admitted neurotic traits early in life, and 17 out of 18 admitted having walked in their sleep in childhood. In these patients it would seem as though sleep-walking was their pattern of reaction to stress.

I. PSYCHOGENIC CAUSES.

I. *Anxiety states*.—Anxiety, either acute or chronic, is the most frequent cause of sleep-walking.

(a) *Acute*.—Exposure to sudden and severe stress may be followed by anxiety symptoms, including sleep disturbances and sleep-walking. Such acute anxiety symptoms were found among some of those men who had broken down after exposure to intense enemy action at Dunkirk, Normandy, Belgium and Holland. They would shout in their sleep, toss about, punch the walls, jump out of their beds, and seizing whatever they could get hold of, rush forwards to attack an imaginary enemy. N.C.O's. would shout orders to imaginary soldiers. They re-lived their battle experiences in their sleep, and psychomotor activities were prominent features in these nocturnal disturbances. A few who had gone home on compassionate leave caused considerable distress to the members of their families by their aggressive tendencies during sleep-walking. These disorders occurred almost every night, and more or less identical words or phrases were used by the same patient night after night. Some were more violent than others, but all were inclined to injure themselves by hitting the walls with their fists, knocking the lockers over, or falling through the windows.

Detailed examination was difficult while they were walking or running. From careful observations made by the nurses and myself it was found that some of them were sweating freely and appeared to be in a state of terror. The skeletal muscles were tense and rigid, the respiration rapid and shallow and eyes staring vacantly into space. The pupils were dilated, and reacted briskly to the light from a torch. The knee-jerks were present and the plantar reflex was flexor. The auditory perception was unimpaired as regards loud noises—the banging of a door or a plane flying over caused an immediate exacerbation of their activities or a marked panic reaction. Pin-prick was appreciated, as indicated by the withdrawal of the part touched. When simple questions were asked there was no reply in the majority of cases. The questions were either not heard or not understood. Incoherent speech, indistinct words and grunting noises were heard, but these appeared to be part of their battle experiences and irrelevant to the questions asked. To test their comprehension I made some remarks to the nurses in their hearing, but there was no response. The majority of these patients resisted our attempts to lead them back to their beds, and in a few instances this required considerable force (the help of two or three men).

During the day they showed somatic signs of acute anxiety, such as tension, tremor of the limbs and body, palmar sweating and frequency of micturition, and some admitted frankly that they were frightened at the prospect of facing enemy action again. All complained of lack of sufficient sleep and battle dreams, but they denied any knowledge of their sleep-walking. None was able to recall any of the remarks made in his hearing at night.

The prognosis as regards sleep-walking was good in these patients as they had been removed from the primary cause, i.e. the front line. Under con-

tinuous narcosis for three or four days, or heavy sedation (medinal gr. 10 at bedtime) for a week or longer their condition improved and sleep-walking subsided. Battle dreams and shouting in their sleep, however, continued for a longer period, especially in unstable persons, but finally responded to psychotherapy, including abreaction, discussion and so on.

(b) *Chronic anxiety*.—In adolescents and young adults of a nervous or unstable type chronic worry in connection with feelings of insecurity or with unsolved domestic or financial problems may result in insomnia and sleep-walking. These patients frequently talk or shout and only occasionally walk in their sleep—the intervals between sleep-walking varying anything from one to several months. A patient may get up from his bed, open the door and go out of the house without making any noise, or he may even endanger his life by falling out of a window, but he is not usually inclined to be violent towards others. The walking is purposeless, as no other activities are carried out, and occasionally he may walk even a mile or two before returning to his bed.

During the sleep-walking all the movements are slow, arms relaxed, and respiration quiet and regular in rhythm. Eyes are open, pupils moderately dilated, but react to light; knee-jerks are present and plantar reflexes are flexor. Pin-pricks are appreciated and auditory perception unimpaired. Conversation is difficult as the patient does not usually answer any questions, but he can easily be led back to his bed. The objective features are those of wakefulness rather than of sleep.

If questioned in the daytime he may admit he is worried about his personal problems and that he suffers from nightmares. He may give a long history of nervous instability and neurotic traits in childhood, e.g. stutter, enuresis, nail-biting, and especially of walking or talking in his sleep, and he may have suffered from nervous breakdowns. Each attack of sleep-walking is usually preceded by a week or two of disturbed nights and recurrent anxiety dreams. In these dreams he may see himself imprisoned in a small room without any doors or windows, and as the room gets smaller and smaller he tries to escape, or he is chased by someone and he tries to run away.

Treatment should be directed towards the removal of the sources of anxiety. Psychiatric social work may be necessary to solve the personal problems. Since each attack of sleep-walking is preceded by distressing dreams, two or more restless nights are indications for commencing a short three weeks' course of heavy sedation, e.g. medinal 10 gr. at bedtime for an adult. Prolonged medication is unnecessary and should be avoided. The following case-histories are representative of this group, and illustrate well that sleep-walking was their pattern of reaction to stress.

CASE 1.—Male, aged 22, was reported to have once fallen through a window, and on another occasion to have burnt his hands on a stove at night. His O.C. stated that he was a keen and efficient soldier. An attack was witnessed in hospital, and resembled the above description. Investigation revealed that he had walked in his sleep as a child, and that at the age of 17, after witnessing his mother's death, he had an attack when he walked half a mile along a road in his night attire. Since then, whenever he was worried over anything, he had recurring bouts of anxiety dreams for several nights, culminating in an attack of sleep-walking. The present bout was precipitated by psychological stress over frustration in connection with

his Army occupation. When this was explained to him and arrangements under the War Office "Annexure scheme" were made to employ him in his own trade, his sleep-walking stopped at once.

CASE 2.—Male, aged 37. His history showed that he had walked in his sleep until the age of 8, and had frequent attacks during six years' service in the Regular Army. While working in civil life for nearly nine years he was free from symptoms. After exposure to enemy action at Dunkirk he had recurrence of his sleep-walking. His present attack was due to chronic worry consequent on unsuitable employment in his unit. His O.C. gave him a good report. His sleep-walking ceased when he was recommended for employment in a suitable trade commensurate with his abilities.

2. *Hysterical dissociation or somnambulism.*—The Oxford dictionary defines somnambulism as "walking or performing other action during sleep, condition of brain inducing this." It would be better to restrict the use of this term to instances where there is apparent dissociation of personality—apparent because the more one studies hysteria the more one doubts whether such a thing as genuine dissociation can ever exist at all. However, it is better to bow to tradition and define somnambulism as a state of dissociation occurring during sleep, and characterized by general or local movements (and invariably by walking) of which the patient denies any knowledge on waking up. In these patients it would seem as though two distinct streams of thought existed side by side without meeting at any time (Janet, 1889). A desire which has been repressed during waking hours may dodge the personality and maintain an independent existence. During sleep, when the basic personality is in abeyance, the repressed desire strives to attain its goal without the full co-operation of the personality. On waking up the personality may deny any knowledge (Janet, 1904) of the nocturnal activities and may even repudiate them. For instance a religious and God-fearing man may, during somnambulism, indulge in sacrilegious and profane activities. Many such cases have been reported in the literature. A college student mentioned by Seashore (1916) used to walk down to the river, undress himself, and after a good swim return to his bed. Nielson (1936) reports a boy with a post-epileptic Parkinsonism who, during somnambulism, was seen walking without any rigidity or contracture. Instances such as these lend support to the theory of dissociation. But Graber (1934) stresses the role of the Oedipus complex. During somnambulism a person carefully avoids obstacles and is not likely to injure himself or others. He behaves as if he were doing some ordinary work in a familiar world of darkness. The attacks occur at infrequent intervals, but the activities indulged in may vary on each occasion. Usually the attacks are not preceded by dreams. If examined during an attack they may appear awake and at perfect ease. The eyes are open, pupils react to light, knee-jerks are present and the plantar reflexes are flexor. Sensations of pain, heat and cold are appreciated. The auditory perception is unimpaired and they may react to loud noises, although they usually do not reply to questions.

Roger (1932) has pointed out that during somnambulism the patient is suggestible and may be made to carry out orders, that he can answer questions correctly and that he exhibits *flexibilitas cerea*. We found these patients suggestible and they also carried out our instructions, but we were not able to enter into conversation with any of them, nor did we find *flexibilitas cerea*.

During somnambulism a heavy smoker was offered a packet of his favourite cigarettes, which were very scarce at this time, but there was not the slightest sign of recognition on his part. Even when a cigarette was inserted between his lips and a light was offered he failed to light it.

During waking hours these patients may not appear anxious and may deny any cause for anxiety. A history of neurotic traits in childhood may be absent, and to all outward appearances they may seem well adjusted to their environment. In the intervals between sleep-walking these patients may not complain of recurrent dreams or nightmares and they may not talk in their sleep.

Hypnosis is useful for this type of case both for discovering the motive and for the purpose of treatment. Sedatives are unnecessary and often fail, while treatment by hypnotic suggestion gives excellent results.

CASE 3.—Aged 29. Sleep-walking of three months' duration witnessed by the M.O. before referring him for investigation. His O.C.'s report—"very efficient, willing, hardworking, and his behaviour excellent." During an attack observed here he appeared completely dissociated—a different personality altogether.

Under hypnosis it was found that sleep-walking started while he was serving a term (for forgery) in a civil gaol. During his waking hours he was a respectable, law-abiding, conscientious citizen; while in the dissociated state he was an anti-social being, a rebel against society and against the Government.

II. PHYSIOGENIC CONDITIONS.

(1) *Post-epileptic*.—This is an extremely uncommon cause of sleep-walking, although it is often advanced as a plea by the defence in medico-legal cases where criminal responsibility has to be assessed. Sleep-walking may occur as part of an epileptic phenomenon either immediately following a seizure or without a fit. In the case of *grand mal* after the clonic stage, when the patient begins to emerge from a fit and before he has regained full consciousness he may carry out automatic movements without being aware of their object. These movements may vary in extent and duration, and may consist in smacking of the lips, chewing, swallowing, incoherent muttering, rambling talk or plucking movements of the fingers (Muskens, 1928), or in the repetition of every-day actions such as rearranging the bedclothes, dressing or undressing and so on. Wilson (1940) says as regards nocturnal fits the post-convulsive phase can at times be identified with somnambulism, during which the patient may dress and return to his bed, or wander about aimlessly or emerge from his house in night attire.

It is believed (Huglins Jackson) that during an epileptic discharge the highest centres of the brain are rendered functionless, and that automatic activities take place before function is restored to these centres. From this it follows that automatism cannot last longer than two to three minutes, and it is understandable that on coming round the patients do not remember anything that happened during the automatic phase. These views have been confirmed by observations on patients who had received electrical convulsions in the course of treatment. Immediately after a fit and when the patient is still unconscious, he may indulge in automatic activities if not forcibly restrained.

For instance, he may try to jump out of the bed and rush towards the door, but such activities cease as soon as he regains full consciousness, which he usually does within about one to two minutes. A patient in this period must be considered to be without a *mens rea*.

Following a nocturnal fit a patient may jump out of his bed and almost immediately return to it without any fuss, or he may walk some distance before returning to the nearest bed ; or after walking some distance he may fall down and spend the rest of the night sleeping on the floor. He seldom walks more than a few yards and occasionally he may injure himself accidentally, but usually he does not harm others, although a chronic epileptic may become aggressive and even homicidal, especially if force is used to restrain him. In the majority of patients the automatic activities do not last longer than about two minutes. If the sleep-walking follows a major fit there may be evidence of tongue-biting, incontinence, etc., but these features may be absent. Sleep-walking with the above-mentioned features may take place without a seizure, in which case the fit should be regarded either as an abortive one or as a *petit mal* attack. As Gowers (1907) pointed out, "it is possible that the elements of an attack may sometimes be extended, drawn out, lengthened as it were, and thereby made less intense, though not less distressing."

Detailed examination may be difficult when the patient is walking, but if examined soon after he has fallen down the eyes may be found closed and the pupils contracted. The knee-jerks are always elicited, but the plantar reflexes are likely to be extensor for about five or more minutes. Auditory and visual perceptions are impaired and pain is not felt. It is possible to prick him with a pin or apply heat and cold without this being appreciated by him. The objective signs are those of unconsciousness or deep sleep, which lasts about one to two minutes. After this period he may come round or he can be roused, and in either case he may rub his eyes, recognize the surroundings and enter into conversation which may be perfectly rational. If he is not disturbed he may pass into slumber. There may be long intervals between attacks, which are not preceded by nightmares or talking in sleep.

Such a patient may not complain of any symptoms and may not have any cause for worry, and he may even deny a history of neurotic traits in childhood. But careful investigation may reveal a history of fits or fainting attacks in parents, siblings or near relatives. The EEG may show dysrhythmia, or the spike and wave pattern, but a single negative record does not exclude epilepsy. Untreated persons may later develop typical fits.

A patient had his first attack of sleep-walking at the age of 11 when he got out of his bed and got into that of his brother. Five years later, after walking as far as the door, he returned to his bed. The third attack occurred at the age of 18, when he woke up one morning and found himself lying on the floor about three yards from the bed. Two years later he had a major fit in the O.P. department of a hospital. More fits have occurred since, and the EEG has confirmed the epileptic nature of these.

Treatment.—If the patient's EEG is conclusive or if there is a family history of epilepsy epanutin should be given at bedtime, and in order to watch progress the EEG should be repeated at intervals of two to three years.

If the diagnosis is in doubt, epanutin should be withheld and some of the simple devices given a trial. As the automatic stage does not last longer than about two minutes, sleeping in a bag or tucking the bed-clothes well under the mattress and adjusting a leather strap across the bed at the level of the umbilicus may be effective in keeping the patient in bed without embarrassing his respiration. These methods will certainly fail if the sleep-walking is due to anxiety or to hysterical dissociation. Hypnotic suggestion would be useless.

(2) *Post-infective*.—Any infection of the brain may be followed by imperfect control of sleep. Among the sequelae of encephalitis lethargica von Economo (1931) mentioned reversal of the sleep rhythm and somnambulism. He explains that in these patients cerebral sleep and somatic sleep do not coincide in time and depth as they do in normal subjects. Sleep-walking may be a persistent residual symptom in some of the survivors of cerebrospinal fever (Pai, 1944, 1945). This may be due to cortical interference. Mayer (1921), Keeser and Keeser (1927), Davison and Denmuth (1945) have stressed the role of the cerebral cortex in regulating the sleep mechanism. Davison and Denmuth conclude that the cortex in the region of the hippocampal, angular, frontal, premotor and temporal convolutions may give rise to some of the fibres for the control of sleep.

Patients in this group may emerge from the house at night and wander about aimlessly, but as a rule they do not indulge in any other elaborate activities, although they may remain on their feet for two or more hours. They may injure themselves, but are not violent towards others. It is possible to converse with them, but in the majority of cases they may appear confused and disorientated as regards time and place. They are not suggestible, and do not exhibit *flexibilitas cerea*. Reflexes can easily be tested and they can easily be guided back to their beds. Those who go out of the house and are not brought back by relatives or nurses may walk for hours and may fall asleep towards the later hours of the morning wherever they may happen to be. Investigation of their early histories may not reveal any neurotic traits, but on physical examination residual signs and symptoms of the primary infection may be found.

The treatment depends on the cause if this can be discovered and tackled. The majority of the cases are resistant to treatment. Hypno-analysis may be useless and narco-analysis dangerous. Sedatives may be tried, and if found useful may be given for long periods.

III. HYSTERO-MALINGERING STATES.

This type of sleep-walking occurs only in an adult who, in addition to walking, also indulges in various complicated and goal-directed activities requiring considerable skill and co-ordination. As these activities are impracticable without recalling old associations and without previous planning, it is obvious that all the higher processes associated with full consciousness are functioning efficiently, and it would be fair to assume that the patient is fully aware of his actions although he may deny all knowledge of this in the morning. While walking he may peer carefully into the darkness and feel his way about, avoiding obstacles. If the light from a torch is shone on his face he may

close his eyes tightly and resist attempts to open them. All the reflexes would be found intact. If he is asked questions he may reply angrily or in monosyllables; but his speech is always distinct. Auditory and visual stimuli are appreciated, and he may even show a startle reaction if he is surprised from behind.

CASE 4.—Aged 31, referred for investigation, ? epilepsy. It was reported that on one occasion he had stabbed a mate without any apparent reason, and on another occasion he had walked in his sleep and slaughtered some of his poultry. One night he had tried to strangle his wife, but next morning denied all knowledge of this. As a result of observation here, there were reasons for believing that he was fully conscious of his nocturnal activities. For instance, one night he stole a tin of jam from the ward kitchen and concealed it behind some bushes. On investigation it was found that his "wife" was a married woman (separated from her husband) whom he had recently suspected of being unfaithful to him. He had slaughtered the poultry (which belonged to her) out of spite, and his attempt to strangle her was premeditated.

Larceny, abnormal sexual practices, suspicions about marital fidelity and malingering were among the motives for so-called sleep-walking in other patients in this group. Neither the cortical characteristics of sleep such as loss of spontaneous activity and loss of elaborate reactions (Kleitman, 1939), nor the subthalamic and mesencephalic features of sleep such as loss of tone and loss of ability to move spontaneously, were present in these patients during their nocturnal activities. One may therefore reasonably assume that they were fully awake. Lady Macbeth's sleep-walking would come under this category.

The treatment of such cases is truly difficult, and they are the despair of the physician, who may well exclaim, "This disease is beyond my practice" (Macbeth, Act IV, Sc. III).

TABLE II.—*Differential Diagnosis.*

	Acute anxiety.	Chronic anxiety.	Hysterical dissociation.	Epilepsy.	Post-infective.	Hystero-malingering.
Family history of Neurotic traits in childhood	Neurosis	Neurosis	+—	Epilepsy	—	—
Sleep-walking in childhood	+	+++	+	—	—	—
Obvious cause for anxiety	+++	+	—	—	—	—
Dreams	++	+	+	—	—	—
Talking or shouting	++	+	—	—	—	—
Objective signs of sleep	—	—	—	++	—	—
Duration of activities.	10-15 min.	10-30 min.	Up to 2 hrs.	1-2 min.	Up to some hrs.	Some min.
Motive	Pseudo-purposive	—	+	—	—	+++
Signs and symptoms during waking hours	{ Tremor Tachycardia Sweating	{ — + —	{ — — —	{ — — —	{ Residual signs of primary illness	{ — — —
EEG	—	—	—	Dys-rhythmia	Abnormality	—

For several reasons a statistical evaluation of the results of treatment is not possible, but the immediate response to treatment could be summarized in a general way. The results were good in the case of acute anxiety, hysterical dissociation, epilepsy and chronic anxiety; not so good in post-infective conditions, and poor in hystero-malingering states.

DISCUSSION.

From what has been stated already it would be seen that post-epileptic automatism is the only condition in which the patient may be said to be asleep. In all other cases of sleep-walking the persons are awake, although the extent and degree of awareness may vary in each patient. This would be understood if one considers sleep as a complex state of physio-psychic phenomena involving a dimming of consciousness, usually relaxation of skeletal muscles and temporary changes in sensory-motor functions. The symptoms depend on the degree and extent of dimming of consciousness and the cortical areas which are still active. The presence of dreams would indicate that the visual centres in the occipital lobes and in the angular gyri are awake; talking in sleep would be the result of the speech centre being active; movements of the body and limbs, tossing about or sitting up in bed would be evidence that the pre-Rolandic motor cortex is awake. If the motor cortex only is active one may expect only simple and automatic movements of which the patient has no recollection on waking up fully. If a person is able to remember some of his nocturnal activities it would indicate that besides the motor cortex, other areas especially those concerned with the higher psychic functions were also awake—in other words, that the person was not fully unconscious during his "sleep" activities. This is in line with the experience of Norwood East, who has rightly suggested that if a person remembers some details of an act (alleged to have been committed by that person) one should hesitate before attributing it to post-epileptic automatism. Elaborate actions would be evidence that almost the entire cortex is awake.

CRIMINAL RESPONSIBILITY.

Although a discussion of the legal aspects of antisocial acts performed during "sleep-walking" is outside the scope of this paper, it is fair to state that a person who performs a criminal action during the post-epileptic phase must be held to be without a *mens rea* and therefore cannot be held responsible for his actions. *Actus non facit reum nisi mens sit rea*. In the case of persons suffering from anxiety and post-infective conditions of the brain it is obvious that during "sleep" activities there is some temporary loss of function of the higher centres, especially those concerned with memory, discrimination, judgment and so on, although they may be awake. A plea of "diminished responsibility" (Law of Scotland) or a plea in mitigation of punishment appears justifiable in these cases (Smith and Cook, 1934). In the case of acts done during hystero-malingering states a person may be held responsible (R. v. Jackson, Liverpool Aut. Ass., 1837, Woodbridge, 1939).

SUMMARY.

117 male adults who had complained of or who were alleged to have walked in their sleep were investigated.

In the majority of these cases the term sleep-walking was found to be a misnomer, as the clinical condition appeared to be one of incomplete sleep with varying degrees of consciousness.

The causes of walking and other activities during apparent sleep could be classified into three groups, e.g. psychogenic causes, physiogenic conditions and hystero-malingering states.

In the preparation of this paper case-notes of patients who were under my care at four hospitals have been utilized. My thanks are due to the Medical Superintendent, Mill Hill Emergency Hospital, and to the nurses, without whose help and resources many of the observations recorded here would not have been possible.

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FRACTURES OF DORSAL VERTEBRAE IN EPILEPSY AND CONVULSION THERAPY.

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INTRODUCTION.

FRACTURES of the dorsal vertebrae remain one of the chief complications of convulsion therapy; and the problems of their mechanism and significance have not yet been completely solved. The present investigation has been developed with the intention of throwing fresh light on these matters by a comparative study of similar lesions in 27 patients suffering from the convulsions of idiopathic epilepsy, 21 of whom have also been treated by electrical convulsion therapy. A control group of 30 patients suffering from non-convulsive psychoses has also been examined, and in all cases the spine has been examined both clinically and radiologically, attention being focused, for the sake of clarity, on the dorsal region only.

REVIEW OF THE LITERATURE.

Ever since the first reports, by Wespi (1938) and Stalker (1938), of vertebral fractures produced in convulsion therapy, many workers have compared these lesions with those which occur during the convulsions of tetanus (Pearson and Ostrum, 1940; Kraus and Viersma, 1940; Worthing and Kalinowski, 1942, etc.). The theories put forward by Lehndorff (1907), Erlacher (1920) and Roberg (1937) as to the muscle forces which produce the fractures in tetanic convulsions have been generally accepted as applying equally well to the vertebral changes of convulsion therapy.

Pearson and Ostrum (1940) have pointed out that similar lesions also follow the convulsions of insulin coma treatment—out of three patients whom they examined, one had a typical wedge-shaped fracture of the fifth dorsal vertebra.

It would therefore be reasonable to expect that similar fractures of the dorsal vertebrae should also be found in patients who suffer from the major convulsions of epilepsy, but a review of the literature on this subject reveals a strange confusion of opinion.

Kraus and Viersma (1940) X-rayed the spines of 21 epileptics, and found one case with a definite compression fracture of D11, and another case with doubtful lesions of D6 and D7 accompanied by slight osteoporosis.

Pearson and Ostrum (1940) examined three patients, who had recovered from status epilepticus, and found in one case wedge-shaped fractures of D12 and L1. They also examined the spine of a patient suffering from meningovascular

syphilis, who had had convulsions for years. X-ray revealed a compression fracture of L3.

Ziskind and Somerfeld-Ziskind (1939) have described spinal changes in three epileptics, and they too found fractures only in the lower dorsal and lumbar regions—D10, 11, 12, and L2 and 3.

Schatz and Konwaler (1941) found no fractures in the dorsal spines of epileptics whom they examined.

Worthing and Kalinowsky (1942) X-rayed 42 epileptics, and found fractured vertebrae in only two cases. One had a fracture of L1, and the other had a fracture of the spinous process of C6. They stated that "no reports of fractures of the mid-dorsal region in epilepsy are given in the literature. . . . The few instances of vertebral fractures reported in epilepsy have the usual localization of compression fractures of traumatic origin. This is easily understood, since in epileptics an occasional trauma from falls can never be excluded. This supposition and the different localization shows that fractures in epilepsy are of quite a different character, nor does it seem that they are caused by muscular contractions during the convulsions as is the case in metrazol convulsions. We feel that we have sufficient evidence for the conclusion that in epileptic seizures fractures of the same type as in convulsion therapy do not occur."

Reed and Dancy (1940) made lateral X-ray studies of the dorsal region of the spine in a group of 72 epileptics. They reported an incidence of compression deformities in the mid-dorsal region of 34.2 per cent. Unfortunately, they gave no details of the individual lesions or their actual distribution among the dorsal vertebrae, but they implied that both types of lesion and distribution were the same as in metrazol-treated patients whom they examined during their investigation; and they contrasted the localization of these fractures with those produced in the lower dorsal and upper lumbar regions by external trauma.

Cook and Sands (1941) took lateral radiograms of the spine of 134 idiopathic epileptics and 135 control cases. They found 14 cases of compression deformity in the first group and only 2 in the control series. Their epileptics included 72 males and 62 females. The incidence of fractures among the males was 14 per cent. and among the females only 4 per cent., the incidence for the whole group being 10.4 per cent. They described the type of compression fracture in these epileptics as "so like that found after induced convulsions that a similar mechanism can justifiably be assumed." They reported, however, that the distribution of the fractures was rather lower than among metrazol patients; of 18 fractured vertebrae there were 4 lesions in D7, 1 in D8, 2 in D10, 3 in D12, and the rest were in the lumbar region. They mentioned that in addition to the compression fractures, "knorpelknötchen" were found in one case, and deformity of the superior surface of a vertebral body with formation of a "cartilaginous pearl" in another. Also "non-traumatic extensive deformity of several vertebrae, apparently due to occupational or constitutional causes, appeared in four cases." They gave no details of any of these lesions, and there is thus no possibility of comparing them with those which other authorities have classified as "minor fractures" or "infractions."

It is also of interest to note that they did not describe the occurrence of such abnormalities in the control group of 135 cases.

Moore, Winkelman and Solis-Cohen (1941) X-rayed the spines of 12 epileptics who had all suffered for years from severe *grand mal* fits. They reported an incidence of definite compression fractures of dorsal vertebrae in 50 per cent. of the cases. The fractures were located as follows :

Number of fractures	Dorsal vertebra.				
	8.	9.	10.	11.	12.
	3	3	1	2	2

Three of the patients had major fractures and the others had minor fractures, of each of which they gave reasonably detailed descriptions.

Barrett, Funkhouser and Barker (1942) have also described fractures of the dorsal vertebrae in epilepsy. They took lateral X-ray films of 20 epileptics, and they found compression fractures in 45 per cent. of cases. A similar number of control cases showed no fractures. They reported that the vertebral lesions in the epileptics "are indistinguishable from those occurring with metrazol and electro-shock both as to type of fracture and localization." They found the distribution of fractures among the dorsal vertebrae to be as follows :

Number of fractures	Dorsal vertebra.									
	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
	2	2	2	2	4	2	2	1	1	1

And they concluded that "the deduction of earlier workers that vertebral fractures in epilepsy are due to the trauma of frequent falls during seizures is not substantiated by these findings."

Significance.

There has been no final decision so far as to the significance of vertebral fractures produced by convulsion therapy as regards the future health of the patient, but the literature contains no account of any serious sequelae.

Worthing and Kalinowsky (1942) followed up eight severe cases over a period of two years and reported that Kummel's disease did not occur, the motility of the spine was not affected, and there was no involvement of the cord.

Roberg (1937), referring to the comparable lesions of tetanus, has reported that a certain amount of healing sometimes takes place, especially in a kyphosis which is treated by a plaster jacket or surgical brace. He has reported no cases of definite involvement of the cord, though one patient, a nine-year-old girl, with fractures of the second and third lumbar vertebrae, retained the gibbus three years later, as well as a "hyperreflexia of one leg." Many of the cases were followed up for years and no serious complications have been recorded.

Jessner and Ryan (1942) have recorded their opinion that "few cases are reported to be seriously inconvenienced through vertebral fractures." They reported that the usual sequela is a slight gibbus.

Cook (1944) pointed out that the discovery of vertebral fractures in so many cases was at first very alarming, and it placed the future of convulsion therapy in serious jeopardy, but "fortunately they are not followed by serious sequelae and have proved to be far less important than was at first feared." He referred to the question of the comparison of these fractures with those occurring in epileptics, but was of the opinion that "no absolute conclusion can be drawn from the absence of referable symptoms in long-standing epilepsy, but it is reassuring that neither Kummel's disease nor spinal involvement occur as a result of epileptic fits." After reviewing the literature he stated: "In spite of the many thousands of convulsion courses given no serious permanent disability has been reported."

DESCRIPTION OF PRESENT INVESTIGATION.

Twenty-seven male patients were chosen who had all suffered at one time or another from frequent *grand mal* epileptic fits. They were carefully examined clinically to see whether they showed any neurological abnormalities which might be attributable to vertebral lesions causing pressure on the spinal cord.

The dorsal region of the spine was then carefully radiographed in each case, and examined for the presence of vertebral fractures. The latter were classified as major fractures and minor fractures. Subsequent descriptions will show how these were differentiated, but it may be briefly stated here that major fractures were those in which there was a definite compression deformity of the vertebral bodies, usually wedge-shaped, and accompanied in many cases by fragmentation and sclerosis of the articulating surfaces; minor fractures were those in which there were lesser degrees of deformity, but in which there was evidence of trabecular buckling, accompanied by a variable number of other abnormalities, e.g. flattening of the articulating surfaces, narrowing of the discs, chip fractures of the antero-superior edge of the vertebral bodies, spur formations and sclerosis of articulating surfaces, etc.

A control group of 30 patients, from the same wards, who were suffering from various chronic non-convulsive psychoses, was subjected to the same clinical and radiological investigation of the dorsal spine.

After carrying out a full radiological investigation of the dorsal spines of the epileptic patients, twenty-one of them were given electrical convulsion therapy, as described in another paper (Caplan, 1945). No attempt was made to fix the patients in hyperextension during the convulsions; they were treated in the usual way, lying on their backs on ordinary beds, and were not restrained in any way either manually or by bed-clothes. After each patient had been given an average of twelve electrical convulsions he was again X-rayed, and the films were carefully compared with the initial ones. During the course of the electrical treatment it was noticed that each patient had his own characteristic set of movements for the convulsion, and that some patients had strong flexion spasms which were absent in most cases. Also the strength of the muscular contractions appeared to vary from one to another, and even the degree of movement of the limbs and trunk during the clonic stage seemed to be a peculiarity, characteristic for each individual. It was felt that these

mechanical variables might have some bearing on the question of individual susceptibility to vertebral fractures, and an attempt was made to record them for each convulsion and investigate their possible correlation with the existence of spinal lesions. The ideal way of doing this would be to employ the method of Strauss, Landis and Hunt (1939), and use high-speed cinematograph cameras and electro-myographic apparatus, but since these were not available a rather rough-and-ready clinical method was worked out.

The mechanical variables in the convulsion were divided into three: posture, strength of muscular contractions, and clonic excursions. In each of these an arbitrary set of standards was devised, and each individual convulsion was then very carefully observed and assessed according to its behaviour in relation to these.

(a) POSTURE.—During a convulsion the patient does not, of course, remain in one position, but is constantly moving. There is, however, in most cases a tonically held posture on which the other movements appear to be superimposed, and this is especially so in the case of the trunk. Interest was for obvious reasons directed solely to the posture of the dorsal spine, and this was in each case investigated not only visually, but also by palpation. Three main types of posture were noted:

i. *Extension*: this varied from a slight hollowing of the back to a marked opisthotonos.

ii. *Straight*: here the back was neither flexed nor extended, although head and neck were often flexed.

iii. *Flexion*: this was divided into mild and severe flexion, and was usually accompanied by flexion of head and neck.

(b) STRENGTH OF MUSCULAR CONTRACTIONS.—This was ascertained by palpation during the convulsion, and was divided into strong, moderate, and weak. Standards were, of course, arbitrary, but it was found that after some practice a fairly consistent judgment was possible.

(c) CLONIC EXCURSIONS.—In some cases there was hardly any movement at all during the seizure, little more than a coarse tremor; such cases were recorded as *Clonus 0*.

In other cases there occurred movements of great amplitude, and these were classified as *Clonus 2*.

Intermediate degrees of movement were recorded as *Clonus 1*.

Here again, despite the subjective nature of the judgments made a satisfactory consistency was soon attained, and this was shown among other things by the fact that although the records of the case were not inspected until afterwards, there was rarely any deviation from previous markings unless there had definitely been a change from the patient's usual behaviour during his convulsion.

RESULTS.

(1) EPILEPTICS.

Radiological study of the 27 epileptics showed that nine of them were suffering from fractures of dorsal vertebrae—an incidence of 33 per cent. Four of this number had only one fracture each, and the rest had multiple fractures

varying from two to four per patient. Four patients had major fractures, and five had minor fractures only. Three of the former had minor fractures in addition.

Table I shows the distribution of the fractures among the dorsal vertebrae. It can be seen that the peak incidence is at D6, 7, 8 and 9; and that lesions of D5 and D10 were also found.

TABLE I.—*Distribution of Vertebral Fractures in Epileptics.*

Number of Cases.	Fractures.		Distribution in dorsal vertebrae.											
	Type.	Number.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
4	Major	6	0	0	0	0	0	2	1	1	2	0	0	0
8	Minor	10	0	0	0	0	1	2	2	3	1	1	0	0
9	Total	16	0	0	0	0	1	4	3	4	3	1	0	0

Table II shows the details of the lesions in the different patients, together with their present ages and also the age of onset of epilepsy in each case. This table shows quite clearly that neither length of history nor age of onset has

TABLE II.—*Vertebral Fractures in 27 Epileptics.*

	Case No.									
	99.	100.	101.	102.	103.	104.	105.	106.	107.	
Present age	42	53	38	45	37	28	35	30	26	
Age of onset of epilepsy	14	15	22	20	12	16	15	17	20	
Major fractures	D6, 8, 9	0	D7	0	0	0	0	0	0	
Minor fractures	D7	D8	0	0	0	0	D8, 9	0	0	

	Case No.									
	108.	109.	110.	111.	112.	113.	114.	115.	116.	
Present age	22	27	50	45	48	32	44	33	37	
Age of onset of epilepsy	20	14	23	11	14	21	40	18	23	
Major fractures	0	0	0	D9	0	0	0	D6	0	
Minor fractures	0	0	0	D10	D6	D7, 8	0	D5	0	

	Case No.									
	117.	118.	119.	120.	121.	122.	123.	124.	125.	
Present age	41	45	24	45	49	24	22	35	37	
Age of onset of epilepsy	19	28	9	25	35	9	13	14	12	
Major fractures	0	0	0	0	0	0	0	0	0	
Minor fractures	D6	0	0	0	0	0	0	0	0	

any influence on the incidence of fractures. In no case did clinical examination show any neurological complication pointing to cord involvement, but in one patient (Case No. 99) there was some degree of kyphosis at the site of the fractures.

The X-ray pictures showed no trace of osteoporosis in any case, nor was there any caries or other bone disease, though a number of patients were found to be suffering from various mild postural defects which were not related in any way to the incidence of fractures. One patient (No. 114) was suffering from an old adolescent kyphosis affecting D7, 9, 10 and 11. The following are the details of the individual lesions in each case :

CASE No. 99.—*Major Fractures—D6, 8 and 9.*

The sixth dorsal vertebra showed flattening and shortening of the body with elongation transversely. There was irregularity and sclerosis of both articulating surfaces. There was indentation of the anterior surface of the body, which was wedge-shaped in appearance.

The body of the eighth dorsal vertebra was more acutely wedge-shaped. Its upper articulating surface was very irregular and had the appearance of healed and sclerosed fragmentation. There was narrowing of the disc between this vertebra and the seventh dorsal.

The ninth dorsal vertebra had a body which was a little less wedge-shaped. Its upper articulating surface was the one chiefly involved, and it showed irregularity and sclerosis.

Minor Fracture—D7.

The body of the seventh dorsal vertebra showed a mild degree of both anterior and lateral wedging. The upper articulating surface had lost its normal concavity—it was flat and sclerosed. There was a little shortening of the body vertically, and some degree of notching of its anterior surface.

The other vertebrae appeared normal. There was some kyphoscoliosis with its apex at the level of D₉.

CASE No. 100.—*Minor Fracture—D8.*

The eighth dorsal vertebra showed a small amount of flattening of the body and shortening in its vertical axis. This was more marked anteriorly, giving a mild degree of wedging. The superior articulating surface was less concave than normal, and there was a zone of increased density just at the margin. The other vertebrae were normal.

CASE No. 101.—*Major Fracture—D7.*

The seventh dorsal vertebra showed irregularity and sclerosis of its upper articulating surface. There was an irregularly shaped shadow superimposed on the upper part of the body, which looked like a piece of excess callus from an old healed fragmentation of the upper articulating surface. The height of the body was materially diminished and there was marked wedging. There was an indentation of the anterior surface. There was some increase in density in the region of the lower articulating surface, but its contour was quite normal.

The other vertebrae showed no abnormality.

CASE No. 105.—*Minor Fractures—D8 and 9.*

The lower anterior end of the body of the eighth dorsal vertebra was compressed and sclerosed. There was a spur formation, and the edge was roughened and thickened by old arthritis. The upper anterior articulating tip of the ninth dorsal vertebra was changed in a similar manner. The anterior part of the upper articulating surface was flattened and sclerosed, and there was some hypertrophic arthritis surrounding it.

The other vertebrae were quite normal, there was no kyphosis or scoliosis, and there was no trace of arthritis elsewhere in the spine.

CASE No. 111.—*Major Fracture—D9.*

The body of the ninth dorsal vertebra was flattened and its height was shortened. The anterior surface showed a semi-circular indentation. The body as a whole showed a mild degree of wedging. The anterior part of the upper articulating surface was flattened and sclerosed. There was some arthritis between this portion and the vertebra above. The lower articulating surface was irregular in shape as though the result of healed fragmentation, and there was a thick zone of increased density at this lower margin.

Minor Fracture—D10.

The anterior portion of the superior articulating surface of the tenth dorsal vertebra was markedly flattened and depressed. It showed dense sclerosis, and

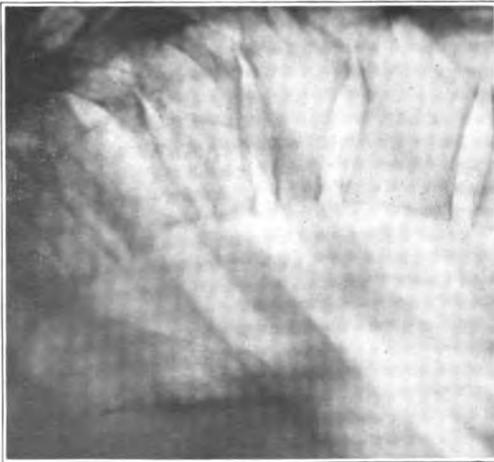


FIG. 1.—X-ray of epileptic, Case No. 99. Major fractures—D6, 8, 9. Minor fracture—D7.



FIG. 2.—X-ray of epileptic, Case No. 101. Major fracture—D7.

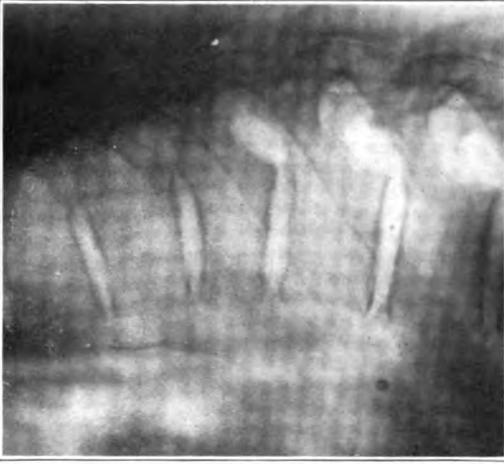


FIG. 3.—X-ray of epileptic, Case No. 115. Major fracture—D6. Minor fracture—D7.

there was a zone of hypertrophic arthritis between it and the adjoining portion of the vertebra above. There was narrowing of the intervertebral disc between the ninth and tenth dorsal vertebrae. The anterior surface of the body of the tenth dorsal vertebra showed a marked indentation, but there was no wedging of the body itself.

The other vertebrae appeared normal.

CASE NO. 112.—*Minor Fracture—D6.*

The body of the sixth dorsal vertebra showed some flattening and shortening in its height. There was a mild degree of wedge-shaped deformity present. The upper articulating surface showed some loss of the normal concavity, and there was a slight reduction in the thickness of the intervertebral disc.

The other vertebrae showed no abnormality, though there was a slight degree of scoliosis with its peak at D3.

CASE NO. 113.—*Minor Fractures—D7 and 8.*

The body of the seventh dorsal vertebra showed a mild degree of wedging, with some shortening and flattening. There was loss of the normal concavity of both the upper and the lower articulating surfaces, and a narrow zone of increased density in both margins.

The body of the eighth dorsal vertebra showed similar slight wedging and flattening. Its upper articulating surface was irregular in outline and sclerosed.

The other vertebrae in the dorsal spine showed no abnormality.

CASE NO. 115.—*Major Fracture—D6.*

The body of the sixth dorsal vertebra showed flattening and vertical shortening. There was a gross degree of wedging, and the anterior surface showed an indentation due to crushing. The lower articulating surface was flattened and somewhat irregular in outline, and showed some sclerosis.

Minor Fracture—D5.

There was some flattening of the body of the fifth dorsal vertebra, and it showed a mild degree of anterior wedging. The upper articulating surface showed loss of its normal concavity, and there was a reduction in thickness of the intervertebral disc, between it and the vertebra above.

There was no kyphosis in the dorsal spine, and the other vertebrae appeared normal.

CASE NO. 117.—*Minor Fracture—D6.*

The body of the sixth dorsal vertebra showed some flattening and vertical shortening. There was a mild degree of anterior wedging. The upper articulating surface showed loss of the normal concavity, and there was narrowing of the intervertebral disc.

There was no abnormality in the other dorsal vertebrae.

From the above details it can be seen that the main changes in the X-ray appearance of these vertebral lesions in epileptics are as follows :

(1) Loss of the normal concavity of the upper articulating surfaces of the bodies of the vertebrae.

(2) Irregularities of both upper and lower articulating surfaces, giving the appearance of old healed fragmentations ; and in many cases showing sclerosis and sometimes roughening.

(3) Zones of increased density at the articulating margins of the vertebrae.

(4) Narrowing of the intervertebral discs.

(5) Indentations of the anterior surfaces of the vertebral bodies.

(6) In occasional cases, spur formations at the upper or lower anterior tips of the vertebral bodies, usually accompanied by arthritic changes.

(7) Flattening of the vertebral bodies, shortening vertically, and sometimes elongation transversely.

(8) Greater or lesser degrees of anterior wedging of the bodies of the vertebrae, giving the characteristic picture of compression fractures.

(9) The fractures seemed to be old ones, and there was no evidence of recency in any of the lesions.

(10) There were no gross associated spinal changes, no evidence of Kummel's disease, and no sign of displacement of the vertebral bodies to produce danger of cord involvement.

(11) There was no evidence of decalcification or rarefaction in any of the vertebrae to suggest interference with calcium or phosphorus metabolism.

(2) CONTROL GROUP.

No such lesions as the above were to be found in any of the control cases. Three of the patients had a mild degree of kyphosis, probably of postural origin, but the vertebral bodies were normal in contour, and there were no changes in any way suggestive of fractures.

(3) EFFECT OF ELECTRICAL CONVULSION THERAPY ON EPILEPTICS.

Twenty-one of the above epileptic patients were given courses of electrical convulsion treatment (Caplan, 1945). They included among their number all the cases in which vertebral fractures had been discovered.

The electrical current used to induce the convulsions was kept down to about the threshold value in order to reduce the initial flexion effect of stimulation of the cortical cells when the current was flowing. As has previously been described (Caplan, 1945), the induced convulsion resembled closely the spontaneous fit which was characteristic for each individual. After an average of 12 convulsions the spines were again examined radiologically.

In no case was there any change to be seen from the condition of the vertebrae which had existed before treatment was commenced.

No additional fractures were found, and the old lesions were not affected in any way by the electrically-induced convulsions.

CONVULSION DETAILS.

Table III gives the details of seven successive convulsions in each case, and also of the incidence of vertebral fractures.

It can be seen that there is a definite correlation between the posture during the convulsion and the presence or absence of fractured vertebrae.

In 7 out of 9 cases which had vertebral lesions, the posture during some or all of the convulsions was one of flexion.

This posture did not occur in any patient who had no fractures.

Of the other two fracture cases, one showed postures which were occasionally straight and sometimes extension.

Of the eleven patients whose spines were normal only three showed occasional straight postures during convulsions, and the rest were entirely confined to extension.

Only one patient with vertebral fractures had his convulsions in extension during the period of observation.

These observations afford strong evidence that susceptibility to fracture in these patients is associated with individual peculiarities of convulsion pattern, and that the majority of fractures occur among those patients whose fits usually take place in an attitude of flexion, or in certain cases in a straight posture. They also show that the majority of patients usually have fits in an attitude of tonic extension of the spine, and that this is associated with their freedom from vertebral fractures.

When attention was directed to the details of the individual convulsions, it was discovered that although the general pattern was characteristic for each person, there were variations from day to day in the patient's convulsion picture. This is shown very well in Table III ; Case No. 117 is a good example. Successive fits showed the following postures: Ext.; Ext.; Strt.; Ext.; Strt.; Flex.; Strt. This was also found to hold for the spontaneous fits. As has been described elsewhere (Caplan, 1945*a*), some patients developed the habit of having a spontaneous fit whilst in bed waiting for their E.C.T. It was thus possible to record in a few cases the details of these fits and compare them directly with the electrically induced convulsions. Sufficient material has not so far been forthcoming to enable any sort of statistical table to be drawn up, but the general clinical impression has been that spontaneous fits resemble induced convulsions in showing individual variations superimposed on a general pattern characteristic for each patient.

The Table also shows that day-to-day variations were more marked among the patients who had the fractures. Out of 7 cases where flexion was found, only 3 were consistent in this posture. This can be compared to the 16 cases of extension, among whom 9 were consistent. There were 8 cases in which straight postures were found, and all of these showed variations from one convulsion to the next.

As for the other variable factors in the convulsions, Table III shows quite clearly that neither the degree of clonus nor the strength of muscular contractions has any significance as regards the incidence of fractures. Patients who had consistently strong muscular contractions, and extensive clonus, were fracture free; while other patients who did have vertebral fractures had weak or moderate muscular contractions, and mild or intermediate degrees of clonus. Apart from this lack of correlation with susceptibility to fractures, it is of interest to note that these factors, too, showed a tendency to variation from one fit to the next, although this variation was less noticeable than it had been in the case of posture.

DISCUSSION.

The results of the present investigation allow some light to be thrown on the various unsolved problems of vertebral fractures.

(1) *Incidence of Vertebral Fractures in Epileptics.*

Our results regarding lesions of the dorsal spine in idiopathic epilepsy confirm the findings of Reed and Dancey (1940), who reported an incidence of

TABLE III (cont).—Correlation of Convulsion Details and Incidence of Fractures in Epileptics.

		Case No.															
Successive convulsions	1	112.	Flex.;	Stng.;	C.1	113.	Ext.;	Stng.;	C.1	114.	Sirt.;	Wk.;	C.1	115.	Ext.;	Mod.;	C.1
	2		Flex.;	Stng.;	C.1		Sirt.;	Mod.;	C.2		Sirt.;	Wk.;	C.1		Ext.;	Mod.;	C.2
	3		Flex.;	Stng.;	C.1		Ext.;	Stng.;	C.2		Ext.;	Stng.;	C.1		Ext.;	Mod.;	C.1
	4		Flex.;	Stng.;	C.0		Sirt.;	Stng.;	C.2		Sirt.;	Stng.;	C.1		Ext.;	Mod.;	C.2
	5		Flex.;	Stng.;	C.0		Sirt.;	Stng.;	C.2		Sirt.;	Stng.;	C.1		Ext.;	Mod.;	C.1
	6		Flex.;	Stng.;	C.0		Sirt.;	Stng.;	C.2		Ext.;	Stng.;	C.2		Ext.;	Mod.;	C.2
	7		Flex.;	Stng.;	C.1		Sirt.;	Stng.;	C.2		Sirt.;	Mod.;	C.1		Ext.;	Mod.;	C.0
Vertebral fractures	Major		0			0				0				D6			
	Minor		D6			D7, 8				0				D5			
Successive convulsions	1	116.	Ext.;	Stng.;	C.2	117.	Ext.;	Mod.;	C.1	118.	Ext.;	Stng.;	C.2	120.	Ext.;	Stng.;	C.2
	2		Ext.;	Stng.;	C.2		Ext.;	Stng.;	C.1		Ext.;	Stng.;	C.2		Ext.;	Stng.;	C.2
	3		Ext.;	Stng.;	C.2		Sirt.;	Stng.;	C.1		Ext.;	Stng.;	C.2		Sirt.;	Stng.;	C.2
	4		Ext.;	Stng.;	C.2		Ext.;	Stng.;	C.1		Ext.;	Stng.;	C.2		Ext.;	Stng.;	C.1
	5		Ext.;	Mod.;	C.1		Sirt.;	Stng.;	C.1		Ext.;	Stng.;	C.2		Sirt.;	Stng.;	C.1
	6		Ext.;	Mod.;	C.2		Flex.;	Stng.;	C.2		Ext.;	Stng.;	C.2		Ext.;	Stng.;	C.1
	7		Ext.;	Stng.;	C.2		Sirt.;	Stng.;	C.0		Ext.;	Mod.;	C.2		Ext.;	Stng.;	C.2
Vertebral fractures	Major		0			0				0				0			
	Minor		0			D6				0				0			

KEY.

Posture: Ext.; Extension. Sirt.; Straight. Flex.; Flexion.

Muscular power: Stng.; Strong. Mod.; Moderate. Wk.; Weak.

Degree of clonus: C.0; Mild clonus. C.1; Intermediate clonus. C.2; Extensive clonus.

34.2 per cent. in 72 cases. Barrett *et al.* (1942) and Moore *et al.* (1941) gave a higher incidence of 45 per cent. and 50 per cent. respectively.

Our figure is about the same as the average incidence of fractures in metrazol-treated patients, where no precautions are taken; and is just what one would expect from the fact that the seizures in epilepsy and pharmacological convulsive therapy are so similar.

Cook and Sands' (1941) figure of 10.4 per cent. of fractures in epileptics is very much lower than our own, but it has already been pointed out that these workers neglected a number of lesions which we would probably have included in our list of fractures—lesions which did not occur in their control group of non-epileptic patients. That these investigators are very conservative in their X-ray diagnosis of fractures can also be seen from the fact that they have given the incidence of compression fractures in a series of 143 patients who received metrazol treatment without restraint or other precautions as 14.7 per cent. Thus they too have given the fracture rates in metrazol treatment and epilepsy as about equal, though by neglecting what we would have called "minor fractures" they have reduced both figures by approximately 50 per cent. Another point to note is that their figures were derived from mixed material while all our patients were males. It will be remembered that in their 72 male cases the incidence was higher (14 per cent.).

(2) *Location of Fractures in Epileptics.*

The results of the present investigation are again in line with the findings of Reed and Dancy (1940) and Barrett *et al.* (1942) in localizing the vertebral fractures throughout the middle and lower dorsal spine. In this we disagree once more with Cook and Sands (1941), who found most of their fractures in the lower dorsal and in the lumbar regions of the spine. They did, however, find that D7 had the highest number of lesions of any single vertebra, and this can be compared to our peak incidence, which was localized in D6, 7, 8 and 9. It must be admitted that our own figures show a somewhat lower distribution for epileptics than for post-convulsive fractures, which have a peak incidence at D4, 5 and 6. Cook and Sands gave no explanation for this difference in location, but a reasonable theory appears to be that convulsions in epileptics often take place with the patients in an erect posture, and this tends to displace the muscle strain further down the back than in the case of those patients who are given therapeutic convulsions invariably in a horizontal position on a bed or couch. The description of Ziskind and Somerfeld-Ziskind (1939) of two cases of epileptics who had fits whilst sitting upright, and who immediately afterwards complained of pain in the back and were found to have sustained fractures of D12, and D10 and 11 respectively, makes the theory sound more plausible. The effect of the upright posture on the localization of strains on the dorsal vertebrae can also be seen in regard to the not uncommon condition of adolescent kyphosis, where the peak of vertebral changes is in the region of D8, 9 and 10 (Roberg, 1937). Also the location of vertebral fractures in tetanus fits in satisfactorily with our theory—in this disease the convulsive movements occur while the patient is lying in bed, and as would be expected, the majority of lesions are found in D5 and 6 (Roberg, 1937).

(3) *Type of Lesion in Epileptics.*

The radiological changes found in the dorsal vertebrae of the epileptics in this investigation have been very similar to those described in the literature as occurring in patients who have had convulsion therapy (e.g. Pearson and Ostrum, 1940), and they are almost identical with those which we have found in our own patients after E.C.T. The few differences between them are probably due to the fact that the lesions in the epileptics are much older, and have in many cases become involved in a greater or lesser degree of secondary change in the form of sclerosis of the injured bone and hypertrophic arthritis, etc. In both epileptics and convulsion therapy patients the lesions are confined to the vertebral bodies and the intervertebral discs, and are obviously the result of compression and crushing which is more marked anteriorly. The fact that the types of lesion are so similar is another confirmation of their similar origin.

(4) *Mechanism.*

The views expressed above regarding the incidence and distribution of fractures in the dorsal spines of epileptics are diametrically opposed to the opinions of Kraus and Viersma (1940), Pearson and Ostrum (1940), Schatz and Konwaler (1941), and Worthing and Kalinowsky (1942).

The explanation for the strange discrepancy in the different reports is obscure. It may be true, as Cook (1944) says, that this shows "all too convincingly that radiological diagnosis of vertebral fractures is by no means an exact science." But it is rather hard to believe that authorities of the standing of Worthing and Kalinowsky, who have had a lot of experience with vertebral fractures in patients after convulsion therapy, should suddenly change their diagnostic criteria when faced with the same lesions in epileptics. It seems more reasonable to assume that findings so different depend chiefly on variations in choice of material. It may be not without significance that the fracture cases in the present study occurred entirely in that group of patients whose epilepsy was so bad that they were all put down for treatment by E.C.T. If the material were available it would be interesting to compare the radiographic appearances of the spines of different types of epileptics, e.g. mental hospital in-patients, epileptic colony patients, out-patients, etc.

Whatever the explanation of the discrepancy of the results of different workers, there can be no doubt as to the findings in our case, and they allow us to take up a definite attitude to the theory put forward by Worthing and Kalinowsky (1942) as to the mechanism of production of fractures in convulsion therapy. They believed that vertebral fractures do not occur during the tonic or clonic stages of a convulsion because they are not found in epilepsy. Also that the only real difference between the epileptic fit and the metrazol and E.C.T. convulsion was in the mode of onset, and therefore the fractures after therapy were due to flexion spasms during the "first clonic phase" of metrazol and the "initial flexion phase" of E.C.T.

From our results, and in substantial agreement with Reed and Dancey (1940), Cook and Sands (1941), Moore *et al.* (1941), and Barrett *et al.* (1942),

we can say that fractures in epilepsy are *mutatis mutandis* of the same type and distribution as those resulting from convulsion therapy, and that their incidence is comparable to that resulting from metrazol therapy. The main plank on which the theory of Worthing and Kalinowsky rests thus falls to the ground, and we can now express our agreement with the views of those workers like Wespi (1938), and Friedman, Brett and Vogt (1940), who have maintained that fractures may occur at any phase of the convulsion. There can, of course, be little doubt that the acute flexion spasms of onset of the therapeutic seizure may be a potent factor in producing fractures, but the absence of such phenomena in epilepsy proves that vertebral compression can be produced also during the tonic and clonic stages of the fit.

It is recognized that the electrically-induced convulsion is less strenuous than the metrazol or epileptic fit (Cook, 1944), and this is probably the main reason why fractures are less common after E.C.T. than after metrazol or epilepsy.

Further light is thrown on this subject and further evidence obtained against the theory of Worthing and Kalinowsky by our interesting findings regarding the effect of E.C.T. on the spines of epileptics. It will be remembered that 21 epileptics were given courses of E.C.T. without taking any precautions to prevent vertebral fractures, and in no case did any fresh fractures occur. If the mechanism of fracture production in E.C.T. had been different from that of epilepsy, we would have expected to find at least two or three patients with fresh fractures of dorsal vertebrae at the end of the treatment. On the other hand, the results do not surprise us if we believe that the mechanism is in fact similar in both cases, though weaker in E.C.T.

(5) *Individual Liability to Fractures.*

We are now in a position to attempt to solve the important question: Why do some patients get fractures and not others?

The findings of the present investigation agree with those of Easton and Sommers (1942), who reported that it is not previous spinal damage which determines the incidence of fractures. In no case among our patients was there evidence of E.C.T. producing fresh damage to old compression fractures due to epileptic fits. Some of our patients had kyphosis, scoliosis and spinal arthritis before treatment, but these changes did not appear to render them more liable to sustain vertebral fractures during electrical convulsion therapy.

A positive contribution towards the solution of the problem is afforded by the results of our clinical observations on the type and individual variations of the convulsions electrically induced in our epileptics. We have seen that certain patients have their fits in a predominantly flexed posture, and that others have convulsions in extension; while some patients are intermediate in pattern, sometimes straight, and at other times flexed or extended. We have also seen that each individual varies his posture to a certain degree from fit to fit, but that on the whole he remains in his own class. And the most important finding was that there was a definite correlation between these classes and the incidence of vertebral fractures. Fractures were present in

the "flexion class" and absent in the "extension class," while the intermediate posture class had a certain number of fractures. This means that, other things being equal, a patient's liability to fractures depends on his individual convulsion pattern, and this in turn probably depends on individual variations as regards the central neurological mechanism governing the muscular movements. From the fact of the day-to-day variation it would appear probable that this pattern is rather of a functional than a structural nature, and it may be that further investigation may bring to light factors which are capable of influencing it. One possible line of approach would be to investigate whether different electrode positions or varying electrode sizes have any effect on the convulsion posture, and it is planned to study this question in the future. The possibility of different electro-encephalographic pictures in the different classes of patients is also of interest.

In connection with the views here put forward it is appropriate to quote from the paper of Strauss, Landis and Hunt (1939), who investigated the metrazol seizure with the aid of accurate apparatus. They said: "Certainly all human epileptic seizures are not the same . . . some of our patients developed a flexion (of the arms) in one attack and an extension in another attack. This proved that in spite of the simultaneous innervation of all muscles the final position of the body is certainly not the result of an *equal* activity of these muscles. There must be central factors determining differences in the degree of innervation of the various muscle groups. What the reason may be for these differences in innervation in repeated experiments on the same subject we do not know."

(6) *Significance of the Fractures.*

The fact that we have established so firmly the similarity of vertebral lesions in epilepsy and convulsive therapy is of the utmost importance when we come to discuss the significance of these fractures in practice. The main weakness of previous assessments of the seriousness of this complication of E.C.T. was the comparatively short period during which the treatment has been carried out. It may well be that such fractures of the dorsal spine produce no immediate serious ill-effects, but this is no guarantee of what will happen in fifteen or twenty years' time, especially in view of the gross structural changes which take place in the vertebral bodies in many cases.

The present study has shown that a large proportion of epileptics have fractures which are identical in type, similar in location, and probably produced by the same forces as those found after convulsion therapy. The literature contains no accounts of any disabilities suffered by epileptics which could be ascribed to these lesions, and in our own cases a careful clinical investigation has failed to uncover any significant sequelae. We cannot be sure of the age of the fractures in our own epileptic patients, but they may well be of fifteen or twenty years' duration in some instances, and they can be used as demonstrations of what the E.C.T. fractures will be like in the distant future.

Why gross compression fractures of dorsal vertebrae should be harmless when similar lesions in the lumbar and cervical regions are so dangerous is a

difficult matter to explain, and the literature on the subject contains no satisfactory theory. My own suggestion is that structural changes in vertebral bodies are only of importance in regions where movement is taking place: the dorsal part of the spine, especially the middle region of it, is normally not required to move in the antero-posterior plane, and in fact acts as a steady fulcrum for the respiratory movements; because of this, changes in contour of these vertebral bodies are of little significance.

CONCLUSIONS.

(1) Fractures of dorsal vertebrae occur in 33 per cent. of male epileptics who suffer from frequent *grand mal* fits.

(2) The incidence of vertebral fractures in epilepsy is the same as in patients who have had pharmacological convulsion therapy.

(3) The type of vertebral lesion in epilepsy is the same as after convulsion therapy.

(4) The fractures in epilepsy are located a little lower down in the dorsal spine than those due to convulsion therapy. This may be associated with the fact that epileptic fits often occur with the patient in a vertical position, whilst convulsive therapy is invariably carried out with the patient lying horizontally.

(5) The mechanism of production of fractures in epilepsy and convulsion therapy is probably identical, the main factor being the force of muscular contraction during a flexion spasm.

(6) Vertebral fractures may be produced at any stage of the convulsive seizure.

(7) The smaller incidence of fractures after electrical convulsion therapy is probably associated with the fact that the seizures are less strenuous than those of epilepsy or cardiazol.

(8) The details of the convulsion in any individual vary on different occasions, but conform with some consistency to a characteristic pattern.

(9) A patient's liability to sustain fractures of the dorsal spine depends partly on his type of convulsion pattern.

(10) Patients may be divided into three main classes as regards posture during the convulsions: (1) Those who have their fit in a position of spinal flexion; (2) those who have their fit in a position of spinal extension; (3) an intermediate group whose spines are either straight, flexed or extended on different occasions.

(11) Patients in class (1) are most liable to sustain fractures, and patients in class (2) are least susceptible.

(12) Previous vertebral damage does not increase the patient's susceptibility to fractures.

(13) Fractures of the dorsal spine following convulsion therapy are not likely to lead to trouble in future years, and this risk should not prevent the treatment being carried out.

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ELECTRICAL CONVULSION THERAPY IN THE TREATMENT OF EPILEPSY.

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THE idea of trying to replace the irregular major fits of epilepsy by convulsions, artificially induced under controlled conditions of time and place, is an eminently reasonable one ; but there has so far been no systematic investigation of the therapeutic possibilities of this procedure. The present work, which has been carried out over a period of two years, is intended to clear the ground for such a study ; and this report includes an account of the effect of electrical convulsion therapy not only on the frequency of the fits, but also on the psychotic symptoms which were associated with the epilepsy in many of the patients.

LITERATURE.

In 1938 Clifford Allen suggested the possibility of substituting cardiazol convulsions for the major fits of epilepsy, and in the following year Pozniak and Erb (1939) reported a diminution in the number of spontaneous fits over a short period in ten epileptics treated with metrazol. Sal y Rosas (1941, 1945) has treated more than 100 non-psychotic epileptics by cardiazol therapy since 1938. He found that immediately after the course of treatment there was a decrease in the frequency of spontaneous fits in all cases, but that after a few months the previous rhythm was re-established in the great majority of patients.

Yahn and de Barros (1944) treated nine epileptics both with electroshock and metrazol, and reported a decrease in the frequency of spontaneous fits. They, too, found that after interruption of the treatment the frequency tended to return to the pre-treatment level after a few months. In addition to the courses of weekly convulsions, they also investigated the effect of the application of the therapy at intervals of a month or more and reported favourable results.

Rondepierre and Vie (1942) treated twelve epileptic women by convulsion therapy with no benefit ; and Pacella and Barrera (1942) found an increase in the incidence of spontaneous seizures after the electrical induction of a convulsion in six epileptic patients.

Kalinowsky and Kennedy (1943) also were disappointed with the effects of electrical convulsion therapy in reducing the incidence of fits, although they did report favourable results in two out of twelve patients whom they treated by this method. On the other hand, they were greatly impressed by their success in breaking up twilight states in three of their patients by means of the E.C.T., and they stated that " the effect of an electrically induced convulsion on irritable epileptics was definitely more convincing to us than the prevention of *grand mal* seizures."

Plattner (1941) had previously drawn attention to the usefulness of convulsion therapy in terminating epileptic twilight states; and he described the case of an epileptic girl, who developed attacks of acute excitement and violence after a prolonged period of freedom from fits. These symptoms did not respond to high doses of sedatives, but were immediately dissipated by an azoman convulsion.

Other workers have reported the beneficial effects of convulsion therapy on the symptoms of the behaviour disorders of the chronic psychotic epileptic (Rondepierre and Vie, 1942; Yahn and de Barros, 1944); and Robinson (1943) has described a case of an epileptic girl, suffering from a psychosis of a schizophrenic type, whose symptoms were greatly improved by a short course of E.C.T. She relapsed after three months, and a second course of therapy gave a similar result.

MATERIAL.

Twenty-seven male epileptics have been treated by electrically induced convulsions over periods of 3 to 17 months. The main criteria governing the choice of these patients were that they were having fairly frequent *grand mal* seizures and that they were physically fit. Two of the patients were given treatment because of occasional twilight states.

With one exception they were mental hospital in-patients and 22 of them were suffering from the typical symptoms of an epileptic psychosis.

In all except five cases, the patients had been under treatment for years by routine pharmacological anticonvulsants, and in order not to complicate the issue these drugs were continued unchanged during the present investigation.

TECHNIQUE.

In all the cases except two, convulsions were electrically induced in the ordinary way at regular intervals. The frequency of treatment depended on the incidence of *grand mal* fits in the particular patient, the usual course consisting of two convulsions a week for two or three months, and thereafter one convulsion every seven or ten days. The two exceptions were the patients who suffered from twilight states and who were having very few major fits; they were given convulsions whenever they developed their particular symptoms.

In certain patients extra convulsions were given, in addition to their regular course, when these were considered necessary in order to terminate psychic equivalents.

The majority of the patients have been treated by continuous or "maintenance" therapy, but in order to investigate whether the effects were of a lasting nature or not, the treatment was interrupted in nine of the cases.

In one case treatment was stopped after three months because of an increase in the patient's spontaneous fits.

The total number of convulsions induced in the 25 patients who have had regular treatment has been 1,183, which gives an average of 47 convulsions per patient. The highest number in any individual case has been 100 con-

vulsions. The average period under treatment has been eight months, and the longest individual course has lasted 17 months.

Treatment was given preferably when the patient's stomach was empty, in order to prevent gastric upsets. No special precautions were taken to prevent vertebral fractures, and no restraint was used during the convulsions.

The convulsion threshold in 22 patients who were having anticonvulsant drugs was higher than normal—the average dose needed to induce a convulsion was 120 volts for 0.5 seconds; and some patients needed as much as 150 volts for 0.8 seconds. The corresponding values for the five epileptics who were not being treated by drugs were 95 volts and 0.4 seconds, which is about the same as for non-epileptic psychotics.

A simplified lightweight electro-convulsant apparatus was used to induce the convulsions, and the average time needed for the treatment was usually about one minute per patient (Caplan, 1945).

RESULTS.

TABLE I.—*Showing the Effect on Psychotic Behaviour and Frequency of Major Fits in 25 Epileptics Treated by E.C.T.*

Case No.	Drugs.	Period of treatment in months.	Total E.C.T. convulsions.	Psychotic mental behaviour.		Monthly number of major fits.	
				Before treatment.	During treatment.	Before treatment.	During treatment.
114	—	10	42	C.	R.	3	0.3
117	P.	10	40	A.	N.	3	0.3
120	—	9	46	A.	I.	3	0.5
102	E.	12	65	A.	M.I.	4	0.5
111	E.	12	88	A.	M.I.	3.3	0.5
107	E.	17	63	—	—	3.5	0.3
100	E.	5	30	A.D.	N.	4	0.2
121	P.	3	10	A.	M.I.	2	0.3
127	E.	4	22	A.	R.	3	0.5
128	P.E.	6	52	A.	M.I.	11	0.2
131	Rl.E.	3	12	—	—	3.5	0
109	P.	13	49	A.	M.I.	3.5	1
101	E.	6	24	A.D.	N.	3.5	1
110	P.	6	34	A.	I.	3.5	1.5
115	—	8	46	C.D.	I.	4	2
116	P.	9	70	A.	N.	10	3.5
104	P.	14	100	A.	N.	9	2.3
106	P.	10	61	C.	M.I.	7.6	3.8
130	Rl.	3	13	—	—	6	2
118	E.	5	32	A.D.	N.	5	2
113	P.	14	79	A.	M.I.	6.5	4
112	P.	10	42	A.D.	N.	4.5	3.2
105	P.E.	13	77	A.D.	I.	4	2.5
103	P.E.	10	41	A.D.	N.	4	1.8
99	P.	3	14	C.D.	N.	14	17

Key.—Drugs: P., phenobarbitone; E., epanutin; Rl., rutilon. *Psychotic behaviour:* C., confused; A., aggressive; D., demented; R., recovered; M.I., much improved; I., improved; N., no change.

(1) *Effect on Frequency of Major Fits.*

Twenty-five patients have received prolonged courses of regular treatment, and in all except one this has resulted in a decrease in the frequency of their spontaneous major fits during the period from an average of 5.2 fits per month to an average of 2 a month.

In 20 cases the fits have been reduced to less than half, and in 15 cases to less than a third of their previous incidence.

In eleven cases (grouped at the top of Table I) the results have been striking—the previous average was four fits per patient per month, and this was reduced to less than one fit in three months over an average treatment period of seven months.

Few of the patients suffered from *petit mal* attacks, and the investigation has yielded no dependable information with regard to the effect on these of the E.C.T.

TABLE II.—*Effect of E.C.T. on Monthly Number of Fits.*

Case No.	Monthly average number before treatment.	Number of major fits per month during treatment.																Average per month.	
		Consecutive months.																	
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	
114	3	0	0	0	0	0	0	3	0	0									0.3
117	3	1	0	0	0	2	0	0	0	0	0								0.3
120	3	0	0	0	0	1	3	0	0	0									0.5
102	4	4	1	1	0	0	0	0	0	0	0	0	0	0					0.5
111	3.3	0	0	0	1	1	1	3	0	0	0	0	0	0					0.5
107	3.5	0	1	2	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0.3
100	4	0	0	0	0	1													0.2
121	2	1	0	0															0.3
127	3	0	2	0	0														0.5
128	11	0	0	0	1	0	0												0.2
131	3.5	0	0	0															0
109	3.5	1	2	0	2	1	1	2	1	0	0	2	1	1					1
101	3.5	2	2	0	1	1	0												1
110	3.5	4	0	1	2	0	2												1.5
115	4	1	1	3	2	4	1	2	3										2
116	10	0	3	4	0	6	5	6	4	3									3.5
104	9	2	6	5	2	2	1	2	3	0	0	1	2	1	5				2.3
106	7.5	2	2	2	1	3	10	4	2	6	6								3.3
130	6	3	0	3															2
118	3.5	2	0	4	1	2													2
113	6.5	24	8	17	4	6	1	1	3	0	0	0	0	0	0				4
112	4.5	7	0	3	1	1	5	7	3	3	2								3.2
105	4	3	2	0	0	1	3	4	6	6	1	4	4	1					2.5
103	4	2	0	4	0	3	3	2	1	1	1								1.8
99	14	22	6	23															17

(2) *Effect on Associated Psychosis.*

Twenty-two of the patients suffered from an associated psychosis, and showed the characteristic troublesome symptoms of irritability, aggressiveness, and destructiveness, together with a varying amount of mental confusion. Eight of that number showed the symptoms of organic dementia.

As a result of the treatment two patients recovered and were deemed fit to leave hospital and seven patients were much improved—they lost their former irritability and quarrelsomeness, they became friendly and co-operative, and they were able to work usefully in the wards and occupational therapy departments. None of these patients had previously been classified as suffering from dementia.

Of the rest, 9 patients were unchanged by the treatment—7 of these were demented; and 4 patients were slightly improved—they were less irritable and aggressive, but were still not able to occupy themselves usefully. This group included two dementias.

Out of the 14 psychotic patients who were not demented, 2 recovered, 7 were much improved, 2 were slightly improved and only 3 were unchanged during the period of convulsion therapy.

Table I illustrates that, on the whole, those patients whose fits were most reduced also showed a greater improvement in their mental symptoms, but there were many exceptions, and there was little evidence of an absolute correlation.

(3) *The Transient Nature of the Effects of Treatment.*

In order to determine whether it would be possible to administer this treatment in short courses, or whether, as seemed more likely on theoretical grounds, it would have to be continued indefinitely as a form of "maintenance" or "replacement" therapy, treatment was interrupted in nine of the cases after its beneficial effects had become definitely established. In all these cases the spontaneous fits began to return to their previous frequency after approximately one month's interval, and the mental symptoms returned a week earlier.

(4) *Effect on Epileptic Twilight States.*

Seven patients suffered from recurrent twilight states during which they became uncontrollably violent and destructive. On nineteen such occasions E.C.T. was given as an emergency measure, and in all except one case it was completely successful in terminating the troublesome episode. Usually a single convulsion was sufficient, but occasionally the symptoms persisted in a milder form until the induction of a second convulsion after an interval of an hour.

ILLUSTRATIVE CASES.

(1) CASE 102.—Patient O. J. P—, aged 45, single, tinworker. Admitted to C.C.H. as a certified patient on 4.vii.41. He has suffered from epilepsy since 1919. On admission he was confused, restless, suspicious and violently combative. He quietened down within a few weeks, but remained irritable and quarrelsome, interfering and complaining, and liable to sudden outbursts of violence. He was treated at first with sodium gardenal, gr. 1, *t.d.s.*, and since 9.iii.43 with epanutin, gr. 1½ *t.d.s.*, but his major fits had never averaged less than four a month.

On 22.viii.44 he commenced electrical treatment, and during the following week he had four spontaneous fits. Treatment was at first given once a week, and after five convulsions it was increased to twice a week until 29.i.45. In the third week he had another spontaneous fit, and subsequently during the next five months he only had one further fit. His behaviour improved greatly—he became friendly and was no longer aggressive, his irritability disappeared, he was working well in the ward without supervision, and he was going regularly on visits to his relatives, who reported that his conduct outside was exemplary.

After 29.i.45 the E.C.T. was interrupted in order to see how long its effect would last.

His behaviour started to deteriorate three weeks after the last electrically induced convulsion; he became once again sullen, irritable, argumentative, and aggressive; and within a fortnight he had relapsed completely to his former psychotic state. He remained free from fits till 29.ii.45, and then during the next two months he had eight major attacks.

The electrical treatment was started again on 30.iv.45, at the rate of one convulsion a week. During the subsequent six months he has remained completely

free from spontaneous fits, and his psychotic symptoms have once more almost completely disappeared.

At the end of October, 1945, he had been given a total of 65 convulsions in 12 months of treatment. There was no clinical sign of any intellectual deterioration, and he appeared clearer mentally than before starting the therapy.

(2) CASE 107.—Patient, W. E. I—, aged 25, single, merchant seaman. Under treatment as an out-patient since 20.iii.44, suffering from epilepsy, which started in 1940. He had received all the usual pharmacological treatments, and had lately been on epanutin, gr. 1½, *b.d.*, and pot. brom., gr. 20, *t.d.s.* Despite this treatment he had still averaged three to four major fits a month. His fits usually came on in the mornings, and were followed by headache and drowsiness, which incapacitated him for the rest of the day. Physical examination and investigations failed to reveal any organic abnormality.

On 29.iii.44 E.C.T. was started, and he was given a convulsion once a fortnight. His fits ceased, and he did not have one until 22.v.44. He had a second fit a month later. The electrically induced convulsions were then increased to once weekly, and between 30.vi.44 and 26.i.45 he came up to the hospital every Friday morning for treatment, and left an hour afterwards to return to his work. He had been forced to give up his job as a seaman because of the frequent fits, and had been unemployed for two years. Shortly after commencing his electrical treatment he obtained employment as a labourer in a timber yard, which job he has kept up to the present day. His bromides were gradually cut down, and then discontinued; but the epanutin has been carried on.

In the seven months during which he was given treatment he only had two spontaneous fits, and these were not followed by the usual post-epileptic confusion and headache.

On 26.i.45 the convulsion treatment was interrupted. In order to try to keep the other factors in the situation constant, he continued to come up once a week and the routine procedure was carried out, but the dose of current and time was adjusted to give him only a pre-convulsive (*petit mal*) seizure. On one occasion (2.ii.45) a convulsion was accidentally induced with 70 volts and 0.1 seconds, but apart from this he had no therapeutic convulsions until 31.iii.45. His spontaneous fits commenced again after four weeks, and in the subsequent month he had four *grand mal* attacks, which were followed by confusion and headache. He became very despondent at what he considered to be the diminishing effect of the convulsion therapy, so E.C.T. was recommenced. During the next seven months he has had only one spontaneous fit.

At the end of October, 1945, he had been given 63 convulsions in 17 months of treatment. He was happy and cheerful, he was working steadily and efficiently, and there was no clinical evidence of any adverse effect of the prolonged treatment on his intelligence or his personality.

(3) CASE 113.—Patient R. H. R. S—, aged 33, single, coal-tipper. Admitted to C.C.H. on 15.i.43, as a certified patient suffering from epilepsy, which had started when he was 20 years old. He suffered from frequent major fits and epileptic twilight states. He was usually irritable, quarrelsome and aggressive; but during his periodic twilight states, he was wildly excited and violently destructive; and being a very powerful man, weighing 16 stone, he was almost completely unmanageable. At such periods drugs were only of use if he was given enough to put him to sleep—and on awakening he would start off again. During the 18 months before commencing E.C.T. he had broken over 150 windows in the hospital. Despite treatment with phenobarbitone, he averaged six to seven major fits per month.

Regular treatment with electrically induced convulsions was started on 2.x.44, and was continued twice weekly until 17.viii.45, when it was decreased to once a week because he became confused. The confusion cleared up in a fortnight.

During the first five months of treatment there was no reduction in the number of his major fits, but in the next nine months he had a total of only five spontaneous fits. The effect on his psychotic symptoms has also been satisfactory. His general irritability and quarrelsomeness have largely disappeared, and he is now playing a normal part in the social life of the hospital. He attends the patients' dances and cinema shows regularly, and he is a trustworthy worker in the ward. The twilight states have decreased from an average of two or three a month to seven in

14 months of treatment, and on each occasion they have been dramatically cut short by electrically induced convulsions given as an emergency measure. There has been no further window breaking, and in place of an almost insuperable problem he has become a quiet and relatively dependable patient.

The total number of electrically induced convulsions in this case has been 79, and apart from the short period of confusion, mentioned above, there have been no adverse effects.

COMPLICATIONS.

No severe or alarming complications have been experienced during the course of this investigation.

(1) *Increase in Frequency of Fits.*

In three cases there was an increase in the frequency of spontaneous fits on commencing the electrical treatment. In two of them this did not last longer than the first two months, and was followed by a reduction in number. In the other case the fits increased from an average of 14 per month to 17, and treatment was discontinued after three months because of this. The patient has suffered no ill effects, and is now back to his previous condition.

(2) *Increase in Confusion.*

In a few cases the patients have gradually become more confused, especially when given treatment twice a week. This confusion invariably disappeared when the frequency of induced convulsions was subsequently decreased.

(3) *Vertebral Fractures.*

All patients have been X-rayed before and after treatment, and no vertebral fractures due to convulsion therapy have been found.

(4) *Intellectual Deterioration.*

Despite the larger number of convulsions electrically induced in many of the patients, there has been no clinical evidence of any consequent intellectual or personality deterioration.

DISCUSSION.

Temple Fay (1942) has pointed out that the pattern of muscular movements in an epileptic fit is characteristic of the amphibian level of development, and is similar to the actions of an amphibious animal which has wandered too far from the water's edge, and is trying to flap its way back. He regards the convulsion as "a normal defence reflex of simple pattern, evolved for the purpose of protecting the economy against alterations in the basic formula of water, oxygen and certain salts." And he has emphasized that the convulsive mechanism is not pathological in itself but "as a latent or retained 'mechanism of defence' it may be potentially present throughout life without need for expression."

Flescher (1942) regards a convulsion as a means of harmlessly discharging the energy of the Death Instinct, of unloading the "huge amounts of energy inherent to the death and destructive drives" in an "individually and socially harmless manner."

Freud (1945) has considered the epileptic fit, "as though a mechanism for abnormal instinctual discharge had been laid down organically, which could be made use of in quite different circumstances, both in the case of dis-

turbance of cerebral activity due to severe histolytic or toxic affections, and also in the case of inadequate control over the mental economy, and at times when the activity of the energy operating in the mind reaches crisis-pitch."

Muskens (1928) has postulated a "detoxicating action" for the fit, and a similar theory (Caplan, 1945) regards the epileptic convulsions as a discharge mechanism for excess cerebral electrical energy.

Whether one agrees with the details of any of these theories, the results of the present investigation, as regards the effect of E.C.T. on epileptic twilight states and on the irritability and aggressiveness of the epileptic psychosis, certainly favour the general idea of some sort of "unloading function" for the convulsive seizure. And our findings even on so limited an amount of material, point to this therapy as the treatment of choice in dealing with epileptic twilight states, and agree on this point with the opinion expressed by Plattner (1941), and Kalinowsky and Kennedy (1943).

That artificially induced convulsions should relieve psychotic symptoms in patients who are already having spontaneous epileptic fits is not so easy to understand. A possible explanation may be based on the main difference between E.C.T. and epileptic fits, namely, that the former is given at regular intervals, whilst the latter take place sporadically and usually without any sort of rhythm. Induced fits can, therefore, be arranged to keep the "aggressive energy" at a fairly uniform low level, and the driving power of the symptoms can be continually drained away. The successful cases in the present investigation illustrate this, and so does the result of interrupting the E.C.T. The transient nature of its beneficial effects is not surprising. As soon as the regular "unloading" process was stopped, the energy began to mount up once more, and in a few weeks the irritability and aggressiveness began to return. It is interesting that the mental symptoms returned in each case before the spontaneous fits started. This lends further support to the theory that the latter have the function of dissipating the forces responsible for the symptoms, and can hardly be reconciled with the old idea that the psychotic symptoms of epileptics are a direct consequence of the repeated fits.

Another question now arises: Why is it that some of the epileptic psychotics did not respond to treatment in the above manner? The limited experience of the present investigation permits only of a tentative hypothesis. It has been seen that most of the patients in this group were in a state of organic dementia, and this may mean that what was in the other patients a functional predisposition has progressed in these cases to a structural alteration, which no longer allows the excess energy to be discharged adequately along the convulsive channels.

There is one mental symptom which has been seen to be produced as an after effect of the convulsions, and that is the symptom of clouding of consciousness and confusion. The fact has also been noted that when this arises as a result of too frequent treatment, it is of a functional and reversible nature, and can always be dissipated by spacing out the induced convulsions more widely. Our results agree with those of Moore (1943), who has treated psychotics with E.C.T. over long periods, and has found no appreciable deterioration in personality or intelligence.

The absence of alarming complications in the present investigation is of some importance, since it used to be thought that convulsion therapy was contra-indicated in patients whose history revealed even a suspicion of possible epilepsy. The safe induction of nearly 1,200 convulsions in various types of epileptics allows of the conclusion that this treatment is reasonably free from risk.

The chief problem raised by the findings of the present investigation must now be considered, namely, the value of E.C.T. as a method of preventing the epileptic fits themselves. And again it must be admitted that the material investigated is too limited in extent to permit of any absolute conclusions, but the results have certainly shown that the spontaneous fits can be materially decreased in many epileptics. In most cases we have not been able to replace the fits by an equal number of induced convulsions, nor could this be expected on theoretical grounds, since we are dealing with an irregular dysrhythmia on which we are trying to impose some degree of regularity. Future research may find a solution for this problem, but at the moment it is necessary to induce a slightly larger number of convulsions in order to prevent the spontaneous fits. And when we add to this the fact that the treatment has no lasting effect, and must be continued indefinitely in order to keep the patient free from fits, we are faced with the question of whether the E.C.T. has any value as a method of therapy in epilepsy, or whether Kalinowsky and Kennedy (1943) were correct in their assumption that "no practical value can be attributed to such a procedure." The answer to this question depends upon other factors than the results of the present investigation. It has been demonstrated that in certain cases fits can be almost entirely eliminated by this treatment, but whether the individual patient would be willing to submit to the inconvenience of regular electrically induced convulsions over an indefinitely long period in order to achieve this result is a matter which will depend essentially upon the circumstances of the case. A mental hospital in-patient, who lives his life in sheltered surroundings and free from the responsibility of earning his living, would benefit little if his fits were replaced by induced convulsions. But many patients outside hospital, who are exposed to the danger of having a fit at any unexpected moment, and who may be prevented by this from carrying on with their work and supporting themselves and their families, would probably be eager to avail themselves of the possibility of spending an hour once or twice a week in "unloading" their "epileptic energy," so that they could be relatively free from fits for the rest of the time. And despite adequate treatment with the pharmacological anticonvulsants, it is felt that the number of such patients would be considerable. Whether it would be possible to provide facilities for the treatment of all these cases is a question which is outside the province of the present paper, except to point out that, with the technique employed in our investigation, the therapy can be efficiently carried out in about one minute per patient, which is not more time consuming than most medical procedures.

The treatment of the out-patient (Case No. 107), previously described, provides an example of the kind of result which can be achieved in certain cases, and whether he will prove to be the prototype of many more will only be shown by further investigation and practical experience.

SUMMARY.

- (1) Twenty-seven epileptics have been treated by electrically induced convulsions.
- (2) Twenty-five patients have been given regular treatment over periods of up to 17 months' duration.
- (3) In 24 cases the frequency of the major fits has been reduced, in 15 of them to less than one third of their previous incidence.
- (4) In 11 cases there has been a reduction from an average of 4 fits a month per patient to less than 1 fit in 3 months.
- (5) In 14 patients who suffered from an associated psychosis without dementia the symptoms were ameliorated in all except 3.
- (6) The treatment must be given as a form of continued replacement therapy because its effects are transient—9 successful cases relapsed completely a few weeks after interruption of the treatment.
- (7) Out of 19 cases of epileptic twilight state treated by E.C.T. as an emergency measure the condition was terminated satisfactorily in all except one case.
- (8) In nearly 1,200 electrically induced convulsions no serious or alarming complications have been experienced.

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INDICATIONS FOR THE TREATMENT OF MENTAL DISEASES BY PHYSICAL METHODS.

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SINCE the work of Sakel, v. Meduna and Moniz, a large number of papers have been published on physical methods of treatment. Statistical studies of the results of these forms of treatment have been most commonly used and have demonstrated their usefulness.

In this paper we shall attempt to compare the results obtained from convulsive and insulin therapy and from leucotomy, and to study the type of symptoms amenable to these treatments, and their relation to the diseases that produce them. It has seemed to us that such a study would be able to throw some light on the inner structure of the psychoses, and on the mechanisms of action of these treatments.

We have used these methods in more than 1,500 patients since 1936, in the psychiatric clinic of the Lisbon University, in the Manicomio Bombarda, and since 1942 in the Julio de Matos Hospital. The results with the individual methods have been published elsewhere (1, 2) except those of insulin treatment, which will shortly be published in collaboration with Nunes da Costa.

This comparative study shows immediately that :

1. These methods are not specific to any special disease, but are useful in schizophrenia, manic-depressive psychosis, symptomatic psychosis, psychotic states in organic encephalography (encephalitis, G.P.I., etc.), and psychogenic and psychopathic reactions.
2. They can be used, concurrently or consecutively, in the treatment of the same psychosis as frequently happens in schizophrenia.
3. The symptoms modified by each form of treatment are very similar in the various diseases.

In our experience convulsive therapy has given useful results in—

Depressive states (with retardation, anxiety, agitation, tension and perplexity, hallucinations, and ideas of reference or delusions of enhanced significance).

Manic and excited states, ecstatic, erotic, expansive, with polymorphic, syntymic delusions and hallucinations.

Emotional lability with elation silliness and patheticism.

Dysthymia (sudden change of mood, expansive or depressive, dull and irritable, sensitive or querulous).

Delusional mood (with bewilderment, derealization, depersonalization, **significant**, cosmic and reference delusions).

Alteration of the vital feelings (with somatic anxiety, physical complaints, **and** their delusional hypochondriacal elaboration).

Akinetic (stupor) and hyperkinetic states (with expressive, reactive and **primitive** movements, short circuit and impulsive actions).

Psychomotor agitation (with hallucinatory or delusional basis).

Confusional and twilight states.

Paranoid states, with alteration of the whole personality, anxiety, perplexity, **altered** states of consciousness—slight clouding or exalted awareness of **significance**.

As it has already been stated, these symptoms are not specific to any particular disease entity, but may occur in almost any psychotic or psychogenic illness. The symptoms themselves are very similar in the various mental diseases, but if the quality and degree of recovery varies, it depends, as we will see later, on the evolutionary tendency of the basic process whether it be psychogenic (complex or conflict) or organic (encephalitis, G.P.I. or dementia).

These symptoms arise from positive or negative variations of psychological functions, such as awareness, attention, mood state, psychomotor activity, which in the normal state have periodic cyclical variations, with day or night, seasons, fatigue, etc.

Also the changes in thought processes mentioned are closely related with the basic instinctive, affective and attention alterations, and can be described under inhibition, disinhibition, flight of ideas and incoherence, all total alterations in the course of thought processes, capable of rapid commutations, probably dependent on a mid-brain regulation. The delusional and hallucinatory symptoms, like the changes in the thought processes, are part of total personality disturbance, and have the same character as the delusional formations of the anxious and confusional patients.

These changes in psychological functions are very frequently accompanied by changes in vegetative functions of the basal ganglia, as is shown by the frequent alterations of sleep, weight, menstruation, water metabolism, secretions and vasomotor tone, which accompany them. It is interesting to note that these types of symptoms can disappear or change under the action of strong cerebral stimuli. We have seen it happen after leucotomy, and it is common knowledge that it may occur after great emotional shocks, cerebral trauma, asphyxia, and sudden metabolic changes, such as come with pyrexial and infectious diseases. With tumours or focal lesions of the third ventricle similar symptoms often disappear after removal of the lesion.

With convulsive therapy these states may completely recover or alter to closely correlated states: thus depression into mania, hypokinesia into hyperkinesia. Negative variations tended to change more easily into their positive correlates. Positive variations require more intensive treatment and have a greater tendency to relapse. Depressives may become hypomanics; manias relapse more frequently.

The best results are obtained in "vital depression," akinesia, dysthymia and twilight states, i.e., those symptoms depending on a kind of vegetative

regulation. When some of these symptoms co-exist they may have an independent evolution—for example hyperkinesia and elation may change to akinesia and elation. Then mixed states develop with discordant symptomatology, darkening the prognosis, until continuation of the treatment clears the picture. The more complex the symptomatology, e.g., presence of hallucinations and delusions, the more difficult the treatment becomes.

INSULIN THERAPY.

Insulin therapy has proved useful in paranoid states, with ideas of reference and delusions of enhanced significance, cosmic and religious experience, delusional inspirations and intuitions, conceptual conflicts of polar character, generally accompanied by increased awareness of significance and perplexity.

Passivity feelings, ambivalence, concretization of ideas and images, with awareness of a fleeting character of inner experience and low tenacity of attention. If these feelings are not in this setting of altered awareness and attention, not always easy to establish, they have a bad prognosis.

Altered spiritual feelings, altered sense of values, fanaticism, new political and moral views.

Loss of elasticity and reactive affective capacity, with discordant affect.

Hallucinations: It is not the mere presence or absence of hallucinations which is important, but their basis and characteristics. In anxiety, tension, perplexity, altered states of consciousness, hallucinations are dependent on these states and disappear with their recovery. A similar situation arises with hallucinations of delusional mood, reference states and many of the so-called physical and sexual hallucinations, in reality delusional interpretations of the altered vital feelings of the body.

Under the action of insulin these symptoms weaken, lose their grip on the personality, and finally disappear. Insulin seems to act in relation to the more differentiated functions of personality, such as the dynamic and spiritual feelings, the interests and motivations, and capacity for concentration and intellectual activity as opposed to the alterations of awareness, mood and psychomotor activity more accessible to convulsive treatment.

Insulin has a general sedative action, which can be seen even before the appearance of comas, and may be utilized in the treatment of acute and chronic excitement states. In states of emotional instability, as may appear in hebephrenic excitements and symptomatic and cycloid psychosis, as well as in certain states with slight clouding of consciousness, can the sedative action be lost in greater affective instability or in the aggravation of the clouding of consciousness? We are in agreement with Sargent (3) that insulin is contraindicated in depressive states unless they are accompanied by tension or anxiety. In pure depressive states people feel worse, and it produces no improvement in their general condition. If improvement in their mental state does not quickly follow the encouraging and often great gain in weight, then prognosis is poor.

Gain of weight, like the sedation, can be produced by subcoma doses, and such "modified insulin treatment" can be used for the treatment of exhaustion

states, drug addiction, and asthenic psychoneuroses. Sargant (4) has made extensive use of this form of treatment in war neuroses, and accepts as its principal indication those psychoneuroses accompanied by great loss of weight.

Insulin has a favourable effect on personality; it often produces in the individual better affective contact, awakening of sympathy, feeling and interest, extraversion and better adaptation to the environment, more objective attitude to the psychotic symptoms, especially the delusional and hallucinatory. If the psychosis is not cured, the personality changes are extremely useful to the application of occupational therapy and psychotherapy and to the future integration of the patient in society. Some patients finish insulin treatment with better personalities, to the astonishment of parents and friends.

COMBINED METHODS.

We have frequently seen the combined use of insulin and convulsive therapy save situations in schizophrenia, depressions and atypical psychoses which had not responded to either alone. In these cases we found insulin and cardiazol more effective than insulin and E.C.T. For depressions we give insulin-cardiazol treatments two or three times a week. In schizophrenias we try this form of treatment if the patient has not responded as expected after 20 comas. Unlike Giorgi (5), who gives cardiazol in the second hour of insulin treatment, we use it in the third hour on the verge of the deeper coma stage. Psychoses with slight clouding of consciousness or with marked affective lability did the best with no insulin on cardiazol-free days.

Shock methods have proved a life-saving form of treatment in the syndrome known as "delirium acutum" or "acute fatal catatonia," which is accompanied by high irregular fever, tachycardia, leucocytosis, and increased blood urea. Leonhard (5) used cardiazol, and we found E.C.T. also of value, but not as effective as cardiazol. Somatic symptoms respond in a dramatic way, and fever and leucocytosis come down with each treatment. In the most advanced cases we give one or two fits daily for two or three days. Death is liable to occur more by under- than by over-treatment. Careful nursing and special care to avoid dehydration must be pursued side by side with convulsive treatment. When the acute stage is over E.C.T. is continued or insulin commenced, depending on the residual symptoms.

E.C.T. followed by insulin has also been used in the acute agitated psychoses, but usually by quick stepping up of insulin the necessary sedation is as soon produced.

Kögler (6) has used the quick stepping up of insulin and two treatments a day in delirium acutum, and claims good results. Our experience has not been favourable, and in some cases it has seemed that fever and confusion were aggravated.

Other forms of combined methods can be used. E.C.T., which had been ineffective in depressive states and in chronic excitement states, may become effective after leucotomy. Sands (8) has used successfully a combination of modified insulin and narcosis. Azevedo Mota is studying in Lisbon the combination of E.C.T. and fever.

LEUCOTOMY.

In leucotomy we consider the shock action, in many ways similar to that of convulsive therapy, that is effective in the same kind of symptoms, sometimes resulting in dramatic recoveries, and personality and vegetative changes of a far different nature. In general we can say that certain functional and organic deviations of behaviour are compensated by a new set of deviations produced by cerebral intervention.

The loss or attenuation of interest, initiative, spontaneity, emotional resonance and awareness of self have a beneficial effect on many symptoms, such as agitation, aggressiveness, impulsiveness, negativism, stereotypy, loquaciousness, depression, anxiety, tension, hypochondriacal pre-occupations, delusional activity and hallucinations. In depressive and anxiety states, the tension and anxiety, the emotional repercussion of the patient's preoccupation become less marked, though the fundamental depressive attitude may not disappear. In manic states we have seen an appreciable attenuation of the agitation and affective exaltation, but the typical manic ideation persisted, though the flow was smaller.

It is important to have a good knowledge of prepsychotic personality because of the possible aggravation of certain trends of character, such as apathy, irritability, disinhibition. If the psychosis changes of personality are similar to the above stated, leucotomy may further aggravate them except in marked irritability, which may be lessened. Leucotomy allows a new integration of personality which goes on for two or more years. Unless careful and intensive rehabilitation is pursued the possible benefits of the operation cannot be obtained.

DISCUSSION.

The therapeutic action of physical methods seems to have no bearing on the aetiological causes of the psychoses. The same factors of favourable or unfavourable prognosis for spontaneous evolution, such as environment, constitution, personality, the acute or insidious onset, the tendency to recovery, fluctuations or progressive deterioration, have the same importance in the case of therapeutical recovery. We can see the total recovery of a depressive state without influencing in any way the organic process and symptoms in more direct relationship with it. We have seen such an evolution in a case of G.P.I. beginning with a depressive state, in which there was rapid recovery of the latter with convulsive treatment; the paralytic process manifested itself afterwards by its neurological and humoral symptoms, which cleared up with malaria treatment.

On the other hand, the treatment of organic diseases causing psychotic symptoms can have no influence on these symptoms if they are of the type usually curable by physical methods. In a case of G.P.I. total humoral recovery by specific treatment was not accompanied by any change in akinesia and mutism which characterized the mental state, but which cleared up promptly with E.C.T. Some hallucinatory paranoid states, coming on after malarial treatment do well on convulsive and insulin treatment or leucotomy.

Akinetic states in pellagra which do not recover after nicotinic acid do very well with E.C.T. Post-infective stupors may last months until a few convulsive treatments stop them, and the same can be said of a great number of symptomatic psychoses. Of particular interest was a hallucinatory paranoid state in pernicious anaemia, which persisted despite a normal blood picture produced by hepatic extracts, but was cured by E.C.T.

E.C.T. is of no avail in reactive depression as long as the psychological factors are the most important determinant in the depressive state. In these cases E.C.T. comes as one more trauma and the patient may be made to feel worse. In long-standing reactive depressions the importance of psychological factors may recede, but the depressive mood persists. Then E.C.T. can be useful particularly if inhibition and dysthymia are outstanding. In some of our cases the depressive state got better, but there remained a depressive lability and a despairing mood, which could now be more adequately dealt with by psychotherapy.

The non-specific character of these methods of treatment is justified by the non-specific type of the symptoms treated by them. We submit that they arise from deviations of biopsychological functions released by the noxious factors, which once in existence may persist for a longer or shorter time. The disturbances of biopsychological function alter the totality of mental life, and manifest themselves in changes of the affective, conative, and cognitive spheres. In a normal individual they function as an integrated whole supra- and subordinated in several ways, reciprocally stimulating and inhibiting each other. In their pathological variations the same complex interplay occurs again, and it is only in the extreme variations that the disturbance of one function seems to dominate the whole picture.

The effectiveness of the multiple approach in the treatment of mental diseases is more the consequence of this totally integrated activity than a manifestation of the insufficiency or backwardness in the methods of treatment. It is an expensive error to lean on one exclusive line of therapeutic approach. The clinics where the best results are obtained are those in which all available methods are applied carefully and with discrimination.

The treatment of focal infections, of endocrine and metabolic disturbances, of vitamin deficiencies has a favourable effect on the evolution, and on the tendency to relapse.

Psychotherapy and occupation therapy must be applied concurrently. We have seen manias, depressions, and cycloid psychoses fail to recover and even become worse with ambulatory E.C.T., and recover easily with their admission to hospital and adequate provision of psychotherapy and occupational treatment. The latter is very useful in the conservation and development of the unaffected mental functions and the consequent compensation of the morbid behaviour. It allows a better adaptation to hospital life, and later an easier integration in society.

At the present time we must therefore use all the available combinations necessary to the treatment of the different symptoms. Such a technique requires an intensive study of the symptoms of each case, both before and during the treatment of the illness.

The careful study of symptoms and their groups is, in the present time, more likely to assist general understanding than their classification into two or three diagnostic labels, and may help to give some understanding of their physiopathological basis.

The non-specific character of many mental symptoms is a well established fact that we owe mostly to the studies of Bonhoeffer (8) on symptomatic psychoses, and which Bumke (9) has lately extended tentatively to the symptoms of schizophrenia, based on the assumption that this disease arises from toxins produced in the organism, which act secondarily on the brain. This would explain why schizophrenic symptoms can have a fugitive and capricious appearance, and why many of them have great similarity to the symptoms of some intoxications (alcohol, hashish, mescaline, etc.).

We cannot discuss fully these problems here, nor the problems related with the aetiology of the changes in biopsychological functions. By their dual nature they can be altered either by psychological or toxic and organic or degenerative factors. As with all the more differentiated and later developed functions, their hereditary basis is specially liable to alteration.

Longer catamnesis and adequate numbers of typical cases are still necessary to answer the very interesting question of the influence of physical methods on the periodic psychosis. E.C.T. seems to have no effect, but with insulin and particularly with leucotomy some striking results have been obtained, particularly with some short-period relapsing catatonias and cyclotymias. We have seen some manic-depressives and periodic catatonias relapse years after their cure by insulin and leucotomy, but there is no doubt that in some cases a stabilizing result has been obtained.

The historical basis and the already-made attempts at the individualization of biopsychological functions must be looked for in our other publications.

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SCHIZOPHRENIA IN THE FORCES.

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COMPARATIVELY little attention has been devoted to schizophrenia in the extensive psychiatric literature which has accumulated during the War. While man-power was more important than Man, it could hardly be otherwise, for those who succumbed to this illness were usually invalided even in the event of full recovery. But there was perhaps another reason to be found in the belief that schizophrenia was merely an old friend of peacetime interjecting itself inconveniently into wartime medicine, but not having any special or unusual qualities save perhaps an acuter onset or a better prognosis.

There are, however, some interesting lessons to be learned from a study of the disease as it occurred during wartime because of the unusual surroundings in which these patients found themselves. They tended to come under medical notice much earlier than in civil life, because of oddities, unpunctuality, and minor disciplinary offences which encountered official opposition and punishment; and because the simple environmental adjustments, which can postpone disablement, tended to be difficult or impracticable. A small and well organized team in the Navy, a relatively small number of hospitals, and comparative ease in gaining access to previous clinical records, made it possible to trace the course and development of these illnesses with unusual completeness. Once the fact had been elicited from the patient that he had previously been in hospital, it was nearly always possible to obtain the clinical records covering the previous admission, and indeed not infrequently to find that he had been under one's own care on that occasion. It was, for example, interesting to note how many of these cases of florid schizophrenia had previously been in hospital with anxiety or depressive reactions, and how many had been in minor trouble, and having been investigated were labelled psychopathic personality because the behaviour disorder was the only presenting feature at that time.

It is proposed in this paper to make a few observations on the mode of onset of the disease, and on certain aetiological factors in so far as study of the illness in the Forces in wartime shows features that are uncommon or less common in civil life; and to record the difference in therapeutic results that followed the introduction in the treatment unit of deep insulin shock.

ONSET OF THE DISEASE.

Schizophrenia is a very insidious disease and its development may be spread over many years. In civil life it is usually possible for the patient to adapt himself progressively to his reduced capacity, and the clinical picture is what is sometimes described as a "falling off" in performance as the patient slowly adjusts himself to his increasing disability by changing his employment, or by working less hard, or less efficiently. This process is not always feasible under service conditions, and incapacity is detected at a very much earlier stage. Moreover the obviousness of the disability to the patient himself may produce profound depressive, anxious, or hysterical reactions from the effort to keep pace with the tempo of service life. Neither affective loss nor affective incongruity are early signs of schizophrenia. On the contrary, most patients show a distinct emotional disturbance when they come to medical notice for the first time. Depression may be marked and typical, and the diagnosis of schizophrenia may not be obvious, or may not be made at all, until treatment by E.C.T. alleviates the depression and reveals schizophrenic thought disorder beneath.

Hysterical reactions are of particular interest, for the diagnosis of hysteria is too often regarded as an adequate explanation by itself of some motor manifestation for which "no organic cause can be found." Yet such a diagnosis is somewhat analogous to a surgical diagnosis of "limp" without ascertainment of the pathology and its site. It is in fact an objective and superficial description of behaviour without determination of the setting in which the reaction occurs. This setting may be organic—for a case of disseminated sclerosis or of post-encephalitic Parkinsonism may easily be driven to severe hysterical limping, if the nervous system of either is passed as normal by a sufficient number of doctors. Or the setting may be an hysterical character or an involutional depression; but what concerns this paper is that it may be simple schizophrenia. In any event it is unwise to be too easily satisfied with the diagnosis of hysteria without careful study of both psyche and soma.

The hysterical psychotic reactions may also be mentioned in this connection. An hysterical stupor in an hysterical personality may, in the acute stage, be quite impossible to differentiate from a psychogenic stupor in a schizophrenic setting. The diagnosis will become clear under sodium amytal analysis, and the reaction itself is usually cured fairly readily. The Ganser reactions have been recently described by Anderson and Mallinson (1941), and by Stern and Whiles (1942); the last two authors describe the condition as occurring "in people who, although mentally deranged, not realizing this, wish to appear so." This coincides in essentials with the writer's experience of the syndrome, for all the cases seen were psychogenic reactions, precipitated by an insupportable situation, and occurring in a setting of chronic schizophrenia.

The schizophrenic episode or acute schizophrenic reaction is a familiar phenomenon in wartime, and some cases of this kind were described by Kasanin (1933) under the title of acute schizo-affective psychoses. It may be, however, that the concept of the acute schizophrenic reaction is not always entirely

satisfying. Some of these cases may be toxic, or dysergastic; and some may be affective. For personal privation and hardship may sometimes liberate emotion of a very violent kind, so strong and intense that clouding, bizarre behaviour, and subsequent patchy amnesia may be evident. The writer has seen cases of self-injury, including the carving of a cross on the forearm, and even mutilation of the sex organs, inflicted in these intense emotional states with what seemed to be an inadequate reason on the surface, but which were quite intelligible in the light of the circumstances at the time and having regard to the trends of the personality. But apart from these, it is likely that a good many schizophrenic episodes are exacerbations in a setting of established schizophrenia—a concept which amounts to far more than a quibble on words, for there is little doubt that many of these cases benefit immeasurably from insulin therapy, and it is often clear in retrospect that a state accepted as normal even by a wife or husband was really far below that level. This is sometimes evidenced by statements such as “I haven’t seen him so well for years.”

AETIOLOGICAL FACTORS.

One hundred cases admitted to the hospital before it was possible to begin insulin therapy have been studied; and a further 100 cases treated with insulin have been compared with them. Both groups had in common the usual symptomatic forms of therapy—narcosis, convulsive therapy, and so on, the last-named being restricted to five or six shocks; and both had the benefit of a well-developed occupational centre, and social therapy under the leadership of one who was also a very good physical training instructor.

Therapeutic results have been assessed in four groups—certified, marked invalidism, slight invalidism, and cured. The difference between the first two of these is indistinct and unrelated to the malignancy of the disease process, and for many purposes they have been considered together. Whether a man was certified or not depended largely on the views of his relatives, their economic situation and ability to care for him, and on whether the illness took a productive aggressive form; but there is no reason to suppose that a docile and disabled cabbage who goes to his home to sit by the fire is any less ill than the paranoid and hallucinated patient taken protesting to his mental hospital. The criteria for cure were severe and are difficult adequately to verbalize. They may be summarized as including a lively but restrained affect, a realization of having been ill, and a reasonable concern about the prognosis, a genuine spontaneity in conversation and behaviour, and future planning in an economic sense. The latter might be shown by a desire to learn a trade if an active service rating learned he was to be invalided. The third group showing slight invalidism included the remainder, who were free from obvious symptoms—hallucinations, delusions, feelings of influence, and so on, but in whose cases there remained some hypo-ergy, some emotional flattening, lack of concern about the illness, and lack of curiosity about the future. Assessment at this stage is on the lines of early diagnosis and the features described by Kant (1940)—the possibility of empathic understanding, and the presence of residual signs of motor impairment, must be the guide.

The first 100 cases were analysed to determine the period elapsing between entry into the Service and the date of social breakdown, which last date coincided usually with admission to hospital. The results were as follows :

Under 6 months	15 per cent.
" 12 "	34 "
" 18 "	46 "
" 2 years	65 "
" 2½ "	76 "
" 3 "	86 "
" 3½ "	89 "
" 4 "	90 "

The average period of service was 18 months, and it will be seen that two-thirds of the cases had broken down within two years. Only 10 per cent. of the total had served for two years or more. The age distribution was as follows :

Under 20	34 per cent.
" 25	76 "
" 30	84 "
" 35	94 "

The average age was 24 years, and it will be seen that 75 per cent. of the cases were under 25 years of age. Only 6 per cent. were over 35. Only 14 per cent had gained any sort of promotion, though this is bound up to some extent with the shortness of the period of service. The average stay in hospital was about 6 months, this being dictated by the desires of relatives and shortage of beds, rather than by any medical assessment.

The results in the first 100 cases were as follows, and it may be stressed again that the classification is as outlined above, and bears no relationship to what is known as the "social remission." This last term would have included many in the "marked invalidism" group. This stringent classification has been adopted in order that a comparison may be made later with the insulin-treated group from a qualitative rather than a quantitative point of view.

Certified	24 per cent.
Marked invalidism	61 "
Slight invalidism	13 "
Cured	2 "

A careful analysis was made from the clinical and service histories of the stresses to which these cases had been exposed. Three groups have been differentiated as shown below. Severe stress means exposure to enemy action or the imminent threat of it, over periods of many months, domestic anxiety such as infidelity reinforced by separation due to foreign service, long periods of service in hot and humid climates with little to do, and so on. Moderate

stress means small doses of the same things or longer periods of less exacting strain.

Stress.	Certified ; marked disability.	Slight disability.	Cured.
None (41)	38	1	2
Moderate (31)	26	5	0
Severe (28)	21	7	0
100	85	13	2

It will be seen that the percentage remaining with a marked disability, after 6 months, is the same (about 75 per cent.) in both moderate and severe groups, which bears out the presumption that such exposure does not of itself introduce an element of malignancy into the illness, which was not previously there. The high incidence of disability in those exposed to no stress is correlated with the fact that the average period of service in this group is only 9 months, compared with the average of 18 months taken over the entire series. These were obviously progressive cases of bad prognosis, probably brought to medical notice earlier than they might have been, by virtue of being in a service, but not otherwise materially affected.

It seems reasonably certain that given a schizophrenia, the impact of a service upon the patient may have two effects. If the illness is progressing very slowly, the difficulty in adapting to service life may produce a pseudo-neurotic reaction of anxiety or depression, or a hysterical avoidance, or a more profound disturbance such as a stupor, or a Ganser state. This reaction of itself is easily dealt with, and indicates little more than the presence of an underlying disability. The prognosis of the latter will depend on other factors, but not at all on the psychogenic episode itself. Alternatively—and this is the second possibility—if the course is more rapid, it becomes obvious rather more quickly under service conditions, and the illness is recognized for what it is, after a period of passable adjustment which may vary in length, but is not very long. How long it is will depend largely on personality preservation, and whether the reaction to the disability is asthenic enough to obviate comment from others. That stress will precipitate schizophrenia where none might otherwise have appeared is a proposition for which there is little or no evidence if the acute episodes mentioned above be excluded.

CHANGES EFFECTED WITH INSULIN TREATMENT.

The technique of deep insulin shock is sufficiently well known and need not be detailed here. The results of treatment of the second group of 100 cases were as follows, referring again to the method of classification used for this analysis :

Certified	18 per cent.
Marked invalidism	12 "
Slight invalidism	14 "
Cured	56 "

It will be observed that the figure of certified and marked invalidism has fallen from 85 to 30 per cent. The number of cases either cured or with slight invalidism has risen from 15 to 70 per cent., and the percentage of cures themselves from 2 to 56 per cent. This paper is not concerned with the long-term results of insulin treatment for which careful "follow-up" studies will be required, and therefore a mere quantitative assessment of social remissions has not been attempted, for it would have no meaning. The cured group has been differentiated in the way it has because the writer felt so strongly that the qualitative difference after insulin treatment was so striking. An assessment of lively affect, of spontaneity, of active interest and attention—all these things are hard to measure, and are impressions which rest on less secure ground than more tangible phenomena like the ability to return to work. What the above figures mean in essence is that the quality of remission observable in 56 per cent. of cases treated with insulin was only observed in 2 per cent. of cases not so treated.

This qualitative difference, most prominent in the volitional field, is particularly notable in the cases described above who recover from schizophrenic episodes. Many of these rather dull and quiet personalities show a most remarkable personality change after insulin shock.

The best results are obtained with insulin when a single doctor is in daily charge of the Unit, though this may not always be practicable, or on other grounds, entirely desirable. Only by constant practice and familiarity can a wholesome respect for a rather dangerous treatment be combined with a freedom from "nerves." A suitable addition of electro-convulsive therapy will make a good deal of difference, and in this series, 45 per cent. of the cases had each an average of six fits throughout the course. The main indications for E.C.T. were volitional disturbance persisting when thought disorder was in abeyance, associated depression, and the "plateau phenomenon"—recovery having proceeded to a considerable extent and then having stopped. It has also the further use, as is well known, of sensitizing the insulin-resistant.

Other approaches to the psychosis must not be neglected, and the writer's practice was to keep all insulin patients in one ward, where they contrived (to a remarkable extent for schizophrenics) to develop quite a family spirit, and even something of a class snobbery. Occupational therapy and the attentions of a social therapist were given the fullest scope in this ward, and indeed almost every activity in the unit was designed with the object of giving priority to these patients. The average number of comas was 32, the range extending from 23 to 46, with the vast majority at about 30 as being the minimal number permissible in the ordinary case, and also the maximum that time could be spared for, in a remitted case when pressure on beds was heavy.

SUMMARY.

1. An account is given of some of the more deceptive modes of onset in schizophrenia, and seen perhaps more commonly, and in purer culture, in the Services than in the out-patients of civil life.

2. Some observations are made on the schizophrenic episode and on hysteria as a symptom.

3. A subjective method of assessment has been used in order to stress the qualitative advantages of insulin shock treatment.
4. The relationship of stress to the psychosis is discussed.

ACKNOWLEDGMENT.

I could not write about the insulin treatment of schizophrenia without expressing my indebtedness to Dr. W. Mayer-Gross, in whose unit at the Crichton Royal (by the courtesy of Dr. P. K. McCowan, the Physician-Superintendent, and by permission of the Admiralty) I first had an opportunity of studying the technique at its best.

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MENTAL DISORDER IN RELEASED PRISONERS OF WAR.

By BRIAN H. KIRMAN, M.D., D.P.M., Major R.A.M.C.

AFTER the cessation of hostilities with Japan some 60,000 Europeans were released from Prisoners of War Camps in territory under Japanese control. Of these, a high proportion were sick and were admitted to hospital. Nearly all the psychiatric cases among them were admitted to the 41 British General Hospital, Hospital Town East, Jalahalli. These cases admitted to this hospital were 60 in number, and of them 50 were considered psychotic, 6 neurotic, and in 4 no gross psychiatric disability was found. In order, adequately, to assess the significance of this incidence of mental disorder in the prison camps, a brief *résumé* of the conditions of imprisonment and of the state of the cases admitted to general medical wards is considered essential.

PLACE OF CONFINEMENT.

The bulk of the prisoners were captured early in 1942. The patients admitted to this hospital had been confined in a variety of prison camps in the vicinity of Singapore, in Siam, Sumatra, Java, the Andamans, China, etc. The biggest number were from Changi gaol near Singapore. Many were moved from one prison camp to another. In no case except those from Changi was it possible to procure adequate notes (paper shortage seems to have been the chief reason for this). It was possible, however, from the accounts of the patients in the general wards to form a clear impression of what conditions were like.

DIET.

The composition of the prison diet varied somewhat from one camp to another, but in general supplies grew shorter with the passing of time. The food was very monotonous and inadequate in quality and quantity. Very few Red Cross parcels reached the prisoners. A small ration of rice formed the basis of the diet. Meat, fish and milk were generally not available. In a few exceptional cases, as in Java in 1942-1943, prisoners were able to grow their own vegetables and fruit, cabbages, tomatoes, onions and carrots, and the men were also able to purchase small amounts of pineapple, papaya and eggs. The allowance of rice in Java in the early years of captivity was 25 to 30 ounces (2,513-3,015 calories) per man per day. In the Changi camp it was 16 ounces (1,608 calories), and the only green stuff available was wild leaves such as Hibiscus. In Borneo and Sumatra during the last year of captivity things were very bad indeed. The issue of rice fell to 6 ounces (603 calories). Canteen supplies were stopped, vegetables and fruit were rarely seen, and the meat ration consisted of a supply of cooked cattle entrails issued about once a month. In most cases the prisoners were compelled to perform heavy work, such as the building of railroads through jungles and marshes.

For the purpose of comparison the daily intake of people in other rice-eating areas may be considered. This is 25 ounces for Bengal, Central Provinces and Kashmir, but only 19 ounces for Assam and Orissa (Aykroyd), though the latter diet is notoriously inadequate. The daily intake of cereals (principally rice) in rural Kashmir averaged 33 ounces per head (Wilson and Widdowson), and 30 ounces among rural Hindus in the Central Provinces. In Japan the average peacetime intake was 15 ounces of rice daily, but that provided only half the calorific value of the diet (Teruoka).

PHYSICAL CONDITION OF THE PRISONERS.

Most of the released prisoners were very emaciated. Among those who were admitted to hospital nutritional deficiencies were extremely common. The majority were moderately anaemic, and had a low plasma protein with a disturbance of the albumen-globulin ratio, which incidentally gave a persistently high blood sedimentation rate. There were few cases of frank pellagra (none among the psychotics), but angular stomatitis, glossitis and scrotal dermatitis were common. Real sprue was not found, but moderate nutritional diarrhoea was frequent. Typical peripheral neuritis was extremely common, especially in its milder forms, but cardiac beri-beri was not found. Most of the cases of so called wet beri-beri were instances of famine oedema.

Captivity amblyopia was common. About half the general medical cases showed signs or gave a history suggesting a deficiency, retro-bulbar neuritis. Many of these had persistent weakness of vision associated with temporal pallor of the optic discs and scotomata. Among the psychotics the incidence of this condition was appreciably less. About a dozen cases of spastic paraplegia and rather more of ataxic paralysis were found among the general medical cases. The former originated in Singapore in 1942 and resembled lathyrism, though probably due to deficiency. The cases of ataxia appeared to be beri-beri with posterior column involvement, and a few had nerve-deafness and vestibular upset. In two cases the clinical picture of subacute combined degeneration of the spinal cord was found. No such evidence of spinal cord involvement was found among the psychotic cases.

TYPES OF MENTAL DISORDER FOUND.

1. Ten of our cases had a history of mental disorder prior to imprisonment. A typical example is :

R. W.—, a civilian, aged 23, admitted September 29, 1945. Interned at Singapore, 1942. Diagnosis : schizophrenia, simple.

History.—It was thought that he had been a patient in Rangoon Mental Hospital at some time before the capture of that city by the enemy. Little information about him was available. He would give no account of himself and used a name other than his own. He is said to have been morose and quiet for the whole period of his imprisonment. He is reported to have wandered about talking to himself and saying that the camp was on fire. He had a history of oedema two months before release.

Condition on admission.—He was very thin and his blood-pressure low, 95/65. His tongue was rather smooth. His skin was rough, but there was no definite evidence of pellagra or neuritis. He appeared hallucinated. There was thought

blocking and blunting of affect with fatuously exaggerated shyness of women. He gave the wrong date and year, but showed by his expression that he knew these to be wrong. There was no evidence of intellectual impairment.

2. In 13 cases a psychosis developed very early during imprisonment. The patients appeared to be chronic psychotics when admitted to this hospital, and there was nothing in the records to suggest that they had suffered from a severe degree of vitamin lack previous to the onset of mental illness. A typical history follows :

Pte. B. R.—, aged 23, admitted October 14., 1945. Captured Singapore, 1942. Diagnosis : schizophrenia, simple.

History.—He was a shy, solitary child who never played games. He was three classes retarded at school. From 1942 he had repeated attacks of diarrhoea and malaria. In 1943 he developed ideas of influence, and was admitted to the P.O.W. Hospital as a case of dementia praecox. In 1944 he attempted suicide by jumping into a pit. In July, 1944, he developed pulmonary tuberculosis.

On admission.—He was grossly emaciated and anaemic, but there was no glossitis, oedema or neuritis. He had pulmonary tuberculosis. He was quiet, apathetic, spoke in a whisper and was emotionally blunted and retarded.

3. Two cases had a history of having markedly abnormal personalities prior to imprisonment :

Driver P. J.—, aged 28, admitted September 29, 1945. Captured Singapore, 1942. Diagnosis : schizophrenia, simple.

History.—He was a nervous child, with enuresis, nail-biting, sleep-walking, fainting attacks and a poor school record. From 1944 he became very dull and developed auditory hallucinations with ideas of persecution. Whilst a prisoner he had several attacks of malaria and dysentery.

On admission.—His general nutrition was good. There was no oedema, glossitis or ataxia. He was dull and retarded, apathetic and emotionally blunted. Auditory hallucinations were present. His face was expressionless and he mumbled to himself.

4. Three cases developed melancholia whilst prisoners :

W. P. D. P.—, a civilian, aged 61, admitted September 27, 1945. Interned February, 1942, at Singapore. Diagnosis : melancholia.

History.—He was admitted to the 114 B.G.H. on September 19, 1945, with a history of dysentery and oedema of the legs. He said that he had been doubly incontinent for six months, but was in fact clean in his habits whilst in hospital. He was noted to behave peculiarly, and locked himself into the lavatory at night.

On admission.—He was extremely thin. There was no evidence of pellagra. He had slight oedema. His ankle-jerks were not elicited. His skin was papery and atrophic. He developed several large and spontaneous bruises. W.R. and Kahn tests negative. Urine N.A.D. B.S.R. 29 mm./1 hour. B.P. 165/95. He appeared depressed and expressed ideas of unworthiness. He was well orientated and there was no evidence of dementia. He became agitated, distressed, restless, noisy and difficult to control. He struggled violently with all those around him and asked to be forgiven.

5. The biggest group of our cases (14) was those who developed symptoms of mental disorder after release—so soon after as to justify the term "Release Reaction." These included manic-depressive and paranoid reactions. The following case is illustrative :

Capt. R. P. Y.—, aged 34, admitted September 19, 1945. Captured Burma, 1943. Diagnosis : reactive depression.

History.—His mother had an attack of depression at the menopause, but the patient himself denied previous attacks. He said that he had behaved in a cowardly fashion at the time of his capture; his O.C. shot his way out of encirclement, and he felt that he should have stood by him instead of submitting tamely. He appears to have overcome his guilt feelings during the period of his imprisonment, but in August, 1945, he felt unable to face the prospects of repatriation, and what he considered would be inevitable disgrace. He thought that everybody was discussing his conduct, and that word of his cowardice would soon reach his native town. He made a suicidal attempt by cutting his wrist.

On admission.—His physical state was satisfactory. There was no evidence of avitaminosis. He was depressed, deluded and hallucinated. He expressed ideas of guilt and unworthiness. He was quick, alert and well orientated.

6. In three of our cases a diagnosis of toxic confusional state was made, with various infectious illnesses as the main causal factors.

Major "D," aged 47. Captured at Singapore, 1942. Diagnosis: toxic confusional state.

History.—In 1942 he had a severe attack of dysentery. He had irregular bouts of fever throughout his imprisonment. Several temperature charts are available for 1945 which show an irregular pyrexia up to 102° F. He was diagnosed as a case of chronic bronchitis. The chest was screened at the time of his release and evidence of tuberculosis was discovered. In September, 1945, he became hallucinated. He thought the Japs were calling his name and were going to shoot him. He talked nonsense and appeared disorientated. On the voyage he made his way to the bridge and began to issue orders.

On admission.—He was very emaciated and had a productive cough. An X-ray of chest showed bronchiectasis at the right base. B.S.R. 46 mm./1 hour. There was no evidence of avitaminosis. He was noisy. He addressed a previous D.D.M.S. through the wall and also a General. He would converse rationally when his attention was secured, and he appeared quite well orientated.

7. In two cases it was considered that psychological stress imposed whilst in confinement determined the onset of the mental illness.

H. K—, a civilian, aged 29, admitted September 29, 1945. Interned in Bangkok, 1943.

History.—He was interned by the Thais, who threatened him with shooting. He was afraid, and thought in fact that he would be shot. The Thais objected to his preaching Christianity in their country and taxed him with having done so. During his interrogation he explained that he was, as it were, only an "apprentice" missionary, and had in fact done very little actual missionary work. Afterwards he felt very much ashamed of this answer and bitterly regretted it. He felt that he had proved false to his religion. He then became over-active, confused, terrified and completely lost. He appears to have had a brief schizophrenic episode.

On admission.—There was no evidence of physical disease. He seemed quite well nourished. He was quiet and shy, but otherwise normal. He was rational, and gave an excellent account of himself. No delusions or hallucinations were expressed. He mixed well and played chess with the other patients.

8. Six patients from among the released prisoners were considered neurotic rather than psychotic.

Cpl. J. F—, aged 30, admitted October 15, 1945. Captured Singapore, 1942. Diagnosis: anxiety state.

History.—He showed some neurotic traits as a child, but adjusted well to Army life. In February, 1942, he had gastro-enteritis, and in April, 1944, he was 10 days in hospital with bacillary dysentery. Following discharge he suffered from dyspepsia, breathlessness, pain round the heart and pain in the limbs. He was admitted to hospital with jaundice a week before the cessation of hostilities. On

September 20, 1945, a complete physical examination, including X-ray of the chest and lumbar puncture, showed no evidence of physical disease.

On admission.—He was not unduly thin, and there was no evidence of nutritional deficiency syndromes. He had some pigmented scars on the right leg. B.P. 130/80. There was no evidence of organic disease. He was an anxious, timid, dependent individual, mildly depressed, tearful and lacking in interest. He was worried about his physical symptoms, fearing that he would never recover.

9. In three of our cases the mental illness was considered primarily due to nutritional deficiencies. In each case there was a brief psychotic episode during imprisonment followed by complete recovery.

B.Q.M.S. E. N. W—, aged 41, admitted October 15, 1945. Captured at Singapore, 1942. Diagnosis: confusional state.

History.—He developed a confusional state in 1943 after malaria and dengue. He imagined that he was dead. At that time he was suffering from peripheral neuritis with impairment of vision, also indolent ulcers of the legs. In September, 1945, he developed deafness, nausea and weakness.

On admission.—There was no residual clinical evidence of nutritional deficiency. He was suffering from mild anxiety symptoms, but was willing to accept reassurance.

10. Four of our cases showed no evidence of psychiatric disorder.

DISCUSSION.

It is quite impossible to present an adequate and comprehensive review of these 60 cases of mental disorder occurring in Repatriated Allied Prisoners of War and Internees. Some patients were with us only for a short time, and in none of them was it possible to arrange for complete biochemical investigation. The diagnosis and opinion as to aetiology must therefore rest primarily on clinical findings and a consideration of the history. Inadequate though the presentation of the cases is, however, it is possible to remark on some of the salient features.

In the first place the total number of psychoses is remarkably small among such a large number of prisoners, especially in view of the insufficient diet and bad conditions in most of the camps, especially in the latter part of the period of confinement. Subsequent experience suggests, however, that a number of prisoners broke down after repatriation. Secondly it is significant that in only three of our cases does it seem possible to regard dietary deficiencies as primarily responsible for the mental disturbance, and in these three cases other factors were probably also operative. This is in sharp contrast to the high incidence of other signs due to dietary deficiency as outlined above, including a variety of lesions of the nervous system. Further consideration of this mass experience of nutritional deprivation may lead to a revision of the opinion of those who are inclined to emphasize the role of nutritional defect in the aetiology of both psychoses and neuroses as they occur in clinical practice in Britain. It is true that the full pellagrous picture was not encountered, but on the other hand many of the lesions among the general patients who did not develop psychoses must have been attributable to a "B complex" deficiency. In this connection it should be noted that although a few camps were able to obtain limited supplies of vitamin concentrates, rice polishings,

etc., which were used when definite deficiency syndromes developed, the majority of the prisoners received no such supplement to their diet during the whole of their period of imprisonment. The incidence of neurosis was so low as to be negligible. This is in keeping with findings under similar conditions elsewhere, e.g., in cities during the air raids, where there is no biological advantage to be gained from the development of neurotic symptoms.

It is interesting that the biggest group of patients is that which first developed symptoms after release. It is assumed that this was a group of inadequate people who were able to overcome their inadequacy under conditions of prison life, but were unable or unwilling to face the uncertainty of life in the outside world. It may be remarked here that a significant number of P.O.W.'s developed depressive reactions after arrival in the U.K. It is hoped that this unique case-material will receive the more detailed consideration which it merits, but it was thought worth while to prepare this brief survey before the patients were scattered to their various homes and to other hospitals. All the data relating to physical disease were provided by Lt.-Col. T. Semple, R.A.M.C., without whose help it would not have been possible to present this paper.

SUMMARY.

From all the European prisoners and internees released from captivity in Japanese occupied territory, only 60 were admitted to psychiatric units. They were classified as follows :

1. Psychotic prior to imprisonment	10
2. Typical psychosis developing very early during captivity	13
3. Psychopathic personality prior to imprisonment	2
4. Involutional melancholia	3
5. Release reaction	14
6. Toxic confusional states	3
7. Effect of psychological trauma	2
8. Neurosis	6
9. Nutritional deficiencies	3
10. No psychiatric disorder	4

The total number of psychoses was very small compared with the number of prisoners. The diet was poor qualitatively and quantitatively, and there were many signs of physical disease due to dietary deficiency. Despite this, diet does not seem to have been an important factor in producing mental disturbances. The incidence of neuroses was negligible. The biggest group of cases was those who became ill after release from captivity.

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PSYCHOLOGICAL ASPECTS OF A CONSCIOUS TEMPORARY GENERALIZED PARALYSIS.

By G. DE M. RUDOLF, M.R.C.P., D.P.H., D.P.M.,

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CONSCIOUS generalized immobility, in which the musculature remains in the tonic state in which it has been placed voluntarily, is known amongst naval officers, printers and nurses, amongst the last being known as "night nurses' paralysis." Its duration is of a few seconds or minutes, and it appears to be a cataleptic phenomenon. It differs from cataplexy in that the musculature is tonic, and perhaps hypertonic, with the eyelids open, whereas in cataplexy the subject falls to the ground with muscles limp and eyelids closed, as if asleep.

The recognition of this conscious immobile state has been described elsewhere, and an account of its characteristics given (Rudolf, 1946).

MATERIAL INVESTIGATED.

Investigations have been made in 12 cases of night nurses' paralysis and in 5 cases of similar phenomena occurring in naval officers and printers. Accounts of the condition in others have been obtained from 10 observers.

TEMPERAMENT.

No constant characteristic, either physical or psychological, was found in persons subject to the attacks. Attacks commenced when the sufferers were calm and unworried, and often in persons who, on the first occasion, were consciously completely unaware of the existence of the condition. In these persons, intense fear of permanent paralysis was frequently felt, but in subjects aware of the state, little or no anxiety was aroused.

In each of eleven subjects investigated, some psychopathological condition was found. One case was moody and frequently was observed to day-dream ; one talked in his sleep ; one showed marked abreaction as she recounted the only attack she had undergone, 15 years previously ; one had been passing through a period of domestic trouble when his 5 or 6 attacks occurred ; one was of the repressed type ; two were dull with little drive or pertinacity, and four showed over-emotional and hysterical temperaments. Nevertheless, none of these conditions were of great intensity. All the subjects, when examined, were on full naval or military duties overseas. All were on duty, in Service or civil life, when the attacks occurred, and, in every instance, the subject was placid at the time, without active movement. The subjects were engaged in occupations such as reading, watching paper coming off printing machines, or observing the horizon and the seas.

CONSCIOUSNESS.

During attacks, conscious sensations may be very mild, such as a slight difficulty in rising, lasting for a short time, accompanied by "tingling" in the legs.

In a more definite attack, without other abnormal sensations, the subject finds he is unable to move from the position, perhaps sitting or standing, in which he has voluntarily placed himself. The subject realizes the eyes cannot be moved and, in some cases, the muscles of the trunk and limbs feel stiff and tense.

One female nurse, when struggling to move during an attack, felt that her arms were moving in the air around her head, although she was fully aware that this was not so, as she could see them on her knees with a book in one hand. This description is reminiscent of that of sufferers from phantom limbs.

A naval officer who had experienced numerous attacks said that although his mind worked he was unable, when on watch on the bridge, to move to reach the voice-pipe for some seconds or even a minute.

A printer described the sensation as "Something came over me. I felt spell-bound."

The subjects agreed that vision and hearing were unimpaired during the attacks.

The end of the attack may be spontaneous, the subject quietly, and without apparent reason, finding he can move. One nurse stated that, although she recovered all movement simultaneously, the toes of both feet were strongly flexed.

One subject reported that his first sensation was that of the removal of a constriction around both legs. He wished to rub his thighs, but found he could not move. He felt a "pumping" in the head, a "start," and discovered that he was able to move freely. As this man had not previously known of the condition, the head sensations could be attributed to anxiety, which was present.

A male nurse, in each of four attacks, felt a generalized crampness which passed away rapidly.

Two subjects relaxed consciously, one thinking, "It's no good going on struggling, so will relax." She felt a "queer feeling like relief" and was able to move. The second subject, remembering that he had been advised to relax his mind and "then you will come out of it. Just don't think of it," thought to himself, "I'll come out of it," which he promptly did.

Observers reported that subjects sometimes shook themselves or "shivered" immediately before coming out of the condition.

A subject kicked in the leg when in an attack came out of it "with a start." Another, shaken by the shoulder, was able to rise from his chair, but felt confused, cold and "pretty horrible." The confusion persisted for from 5 to 10 minutes.

Mental confusion was reported by several observers. A night nurse handed to the Superintendent the Report Book upside down. Subjects in printing works, pushed away from their machines, were dazed and speechless.

CONSEQUENCES OF ATTACK.

The consequences of the immobility depend, not upon the subject, but upon the nature of the action at the time of the attack. Although multiple attacks in the same individual often occurred whilst that individual was in similar positions and so somewhat similar circumstances followed, in one case the first attack took place whilst sitting, the second when standing. Attacks occurred when the consequences were trivial and unobserved by others, and also when they were grave and of far-reaching importance.

Unimportant and trivial consequences are those of nurses unable to move when with no necessity to do so, or of a nurse unable to rise for a few seconds to go for his dinner. More important results are exemplified by a nurse who was unable to rise to stop a cistern overflowing, and by a naval commander who could not stop an electric motor, at the correct moment, to prevent a wire from burning out.

SUMMARY.

The sensations occurring during the brief conscious attacks of immobility well known amongst nurses have been investigated in 17 cases amongst naval officers, nurses and printers. Information has been obtained from 10 observers of attacks in others.

Anxiety is not an integral part of the attack, but is produced by the uncertainty of the results of an unknown condition.

All of 11 subjects who had suffered from attacks showed evidence of slight psychopathological conditions, but all were on full naval or military service overseas.

The consequences of attacks may be trivial and unknown to others, or may be serious and the cause of accidents.

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A CLINICAL NOTE.

AN EXAMPLE OF SIMILAR MENTAL DISORDER IN IDENTICAL TWINS.

By HAROLD PALMER, M.D., M.R.C.P., D.P.M.,

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[Received March 10, 1946.]

THE following two case-records furnish an interesting example of similar mental illness occurring in identical twins, in which, however, in the one case the illness had come on endogenously, whereas in the other there was an apparent precipitating cause. Their age when seen was 25 years.

The first patient complained on admission of an all-round loss of interest with some depression and sought relief especially from his thoughts, which milled round in a ceaseless turmoil, concerning his loss of contact with people and things. There was some complaint of unreality and loss of sexual desire over the previous nine months. Three years previously he had had a nervous breakdown characterized by loss of concentration, which had cleared up six months later. No precipitating cause could be discovered. He expressed no ideas of guilt whatsoever, and his condition was in general one of distressed perplexity. The illness had come on gradually.

The second patient stated that for three months he had assisted in trying to get his twin brother to "pull himself together," when one Saturday he got intoxicated, and for a wager attempted bestiality. He woke up the next morning feeling unutterably guilty and depressed, and rapidly developed feelings of unreality. His compelling symptom was the scare that his mind was disintegrating, and he churned over in a ceaseless turmoil the fear of insanity.

The family history of the twins was bad; the mother had developed a menopausal depression and two sisters had had nervous breakdowns. One of these was subsequently under my care with severe feelings of unreality and depersonalization.

The twins were uniovular, but distinguishable from one another on brief acquaintance. Their eye colour, hair colour, lobes of the ears and finger-prints were identical. They both continued under my care for six months without improvement and both had a prolonged course of convulsion therapy. Finally they were sent home, where one married his nurse, the other remaining single. Six years later they are reported as earning their living, but still hypochondriacal and full of woes whenever they see their general practitioner.

Part II.—Reviews.

Active Psychotherapy. By ALEXANDER HERZBERG, M.D., Ph.D. London: Research Books, Ltd., 1945. Pp. 152. Price 12s. 6d.

This psychotherapist is a eclectic and, though his sheet-anchor is psychoanalysis, other methods borrowed from various sources are incorporated into his therapeutic system. His main disagreement with the Freudians is that he does not admit the universal importance of repression in the aetiology of the neuroses. His psychology and psychopathology is practically identical with that of McDougall, the mind being conceived as a hierarchy, which is, or should be, dominated by the sentiment of self-regard. Other methods employed in active psychotherapy are persuasion, the exertion of direct influence on the patient's environment and the use of tasks which the patient has to carry out. In the case of the last two, at a mental hospital, such work is carried out by the social worker and the occupational therapist under the psychiatrist's direction. Here Dr. Herzberg has a valuable contribution to make. He shows clearly that each patient should be treated as an individual, the changes in environment and the tasks given being adjusted to the particular case.

There is a report on 100 patients treated by active psychotherapy in Berlin before the war. The best results were obtained in cases of reactive depression, anxiety neuroses and hysteria. In reactive depression and the anxiety neuroses the recovery rate was approximately 50 per cent. One may doubt whether these results compare favourably with patients treated by hospitalization and physical methods of treatment combined with psychotherapy. Again, Dr. Herzberg's treatment takes from one to two years, though with decreasing frequency of attendance, against in-patient treatment of two to six months.

This book gives many useful practical hints and there are some excellent case-studies. The psychological background is rather elementary. It is a book worth reading.

S. M. COLEMAN.

Aviation Neuro-Psychiatry. By R. N. IRONSIDE, M.B., F.R.C.P., and I. R. C. BATCHELOR, M.B. Edinburgh: E. & S. Livingstone, Ltd., 1945. Pp. viii + 168. Price 8s. 6d.

The foreword explains that the authors' views are based on practical experience in the field and that there had been little opportunity for reference to current opinion. This enhances the interest and value of the book. The peculiar problem of a psychiatrist attached to the R.A.F. is the maintenance of morale and efficiency of a more or less closed unit of highly selected personnel, who however are subjected to exceptional hazards. In tackling this the writers would seem to have combined common sense with sound psychiatric principles. This book will be of particular value to psychiatrists attached to the R.A.F., but with the dispersal of many men from this service other psychiatrists will find that this book will be of help in understanding the difficulties with which ex-flying men had had to contend.

S. M. COLEMAN.

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* A number of extracts in this section are reproduced from *Chemical Abstracts* and *Psychological Abstracts*. To the Editors of these Journals we extend our grateful thanks.

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The Search for Intellectual Deterioration Among Epileptic Patients.

A sample of 85 epileptic institutional patients were tested and retested with the Stanford-Binet 3 or 4 times over a period varying from 9 to 14 years. No evidence of mental deterioration was found except in the case of 3 psychotic epileptics. An appendix gives the method used for calculating mean rate of change in I.Q. in a given subject. S. B. SARASON (Psychol. Abstr.).

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*The Central Nervous System in Pneumonia (Non-suppurative Pneumonic Encephalitis). <i>Noran, H. H., and Baker, A. B.</i>	579

Obliterative Cerebral Arteriosclerosis: A Characteristic Vascular Syndrome.

Distinctive alterations of the smaller blood vessels as found in the brains of 10 cases with cerebral arteriosclerosis are described. This lesion is characterized by tremendous expansion of the intima, resulting in narrowing or complete obliteration of the vessel lumen. It is proposed that this process be designated as "obliterative arteriosclerosis," and considered as a special type of arteriosclerosis of small cerebral blood vessels. Emphasis is placed on differentiation from "hyperplastic sclerosis."

Histologic changes in the parenchyma of the brain, particularly the cortical gray matter, consisted of diffusely scattered, stripe-like, small, old and recent softenings secondary to the obliterative vascular lesions.

A gross finding in the brain which was regarded as characteristic of "obliterative arteriosclerosis" was a granulated appearance of the cortical surface, due to numerous focal areas of glial scarring, often associated with stripe-like areas of softening involving the upper layers of the cortical ribbon.

"Obliterative arteriosclerosis" may occur independently of arteriosclerotic changes of the major cerebral arteries. (Author's abstr.)

The Central Nervous System in Pneumonia (Non-suppurative Pneumonic Encephalitis). II. A Pathologic Study.

1. A survey of the literature regarding pneumonic encephalitis reveals only a small number of sporadic clinical and pathologic case-reports.
2. A careful study of the pathologic lesions of the brain in 10 cases of pneumonic encephalitis revealed that the cerebral alterations are uniform throughout the entire series, even though the cause of the pneumonitis is highly variable.
3. Extensive thrombosis and prominent perivascular haemorrhages are the outstanding microscopic findings observed in the nervous system.
4. Various theories regarding the pathogenesis of this type of encephalitis have been presented. The prodigious number of thrombosed cerebral vessels observed in this study suggests the possibility that some alteration in the clotting mechanism of the blood may cause these cerebral lesions.
5. The constancy of the cerebral lesions, regardless of the type of pneumonia, indicates that the real cause of the encephalitis may be the pulmonary tissue itself. Some factor from the lung parenchyma may possibly accelerate intravascular clotting. (Authors' abstr.)

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Complications in Electric Shock Therapy.

Therapeutic electric shocks produce some reversible cortical changes, probably together with some irreversible neuronal degeneration and gliosis. The typical memory losses are generally recoverable, and the diversified EEG disturbances tend to disappear in several months.

According to reports in the literature, the neuronal discharge may have other effects than the intended *grand mal*: cardiac arrest, autonomic disorders, *status epilepticus*, or manic delirium.

Regardless of operating technique, reported rate of compression fracture of a vertebral body varies from 0.5 per cent. of cases, to 20 per cent. with routine X-raying. Many compressions will remain undiscovered unless spines are routinely X-rayed post-shock. Compression spinal fractures are clinically inconsequential. The humerus, or more rarely some other bony structure, is occasionally fractured; to these instances the technique of shocking seems relevant.

Dislocation at the shoulder or mandibular joint should be technically preventable.

Arterial hypertension may be aggravated by electroshock, and myocardial insufficiencies can lead to a fatal outcome. Curare attenuates the convulsive violence, but may add new dangers; its drawbacks are still under scrutiny.

Aspiration during the coma has been deemed responsible for complicating lung abscesses. Liability to pulmonary complications probably has other unknown causes. Post-shock pneumonias have not always been charged to the therapy. The published mortality rates appear over-optimistic. (Authors' abstr.)

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Toxic Psychoses Associated with Administration of Quinacrine.

A series of 19 cases of toxic psychosis following quinacrine treatment of malaria, as observed in Gorgas Hospital from 1935 to 1943, is reported.

The incidence of quinacrine psychosis in Gorgas Hospital was 0.39 per cent. of all quinacrine-treated patients, or about 1 out of 250 so treated. It appeared to be moderately higher with estivo-autumnal than with tertian malaria.

The clinical characteristics of our observations are described and compared with those in 43 cases previously published by other observers. Case-histories and post-mortem observations are given in one fatal case of quinacrine psychosis, and in one case of quinacrine psychosis superimposed on early dementia paralytica.

The etiologic factor responsible for quinacrine psychosis is probably to be found either in an individual hypersensitivity to the drug or, in some cases, in constitutional psychopathy. Toxic damage to the central nervous system caused by malaria seems to be a contributing factor. The effect of overdosage of the drug remains doubtful. The pathogenesis of quinacrine psychosis is probably determined by hypersensitivity to the drug, and its specific toxic effect on brain tissue previously sensitized by malarial infection.

Prevention of quinacrine psychosis consists in recognizing that a certain few persons are probably hypersensitive to the drug. The dosage should rarely exceed 2.8 gm. in one course of treatment, especially when the therapeutic effect can be attained with a lower dose. Parenteral, in particular intravenous, administration should be limited to cases in which therapeutic results cannot be obtained otherwise. For treatment, high doses of vitamin B preparations and forced intake of fluids are recommended. The prognosis is favorable with few exceptions. No chronic mental ailment has been observed to develop from this condition.

(Authors' abstr.)

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A Note on the Problem of Brain Damage in Rehabilitation and Personnel Work.

The extent of behavior difficulty depends chiefly upon the extent of brain damage and upon the prior personality organization of the individual. The resulting psychological disorders include rigidity and perseveration in attacking new problems, increased distractability and general slowing of thinking and speed of reaction, heightened emotional response with rapid dissipation, and generally lowered efficiency of adjustment to everyday life situations. Vocational prognosis depends not only upon the extent of damage and the possibility of clinical recovery, but also upon the person's work history and fields of interest.

H. HILL (Psychol. Abstr.).

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The Pyramidal Tract. The Sensitivity of Axons to Maximal Injury of the Cells of Origin in the Cat.

1. The axons of the pyramidal tract with the largest diameters appear to be more sensitive than smaller ones following loss of cells of origin. They disappear within the second and third day post-operatively.

2. The axonal reaction following maximal injury to cells of origin as indicated by the protargol technic is as sensitive a test for secondary degeneration in the pyramidal tract of the cat as that which occurs in the Marchi or acid phosphatase methods.
3. The glial activity begins early and continues for over 12 months during the process of secondary degeneration.
4. In general, shrinkage in the degenerated field occurs gradually, although there are individual variations.
5. Within the limits of the investigation, the results suggest that diameter of nerve fibers may have pathologic as well as physiologic significance.

(Author's abstr.)

I. *The Olivary Peduncle and Other Fiber Projections of the Superior Olivary Complex.*

1. The origin of the olivary peduncle has been confined chiefly to an area situated medial to the accessory olive and dorsal to the nucleus of the trapezoid body. In this region there are small multipolar cells known as the retro-olivary group. These cells are morphologically of the visceral efferent type, their dendrites intermingle with the fibrous plexus of the superior olivary complex and their axons are directed dorsally.
2. The course and topographical relationship of the crossed and uncrossed limbs of the peduncle are described in detail and a historical review of the various names and interpretations associated with the crossed portion is given.
3. The myelinated fibers comprising the olivary peduncle are 3 to 5 μ in diameter, and the bundle as a whole is remarkably uniform as to topographical relationship and size in the different mammals studied. This constancy is probably related to the fact that this bundle innervates an organ (cochlea) which likewise varies very little in size irrespective of body weights and species.
4. The difficulties encountered by various investigators in tracing peduncular fibers through the distal glial portion of the vestibular nerve were overcome and the method used is described. The peduncular fibers leave the central nervous system between the two divisions of the vestibular nerve and dorsal to the rootlets of the *pars intermedia* nerve.
5. Initially, the presence of peduncular fibers coursing in the eighth nerve could not be clearly demonstrated by the Marchi method. The difficulty was due to the fact that the peripheral portion of the peduncle underwent a more rapid breakdown than the central glial portion. This was overcome by reducing to one-half the usual time (10 to 14 days) allowed for degeneration. The difference in the degenerative behavior between the central and peripheral portion of nerves has not been generally recognized.
6. The course of the peduncular fibers within the eighth nerve is as follows: From the glial-Schwann sheath junction they course in the inferior division of the vestibular nerve as far as the ganglion associated with the main saccular ramus. Beyond the ganglion the fibers pass into Oort's (vestibulo-cochlear) anastomosis, which was formerly believed to be a bundle of aberrant cochlear fibers. The degenerated bundle accompanies the blood vessels of the cochlea over one half turn of the basal coil; subdividing *en route*, the tiny branches pass toward the spiral ganglion cells. Due to technical difficulties, the fibers have not been followed into the ganglion itself.
7. The morphological features of the olivary peduncle suggest that it is a visceral efferent fascicle which terminates in the cochlea. Presumably it might consist of preganglionic fibers which probably supply the blood vessels of the cochlea and/or the secretory epithelium overlaying the stria vascularis. If this is true, involvement of this bundle by either irritation or destruction might affect proper functioning of the sense organ of hearing, and perhaps the equilibratory mechanism as well. In this respect its significance to certain forms of Ménière's syndrome should be considered.
8. A cochleo-saccular anastomotic bundle, probably that described by Hardy, is closely related morphologically to the vestibulo-cochlear anastomosis (Oort), and on this basis might also represent visceral efferent fibers which innervate the sacculle. The proximal portion of this bundle, unrevealed by Hardy, has been displayed by dissection of normal material, but its origin and nature has not been determined.

II. Other Projection Fibers of the Superior Olivary Complex.

1. Contrary to the general belief and teaching, the observations in cats show that the vast majority of fibers ascending from the superior olivary nuclei terminate in the nuclei of the lateral lemniscus, relatively few reaching the inferior colliculus, and none passing as far as the medial geniculate body.

2. The accessory nucleus sends a considerable number of crossed and uncrossed axons via the medial portion of the lateral lemniscus to the ventral and dorsal nuclei of the lateral lemniscus, and to the latter in particular. The proximal course of this group of fibers is with the peduncular fibers, and on this account has been confused with the latter by other authors. So far as it is known, this particular group of fibers has not been described by other investigators.

3. Apparently no peduncular fibers terminate in the sixth nucleus, although this point cannot be determined with certainty in Marchi treated material. Careful studies of Marchi serial sections, however, reveal the probability of an auditory-abducens reflex connection in two other ways: a circuitous connection between the abducens and the cochlear nuclei of the opposite side, and a stronger one between the medial pre-olivary and/or the nucleus of the trapezoid body. This group of fibers, few in number, climb upward with the rootlets of the abducens nerve to the nucleus.

4. Lesions of the rostral half of the medial three olivary segments were productive of bilateral descending degeneration, which successively coursed in the medial longitudinal fasciculus, and then more ventrally in the region of the tectospinal tract and ventral funiculus of the cervical cord. The cells of these axons are located either within the nucleus of the trapezoid body, the accessory olive, or neighboring retro-olivary region. There are about half as many crossed as uncrossed fibers. Presumably, this pathway would affect reflex movements of the head toward the source of sound. In no case of olivary involvement were ascending fibers found in the medial longitudinal fasciculi.

5. In Marchi sections, scattered fibers streamed through the reticular formation, but most if not all passed to higher auditory nuclei. These preparations do not permit the determination of whether some collaterals or terminals connect with cells of the reticular formation, as has been claimed by others on a basis of Golgi preparation studies.

Evidence was found in Golgi preparations that cells of the reticular formation might serve as intermediate connections between the olivary complex and the various motor nuclei of the medulla oblongata.

6. The caudal extremity of the accessory olive appears to distribute a few fibers to the corresponding portion of the motor facial nucleus. This connection may initiate movements of the auricle toward the source of sound and mediate reflex movement of the stapedial muscle.

7. Evidence in Marchi material was found in support of Held's recurrent connection passing from the olive to the cochlear nuclei. (Author's abstr.)

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Studies of Motor Function in Schizophrenia: III. Steadiness.

In order to discover whether schizophrenic patients differ from normal subjects in the ability to make fine neuromuscular co-ordinations, groups of patients and control subjects were tested with the Dunlap steadiness apparatus. The results, which were compared according to two indices of steadiness, indicated that the total patient group performed at a level significantly poorer than the control group. A smaller group of patients was retested twice, and their results were still significantly inferior to that of the control group upon retest. However, when those patients who co-operated as well as the normal group were compared with the latter the differences between the groups disappeared. Such a finding would seem to indicate that schizophrenia *per se* does not carry with it a loss in finer neuromuscular co-ordination. It would seem that in more complicated tasks in which this type of co-ordination is involved this factor may be considered as insignificant in determining differences which may appear between schizophrenic and normal groups.

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Shock Treatment of Psychoses Associated with Pregnancy.

The use of shock therapy in a group of patients with post-partum and gestational psychoses has been presented, and some of the problems discussed. A cardinal question is that of the interval necessary to elapse between delivery and the first convulsive treatment, an interval which we consider to be four weeks. A case of fatality associated with electro-convulsive therapy in a post-partum psychosis is reported. (Authors' abstr.)

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Dorsal Root Potentials of the Spinal Cord.

The dorsal root potentials which are set up in the frog's spinal cord, either by dorsal or by ventral root volleys, have been systematically studied. The results of previous investigations have been confirmed, and in addition the experiments indicate that:

1. The d.r.p. is a catelectrotonic potential propagated electrotonically from a central focus, and is analyzable into an initial active phase and a later phase of passive decay.

2. The d.r.p.'s set up by strong and/or repetitive stimulation of dorsal roots have in addition a prolonged phase due to internuncial after-discharge, which is

increased by the convulsant drugs, strychnine, curarine and veratrine, and diminished by the narcotic, nembital.

3. On the other hand, internuncial after-discharge is not effective in prolonging the d.r.p.'s set up by ventral root volleys, which always show a late phase of passive decay comparable with that of 1, above.

4. Nembital greatly prolongs (up to 10 times) the time constant of decay of the d.r.p.'s set up by dorsal and ventral root volleys, but has relatively little effect on the rising phases.

5. The d.r.p. recorded in a dorsal root is abolished during the spike of a maximum volley fired in through that root, and in part recovers during the decline of the spike, leaving usually 50 to 90 per cent permanently destroyed.

6. The discharges of impulses out along the dorsal root fibres (dorsal root reflex), which often is associated with the d.r.p., has been shown to conform in all respects to the hypothesis that they are fired off by the cathodal polarization of the central terminals of these fibres.

An hypothesis is developed which shows how the synaptic potential set up by the trans-synaptic action of the dorsal root volley could secondarily produce the cathodal focus at the terminals of dorsal root fibres, and hence the spreading catelectrotonus of d.r.p. The mechanism of such a reversed electrical transmission across the synapse is closely related to the mechanism recently postulated for synaptic transmission. This hypothesis explains all the experimental results on the d.r.p. set up by dorsal root volleys, being particularly satisfactory in regard to the relative time courses of the events. It has not yet been possible to develop it for the d.r.p. set up by ventral root volleys. (Authors' abstr.)

Influence of Harmonic Content on the Wave Forms of the Human Electroencephalogram.

It is clearly demonstrated that the compounded harmonic waves generated by physical (electric) oscillators and the compounded harmonic oscillations of bio-electric systems, as observed "spontaneously" in certain human EEGs, have similar contours. This points to a similar electrical mechanism operating in each system. Furthermore, this strongly suggests that asymmetrically peaked waves in general, including square waves, are not intracellular phenomena, hence are not uniquely developed potentials—that is, unless a single neurone is found capable of generating two or more autonomous, and simultaneous, frequencies of oscillation. To date such phenomena have not been observed. It is apparent that the smallest known unit capable of giving rise to the observed electric activity must be two discharging nerve cells. However, in the light of ephaptic phenomena and pacemaker mechanisms in general, it is most probable that the asymmetric wave forms are the resultant combination of the electric output of two functionally independent relatively large aggregates of cells.

That clinically there is a fairly well defined group of subjects who give rise to bursts of square wave activity is worthy of much consideration. Further study will be necessary to determine whether the individuals subject to clinical "psychomotor" seizures have an exceptionally well developed intercellular synchronizing (phasing) mechanism that is essential for the production of square wave discharges. However, the prominent *phase shifting* and the random nature of the square wave discharges, even in clinically appropriate subjects, points to a statistical chance phenomenon in an individual who generates a fundamental frequency with relatively high voltage harmonics. (Author's abstr.)

An Inhibitory Mechanism in the Bulbar Reticular Formation.

Electrical stimulation of the lower brain stem of the cat has revealed a bulbar area capable of inhibiting motor activity whether initiated reflexly, in decerebrate rigidity or from the motor cortex. The excitable region is distributed in the bulbar reticular formation, chiefly its ventromedial part, and efferent connections descend from it in the ventral part of the cord. (Authors' abstr.)

Morphology and Conduction of Bipolar Dorsal Root Ganglion Cells of Selachian Fishes.

1. The dorsal root ganglia of *Raja* and *Squalus* among the selachian fishes are made up exclusively of bipolar cells.

2. The large bipolar cells are covered with a myelin layer, and in addition to the neurolemma capsule have a substantial endoneurial covering.
3. The volume of these bipolar cells ranges from 2,000 to 38,000 cubic micra.
4. Conduction of single volleys over the dorsal root ganglion is simple, and proceeds either centripetally or centrifugally.
5. The dorsal roots and peripheral nerves transmit activity in a multimodal conduction potential. The conduction speeds of the three most rapid groups are 36, 14 and 8 meters per second.
6. Size distribution curves of fiber diameter in peripheral nerve and dorsal root are given. (Author's abstr.)

A Midbrain Mechanism for Facio-vocal Activity.

Central midbrain lesions, destroying the periaqueductal grey matter and adjacent tegmentum beneath the superior colliculus, abolished or greatly reduced facio-vocal behavior in a series of cats. The maintenance of other activities in these animals and the preservation of facio-vocal behavior in other animals after control lesions elsewhere in the rostral brain stem emphasized the specificity of the deficit. Facio-vocal responses had previously been elicited by electrical stimulation within the mesencephalic region destroyed in these experiments. The two lines of evidence point to a central midbrain mechanism for integrating facio-vocal behavior in emotional expression. (Authors' abstr.)

Central Effects of Centripetal Impulses in Axons of Spinal Ventral Roots.

Centripetal volleys of impulses which enter the spinal cord over alpha fibers of ventral (motor) roots in cats and rabbits evoke in the ipsilateral ventral horn action potentials (spikes) which persist, in progressively decreasing numbers, for 30-50 msec. The action potentials do not represent repetitive centripetal discharges from the periphery, and no comparable centrifugal impulses in motor axons have been detected. It is, therefore, inferred that they represent the activity of interneurons located in the ventral horn. The available evidence suggests that the discharges are not injury effects associated with the presence of the recording micro-electrode.

Impulses in many motor axons regulate the discharges. In general, as the size of an antidromic volley is increased, individual neurons respond with an increasing number of spikes at increasing frequencies and decreasing latencies. The first action potential has a *minimum* latency, measured from the time of arrival of the centripetal volley at the somas of the motoneurons, of 0.7 msec. The first two or three action potentials are sometimes spaced at intervals as short as 0.6-0.7 msec., i.e. the frequency is about 1,500 per second. The succeeding impulses, which may total as many as fifteen, are spaced in a regular pattern at progressively increasing intervals.

A neuron's discharge to a centripetal volley in one deafferented motor nerve can be conditioned (augmented or decreased) by simultaneous or preceding volleys in a second deafferented motor nerve. The neurons frequently are not discharged by dorsal root volleys sufficing to activate relatively few motoneurons; in other instances the same neuron can be thrown into activity by either an antidromic motor volley or a dorsal root volley.

It is reasonable to extrapolate the present findings to instances in which motoneurons are synaptically rather than antidromically stimulated. Thus the internuncial system in the ventral horn may act as a significant correlating system.

Attention is directed to the regular pattern of discharge at surprisingly high initial frequencies, and it is suggested that some types of interneurons may normally exhibit this type of activity. (Author's abstr.)

Tonic and Reflex Functions of Medullary Sympathetic Cardiovascular Centers.

1. In confirmation of previous studies, pressor and depressor regions in the medulla of the cat have been identified by exploratory stimulation with the aid of the Horsley-Clarke stereotaxic instrument. The pressor center was found to occupy an extensive region of the lateral reticular formation in the rostral two-thirds of the medulla, while the depressor centre includes a greater part of the medial reticular formation in the caudal half of the medulla.

2. The functional significance of the pressor center is confirmed by the fact that transections designed to remove a portion of the pressor region produce an equivalent reduction in blood pressure and cardio-accelerator tone, the latter having been observed directly by recording the activity in the inferior cardiac nerve.

3. The depressor center is shown to be functionally significant in that it is capable of tonically inhibiting the activity of the spinal cardiovascular centers.

4. Somatic pressor reflexes produced by stimulating the sciatic nerve are dependent upon the integrity of the bulbar pressor center.

5. Depressor reflexes remain functional as long as the depressor center in the medulla is intact.

6. Recordings from the peripheral nerves demonstrate that stimulation of the bulbar pressor center of one side produces increased activity in the inferior cardiac nerves bilaterally, while in the cervical sympathetic the excitatory influence of the bulbar pressor center of one side is restricted to the ipsilateral nerve with a reciprocal inhibition of activity in the contralateral nerve. In the case of the cervical sympathetic this indicates the possibility of selective control over the activity in the sympathetic-outflow to structures on one side of the head. (Author's abstr.)

Brain Stem Facilitation of Cortical Motor Response.

In cats and monkeys, cortically induced movements are facilitated by exciting a ventral diencephalic mechanism (sub- and hypothalamus) which appears to receive functional contributions from the globus pallidus and the midline and other nuclei of the thalamus.

An uninterrupted continuity of facilitatory sites may be followed from the ventral diencephalon backward through the central gray and tegmentum of the midbrain, the pontile tegmentum and the bulbar reticular formation.

Ventral diencephalic sites, whose stimulation facilitates cortically induced movement, are also effective in facilitating motor activity evoked from the bulbar pyramid, even after cortical extirpation.

From these results, diencephalic stimulation would appear to facilitate cortically induced movement, not at the cortex, but within the spinal cord, to which its influence is conducted by connections descending through the lower brain stem.

Impairment of this brain-stem facilitatory system may be responsible for the hypokinesia, resembling that of Parkinson's disease in man, which follows experimental destruction of the globus pallidus and ventral diencephalon.

(Authors' abstr.)

Properties of Maximal Seizures and Their Alteration by Anticonvulsant Drugs and Other Agents.

1. Seizures produced in rabbits, cats, and rats by electroshock intensities not far above threshold are usually characterized by extreme tonic extension, and are relatively constant in duration. This tonic extensor type of seizure is not altered by further increase in stimulus intensity or by lowering of threshold. Once it has begun it cannot be modified by additional stimulation while in progress. When the tonic extensor component is abolished by repeated electroshock, it may be restored by stimulation during a seizure. The depression following tonic extensor convulsions is uniform in duration and greater than for purely clonic seizures, although the latter are often considerably longer. The tonic extensor seizure would appear to represent the maximum rate of dissipation of energy of which the brain is capable.

2. The clinically recognized antiepileptic agents abolish the tonic phase of major seizures even when these drugs fail to raise appreciably the threshold for electroshock or metrazol seizures. Diphenylhydantoin and phenobarbital show the highest protective index. Several new agents, including tridione rank, with phenobarbital in efficacy.

3. A rapid and simple method for detecting and evaluating experimental antiepileptic agents is presented.

(Authors' abstr.)

Transmission of Impulses in Peripheral Nerves Treated with Di-isopropyl Fluorophosphate (DFP).

1. Local application of eserine or di-isopropyl fluorophosphate (DFP) in Ringer solution to segments of isolated nerves of the cat or bullfrog led to a block of nerve

impulses, indicated by the failure to record action potentials in the nerve beyond the region of application.

2. Such a block was not irreversible, but was abolished by washing the exposed segment of the nerve in Ringer solution, or in the case of DFP by merely lifting the nerve out of solution of the drug.

3. Eserine salicylate in the same concentration (0.01-0.02 M) had no blocking action when applied locally.

4. The *in vivo* administration of DFP to bullfrogs produced a reduction in the cholinesterase content of the nerves to a mean value of 2.3 per cent. of that from the control nerves. This indicates that the experimental nerves had virtually no acetylcholine-splitting activity. Such nerves, however, were found to conduct impulses equally as well as the control nerves following either single or repetitive shocks at frequencies as high as 43 per second.

5. The conclusion is reached that in nerve fibers there is no parallel relationship between the magnitude of the action (spike) potential and the cholinesterase activity as determined on the nerves after homogenization. It appears that the block which was produced by local application of DFP was not one resulting from the anticholinesterase action of this compound. (Authors' abstr.)

Effect of Di-isopropyl Fluorophosphate (DFP) on Action Potential and Choline Esterase of Nerve.

1. DFP, like other anti-choline esterases, abolished the action potential of the fin nerve of squid. The same effect at the same concentration and in the same period of time is observed on the abdominal chain of lobster.

2. When the nerves are washed in sea water immediately after the disappearance of the action potential, the response reappears completely or nearly completely.

3. If, however, the nerve is kept in DFP for various additional periods of time, reversibility becomes increasingly incomplete and eventually the action potential is irreversibly abolished.

4. The degree of reversibility of the action potential is strikingly parallel to the amount of choline esterase which reappears in the nerve preparation of the lobster.

5. The experiments indicate that choline esterase inhibition by DFP in nerves of cold-blooded animals is partly reversible for a certain period of time.

6. This is confirmed by observations on *in vitro* inhibition of choline esterase solution.

7. The observations are consistent with the concept that the release and rapid removal of acetylcholine is an essential event during conduction. (Authors' abstr.)

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Electrospinogram (ESG). Spinal Cord Action Potentials Recorded from a Paraplegic Patient.

1. Records are presented which are believed to represent electrical activity within the isolated portion of the spinal cord in a "spastic" paraplegic patient.

2. It is proposed that such recordings be called an Electrospinogram or ESG.
3. Attention is directed to the probability that subclinical as well as clinical mass discharges may occur within the spinal cord of paraplegic patients, which may represent "cord convulsions" or "spinal epilepsy."
4. ESG tracings are presented which are believed to represent post-stimulus "after-discharge" and action potentials coincident with isolated muscle twitch.
(Author's abstr.)

Sensations of Electric Shock on Flexion of the Neck as a Sign of Head Injury.

In a series of 17 cases of gunshot or shrapnel wounds and other types of injuries to the head, the patients complained of sensations of electric shock or pallesthesiae in the extremities. These sensations were symmetrical, radiated along well-known anatomical dermatomes, and could be elicited on flexion of the head. They appeared during the post-traumatic period (several weeks after the injury), changed from one set of dermatomes to another, and lasted for a short time (weeks to months). It is believed that the syndrome is caused by a simultaneous contrecoup injury to the spinal cord. The occurrence of such a syndrome after a head trauma should be considered as a significant sign of injury to the nervous system, and should remove existing doubts as to the organicity of the case.
(Authors' abstr.)

Ventricular Electroencephalography: A Description of the Technique.

A technique is described for recording the electrical activity of the brain by means of wire electrodes inserted in the ventricles. After one and one-half years of experience with monkey recordings, we believe the method to be simple, safe, and adaptable to routine use in conjunction with ventriculography. By application of this method to man, it may be possible to lateralize deep subcortical lesions and to demonstrate the subcortical origin of various abnormal waves.
(Authors' abstr.)

Penetrating Craniocerebral Injuries. Evaluation of the Late Results in a Group of 200 Consecutive Penetrating Cranial War Wounds.

1. The late results in a series of 200 severe cranio-cerebral war wounds have been evaluated at the time the patients were discharged from an Army General Hospital in the zone of the interior. All of these men had sustained injury severe enough to have dural penetration:
2. It is recognized that this is not a report of end results, but rather an intermediate evaluation.
3. The great majority of injuries were caused by artillery shell fragments. Over one-third of the injuries were in the parietal regions.
4. There was evidence of infection in 47, or 23 per cent of the cases. In 15 of these there was only superficial wound infection, while in 32 there were deep or major infections, including 17 brain abscesses. There were 6 cases of extensive cerebral fungi.

The average time of debridement following injury for the whole series was 33 hours, with extremes of 2 and 504 hours. The average time of debridement in the group with infections was 25.3 hours or less than that for the series as a whole.

All patients with infection had essentially the same type of drug therapy as those that remained uninfected.

In this series foreign bodies retained in the brain seemed to have little influence on the incidence of infection.

It is felt that these statistics confirm the opinion that the most important single factor in treating penetrating craniocerebral injuries is careful and complete debridement.

5. Some type of convulsive disorder following their injury occurred in 34 or 17 per cent of the patients. Of these one-third had a history of convulsive seizures during the acute stage of their injury, and only three continued to have epilepsy at the time of disposition from the hospital. The remaining two-thirds developed their first seizure from 2 weeks to 8 months after injury, and the majority of these continued to have seizures until seen at this hospital and controlled medically.

One-half (56 per cent.) of the patients with convulsions had no evidence or history of infection. However, all but 3 of the remaining 44 per cent. had major or deep

infection. Time of debridement, unconsciousness, and retained foreign bodies seem to have little to do with the development of convulsions. This stresses the feeling that it is the cerebrodural scar and not the foreign body that is epileptogenic.

6. Twenty per cent. of the patients with dural penetration had no neurological residua, and another 15 per cent. had only convulsive seizures without localized residua. Motor, speech, and visual defects were the most common. Headaches and dizziness were conspicuous because of their infrequency.

It was of interest that in 34.7 per cent. of this group of severe injuries, there was no loss of consciousness.

7. There were 174 (85 per cent.) patients separated from the military service—a figure which is influenced by military necessity and medical department policies, as much as by the patients' physical condition.

There were 159 (79.5 per cent.) soldiers returned either to their homes or to some type of duty. These men must be considered capable of being completely or partially self-supporting. Twenty-six (18 per cent.) patients had severe enough residua to necessitate further hospital care in the Veterans' Hospitals. These men for the present must be considered completely incapacitated.

There were 2 (1 per cent.) fatalities in this group, both occurring in patients with deep cerebral infection.

Stress has been laid on the importance of organized rehabilitation of these patients. (Author's abstr.)

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The Role of Feeble-mindedness in Criminality.

Of 1,293 criminals examined from 1900 to 1942 in the Psychiatric Hospital of Munsingen, 321 were feeble-minded. While psychopaths showed greater tendency to crimes against property and against body and life, the feeble-minded leaned heavily to incendiarism and crimes against morality (incest, rape, exhibitionism, and unchastity). Idiots were not involved criminally; imbeciles slightly, morons markedly involved. Of moral crimes, unchastity was the most frequent offence of imbeciles and morons. Difficulty in finding a sex partner, their wooing being rejected or ridiculed, forces them to masturbation, exhibitionism, finding of sex-object in children, old people, animals, or to prostitution. Lack of intelligence for making fine moral discriminations, early exposure to free sex relations among domestics, stimulation by obscene talk, shyness, and an intellectual inferiority feeling contribute to an immoral or harmful approach to the sex partner. Motives to incendiarism in the feeble-minded are momentary impulse to vengeance, homesickness, sheer delight in fire, or desire for omnipotence and personality enhancement. In the feeble-minded the crime rate is highest between 15 and 19, and is four times more frequent in males than in females; two-thirds are pure oligophrenes, the rest mixed with psychopathy, epilepsy, or alcoholism. *Profpschizophrenie* (feeble-mindedness plus psychopathy) is the most common blend.

F. C. SUMNER (Psychol. Abstr.).

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Experimental Phobia.

An experimental phobia of depth was produced and controlled in a dog. It was found that the pathological symptom could be produced by any factor which tended to weaken the animal's inhibitory capacities. The procedures considered responsible for the development of the phobia were early castration and a long history of performance in difficult discrimination experiments. Such experimental variables as alternation of positive and negative stimuli and prolonged stimulation by the negative stimulus were found to be adequate to produce the phobia, which appeared as an intense fear of the edge of the stairs where the dog was ordinarily fed.

G. A. KIMBLE (Psychol. Abstr.).

Skin Diseases in Experimental Dogs; Their Origin and Therapy.

Cases of functional skin disorders in dogs are described. It is demonstrated that eczema sometimes develops in the case of dogs who become neurotic in the conditioning situation. Local methods of treatment fail to cure the disease, but rest and removal of the dog from the laboratory frequently effect a cure of the skin disease which is coincident with the disappearance of the nervous symptoms. Valuable auxiliary methods of therapy include the use of bromine and veronal as well as the induction of a trance-like state in the dog.

G. A. KIMBLE (Psychol. Abstr.).

Inhibition as a Factor of Restoration of Nervous Activity.

Two types of therapeutic procedure are shown to be effective in treating dogs suffering from experimental neuroses. A considerable change was noted in animals subjected to two 8-day periods of veronal sleep in that, following such treatment, they were able to resist experimental neurosis to a greater extent than prior to narcosis. The treatment was particularly effective in treating functional skin diseases such as ulcers, eczema, and baldness. It is shown that the amount of the drug necessary to produce a favorable effect is directly proportional to the severity of the neurosis. The second method of treatment was an hypnotic technique. The rate of disappearance of the neurotic symptoms was closely related to the depth of the trance induced in the subject.

G. A. KIMBLE (Psychol. Abstr.).

Effect of CaCl₂ and of its Combination with Bromine and Caffeine on Higher Nervous Activity in Dogs belonging to the Strong Type and Suffering from Experimental Neuroses.

Small doses (.05 gr. to .5 gr.) of CaCl₂ were shown to aggravate an experimental neurotic syndrome in dogs. Larger doses (3.0 gr.) produced a positive effect and restored normal conditioned reflexes in the animals. When treatment was discontinued, the dogs returned to neurotic behavior. Dosages of 5.0 gr. alleviated the neurotic symptoms, but dogs treated with this dosage became overexcitable. 2.5 gr. of CaCl₂ was finally shown to be the optimal dosage. A combination of 2.0 gr. CaCl₂ and .5 gr. NaBr produced a better effect than CaCl₂ alone, while a dose of .005-gr. of pure caffeine added to the above mixture produced a still better effect. The importance of correct dosage is emphasized.

G. A. KIMBLE (Psychol. Abstr.).

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Z. PÄDAG. PSYCHOL.

- VOL. XLIV. 1943.
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- VOL. XIV. 1944.
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1. Anatomy, Physiology, Psychology, Biochemistry, &c.

Release of Phosphate by the Brain upon Stimulation. Cicardo, Vincente H. (Centro Investigaciones Tisiológicas, Buenos Aires, Argentina). [Am. J. Physiol., 145, 542-8 (1946).]

The stimulation of the brain of the dog by a tetanizing electric current or by cardiazole or picrotoxin causes a release of P which is indicated by the increase of the total acid-soluble plasma P of the blood collected from the superior longitudinal venous sinus.
 E. D. WALTER (Chem. Abstr.).

Production of Hypovitaminosis C by Medication. II. The Barbiturates. Frommel, E., Piquet, J., and Loutfi, M (Univ. Genève). [*Helv. Physiol. Pharmacol. Acta*, 3, 391-8 (1945) (in French); cf. *C. A.*, 40, 402¹.]

In guinea-pigs heavy doses of the common barbiturates produced decreases in the ascorbic acid of most of the tissues in 1-4 hours. The liver and the lungs showed the greatest decrease; the brain and the spleen were but little affected. The adrenals frequently showed an increase, as though ascorbic acid were being mobilized.
L. E. GILSON (Chem. Abstr.).

Lesions of the Central Nervous System in Experimental Avitaminosis B₁. Austregesilo, A., and Borges-Fortes, A. (Univ. Brazil, Rio de Janeiro). [*Rev. neurol.*, 73, 305-25 (1941).]

H. L. WILLIAMS (Chem. Abstr.).

Effect of Pellagra-producing Diet in Dogs, with Special Reference to the Histological Changes in the Central Nervous System. Jensenius, Hans, and Nørsgaard, Flemming (Kommune-Hospitalet, Copenhagen, Denmark). [*Acta Path. Microbiol. Scand.*, 19, 433-47 (1942) (in English).]

A pellagra-producing diet fed young dogs caused a morbid condition resembling black tongue, but lacking the oral symptoms. The condition, however, caused the same changes in the central nervous system, the changes in the ganglion cells being particularly pronounced. Similar changes were observed in the sympathetic ganglia.
H. L. WILLIAMS (Chem. Abstr.).

The Effect of Introduction of Isotonic Sodium Chloride Solution into the Cisterna Magna of the Dog on the Cell Content of the Cerebrospinal Fluid. Bedford, T. H. B. (Manchester Univ., Eng.). [*J. Physiol.*, 104, 299-304 (1946).]

Isotonic saline introduced into the cisterna magna of dogs under nembutal anesthesia resulted in the appearance of polymorphonuclear leucocytes in the cerebrospinal fluid, which effect was not observed following introduction of distilled water or Ringer's solution, Dale's formula.
H. L. WILLIAMS (Chem. Abstr.).

Can the α -Waves of the Electroencephalogram Originate Outside the Cerebral Cortex? Cate, J. ten, et al. [*Arch. néerl. Physiol.*, 25, 366-80 (1941).]

Working with cats under dial narcosis, the authors were able to elicit typical alpha waves from all parts of the neopallium, and also from the cornu ammonis (archipallium), the lobus piriformis (palaeopallium), and the thalamus. No alpha waves could be obtained from the nucleus caudatus or globus pallidus of the corpus striatum, the corpora quadrigemina, or the cerebellum. Those arising in the thalamus are of so small amplitude that, in the opinion of the authors, they do not play a part in the EEGs obtained from the other brain parts mentioned above.

C. P. STONE (Psychol. Abstr.).

Continued Investigations into the Nitrogen Metabolism in Manic-depressive Patients with a Special View to Amino Acids and Non-protein Nitrogen in the Plasma. Schou, H. I., and Trolle, C. (Hosp. Nervous Mental Disorders, Filadelfia, Dianalund, Denmark). [*Acta Psychiat. Neurol.*, 19, 495-516 (1944) (in English).]

During the recovery period from cariazole shock the plasma N.P.N. fell to 12-14 mgm. per cent. Similar values were observed during the recovery phase from electric shock and during spontaneous recovery. The fraction of the N.P.N. responsible varied, but it can be the amino acids. The N output of the urine was decreased also.
H. L. WILLIAMS (Chem. Abstr.).

Studies of the Water Excretion in Recovery from Manic-depressive Psychosis (Depressive Phase). [*Ibid.*, 20, 235-45 (1945).]

The renal water excretion and N excretion were parallel.

H. L. WILLIAMS (Chem. Abstr.).

Blood Sugar and Cholesterol in Electric Shock. Silfverskiöld, Boris, and Stenberg, Sven (Psychiatric Clinic, Stockholm, Sweden). [*Acta Psychiat. Neurol.*, 18, 339-48 (1943) (in English).]

There was a statistically significant increase in the blood sugar and cholesterol immediately after electric shock with convulsions, the values returning nearly to normal in 1 hour.

H. L. WILLIAMS (Chem. Abstr.).

Biological Syndrome of Air Encephalography. Delay, Jean, Soulairac, A., and Desclaux, P. (Univ. Paris). [*Compt. rend. soc. biol.*, 139, 296-7 (1945).]

Discussion of results previously reported (*C. A.*, 40, 943¹).

L. E. GILSON (Chem. Abstr.).

The Effect of Methylene Blue on the Cells of the Central Nervous System. Näätänen, E. (Univ. Helsinki, Finland). [*Acta Path. Microbiol. Scand.*, 22, 603-14 (1945) (in English).]

The subcutaneous injection of 0.2-4.5 ml. of 1 per cent. methylene blue into rats resulted in sclerotic tissue changes in all parts of the central nervous system. The use of methylene blue in the treatment of CO poisoning is contraindicated.

H. L. WILLIAMS (Chem. Abstr.).

An Attempt to Produce Brain Tumors in Mice (with Negative Results). Christensen, Erna, and Engelbreth-Holm, J. (Univ. Inst. Path. Anatomy, Copenhagen, Denmark). [*Acta Path. Microbiol. Scand. Suppl.*, 54, 71-6 (1944) (in English).]

Pellets of 5 mgm. 9,10-dimethyl-1,2-benzanthracene dissolved in a mixture of cholesterol-lecithin were implanted in the brains of mice of Street, AKA and Drb strains. No brain tumors developed, but subcutaneous sarcomas appeared in a few cases.

H. L. WILLIAMS (Chem. Abstr.).

Effect of Anesthetics and Convulsants on Brain Acetylcholine Content. Tobias, J. M., Lipton, M. A., and Lepinat, A. A. (Univ. Chicago). [*Proc. Soc. Exptl. Biol. Med.*, 61, 51-4 (1946).]

Both free and total acetylcholine (I) contents of the whole rat brain are higher after nembutal or CHCl₃ anesthesia (diffuse diminution of activity) than in the unanesthetized rat. The free (I) change is greater after CHCl₃, whereas the total (I) change is greater after nembutal. The total (I) of frog brain is increased after administration of nembutal. Neither free nor total (I) of rat brain changed significantly after the onset of strychnine or picrotoxin convulsions (diffuse increase of activity) from that found in quiet, awake rats. Strychnine did not alter the total (I) content of frog brain. By the methods used, normal whole rat brain was found to contain about 0.7γ of free (I) and 2.0γ of total (I) per gm. wet weight. Frog brain contained approximately 4.9γ of total (I) per gm.

L. E. GILSON (Chem. Abstr.).

The Production of Acetylcholine and Antidromic Vasodilation. Matthew, L., and Bach, N. (Univ. of Calif., Berkeley). [*Am. J. Physiol.*, 145, 478-82 (1946).]

Acetylcholine is definitely formed as a result of stimulation of the vasodilator fibers of the dorsal roots of the rabbit. Adrenoxine is not produced in significant amounts. The role of histamine in this and other types of vasodilation is discussed; this substance is probably formed after the initiation of the vasodilation and so is not the causal factor. The mechanism of reflex activation and action of the parasympathetic type fibers in antidromic vasodilation is suggested.

E. D. WALTER (Chem. Abstr.).

The Brain-wave Pattern, an Hereditary Trait; Evidence from 74 "Normal" Pairs of Twins. Lennox, W. G., et al. [*J. Hered.*, 36, 233-43 (1945).]

Among 55 monozygotic twins, electroencephalographic tracings were judged to be identical in 85 per cent., non-identical in 4 per cent., and in doubt in 11 per cent. of the records. Among 19 dizygotic twins (including a triplet), tracings were found unlike in 95 per cent. and alike in 5 per cent. Among the total of 74 twins examined, the results of the brain-wave test agreed with standard physical criteria

as to identity for 88 per cent., disagreed for 4 per cent., and were in doubt for 8 per cent. Results indicate that brain-wave pattern is hereditary, and that the encephalogram can be used in human genetic studies and in tracing the heredity of neuropsychiatric diseases associated with cerebral dysrhythmia, provided that acquired conditions have not modified the brain-wave pattern and that test conditions are standard, apparatus dependable, and record-readers experienced. Ten figures of brain-wave paired tracings and one table accompany the article.

G. C. SCHWESINGER (Psychol. Abstr.).

Electroencephalogram in Syncopal Reactions: Collapse at 18,000 Feet Simulated Altitude in the Low Pressure Chamber. Sugar, O. [War Med., Chicago, 8, 9-13 (1945).]

Sixty-four cadets were chosen at random from the 2.5 per cent. suffering neuro-circulatory collapse with unconsciousness and in some cases convulsive movements at 18,000 ft., and from 20 normal controls. Abnormal EEGs were obtained from 20.8-22.8 per cent. of the former and from 15 per cent. of the controls. Only one record suggested *petit mal*. The others were considered abnormal because of non-pathognomonic slow-wave activity (6-7 per second). This syncopal reaction probably represents a psychosomatic disorder. Persons under emotional stress are liable to react poorly to reduction in oxygen pressure, since the mechanisms involved in the two states are similar (sympathetic nervous system). Motivation is of considerable importance in processing cadets through pressure chambers because the men look on it as a test.

M. E. MORSE (Psychol. Abstr.).

Porphyryn Fluorescence in the Livers of Pellagrins in Relation to Ultraviolet Light. Gillman, J., Gillman, T., and Brenner, S. (Univ. Witwatersrand, Johannesburg). [Nature, 156, 689 (1945).]

Porphyryn fluorescence in the liver can occur during the acute phases of pellagra. The great accumulation of Fe pigment in many livers of adult African pellagrins is probably caused by the disruption of an intracellular Fe porphyrin complex, such as catalase and cytochrome, present normally in the liver cell. Treatment with vitamin B complex is not required to resolve the porphyrin fluorescence in the livers of pellagrins while on a carbohydrate vitamin-poor diet. Ultraviolet light can excite a recrudescence of the porphyrin fluorescence in the liver without causing an exacerbation of the other external manifestations of the disease. Massive quantities of porphyrins can appear in the liver cells without any detectable amounts in the urine. These experiments emphasize the close interrelationship between the reactivity of the skin to ultraviolet light and the deposition of Fe and the appearance of porphyrin fluorescence in the liver in African pellagrins.

E. D. WALTER (Chem. Abstr.).

Electrical Correlates of Peripheral Nerve Injury: A Preliminary Note. Grenell, R. G., and Burr, H. S. [Science, 103, 48-9 (1946).]

In experiments on rabbit sciatic nerves, the potential relationships between the outer limb surface and the nerve were investigated under normal conditions, after severing or crushing the nerve, and after procaine infiltration. In humans the ulnar nerve was procaine infiltrated. Records obtained on the rabbit preparations between outer limb surface and selected points along the nerve, both before and after nerve damage, showed that potential gradients along the nerve are present. Potential differences recorded from the surface of the limb showed that the differences were correlated with the state of the nerve supplying the area. Functional nerve blocking (procaine infiltration) results in a shift in potential in humans over a range of 50-60 mv. in the surface EMF of the functionally disturbed area. It is clear from such experiments that the condition of the peripheral nerve is reflected in the changing surface potential differences.

F. A. MOTE (Psychol. Abstr.).

Recent Advances in the Study of the Brain as the Implement of the Mind. Berry, R. J. A. [Proc. roy. Soc. Edinb., 62B, 85-96 (1944).]

Correlations between brain size and/or brain weight are considered. As an index of brain size, a rough measure of volume (length \times breadth \times height) is employed. It has been demonstrated that the brain develops rapidly in the normal

individual, doubling its weight in 2 months after birth and trebling it in 12. Beyond 12 months, the increase in brain weight proceeds more slowly. In a selected group of mental defectives, it is shown that the normal brain weight of the 2½-year-old child is not attained until the age of 25 years. The development of brain volume presents an almost exactly parallel picture. It is further shown that mean brain weight and mean brain size decrease with an increase in the degree of mental deficiency. The measurements resulting in these generalisations were made post mortem, using a technique which eliminates errors that have vitiated the results of many earlier experiments. A theory of brain function is advanced according to which the cortex is divided into three functionally discrete layers: (1) The infragranular cortex is assumed to mediate the function of instinctual activities; (2) the granular cortex has a receptive function; and (3) the supragranular layer is the locus of control, inhibition and educability. The various types of mental disturbance and deficiency are postulated to be the result of dysfunction in different cortical layers.

G. A. KIMBLE (Psychol. Abstr.).

The Results of Unilateral and Bilateral Extirpation of the Forebrain of Amblystoma.
Detwiler, S. R. [J. exp. Zool., 100, 103-17 (1945).]

Two types of operations were performed on *Amblystoma* embryos in Harrison's stage 21: (1) Complete removal of the forebrain, the presumptive nasal placodes, and the rudiments of the eyes; and (2) removal of the right half of the forebrain. Seventeen of the embryos subjected to the first type of operation were joined parabiologically with normal embryos, which served both as nurses and controls. The larvae devoid of cerebral hemispheres, eyes, and nasal sacs were able to lead an autonomous existence; the motor activities concerned with lurching, engulfing food, chewing, and swallowing were carried out in an integrated manner, but with slightly less vigor than in normal larvae; spontaneous foraging reactions were reduced and growth was greatly retarded; no morphogenetic influence upon the medulla was noted, but there were striking deformities in the morphology of the head. After removal of the right half of the forebrain no regeneration was observed; there was cellular hyperplasia in the contralateral hemisphere, and the ipsilateral nasal sac showed a compensatory size increase.

L. C. MEAD (Psychol. Abstr.).

An Electrical Hypothesis of Synaptic and Neuromuscular Transmission. Eccles, J. C. [Nature, Lond., 156, 680-3 (1945).]

The author offers an electrical theory of junctional transmission in which the sequence of events is envisaged as follows: "(1) Impulse in terminal nerve fibre generates a current which gives a diphasic effect at the junctional region of the effector cell with a total duration of probably not more than 1 m.sec. in mammalian muscle and spinal cord: (a) initial anodal focus with cathodal surround; (b) more intense cathodal focus with anodal surround. (2) This cathodal focus sets up a brief and intense local response at the junctional region. (3) From this local response a catelectrotonus spreads decrementally over the effector cell membrane. (4) A propagated impulse is set up in the effector cell if this catelectrotonus is above a critical value; if it is below, then as the local response subsides, the catelectrotonic surround decays passively." The initial assumptions of, the explanations offered by, and the possible tests of this hypothesis are discussed.

A. C. HOFFMAN (Psychol. Abstr.).

Some Bioelectric Manifestations of the Human Cerebral Cortex during Voluntary Movements and Under the Influence of Sensory Stimulation. Kornmüller, A. E. [Z. Sinnesphysiol., 68, 117-50 (1940).]

Monopolar recording of the EEG was used. During voluntary movement of the limbs or the fingers, there was a reduction of potential in the central region but no occipital change. During movement or cutaneous or auditory stimulation, the tracings of corresponding bilateral points were in synchrony. Voluntary ocular movements increased occipital potentials, as did intermittent visual stimulation (with bilateral synchronization). With less frequent visual stimulation, there appeared waves lacking the sinusoidal character of the alpha. With intermittent visual stimulation ranging from 7 to 26 per second, the occipital potential sometimes showed a corresponding frequency, persisting for several seconds after termination of the flickering light.

(Psychol. Abstr.).

Conditioned Exciters and Human Sense Organs. Kekcheyev, K. [*Nature, Lond.*, 156, 573-4 (1945).]

Russian experiments are briefly reviewed in which the sensitivity of human sense organs was modified by extramodal or extraneous conditioning stimuli. A phrase or sentence was read aloud while the face was rubbed with a cold, wet towel; after conditioning, the reading of the phrase was accompanied by increased scotopic sensitivity. The idea of the bright light of automobile headlights was accompanied by increased auditory sensitivity; emotionally pleasant ideas, by increased sensitivity of all the sense organs. The idea of weak or of strong exciters produced the same effect respectively as the weak or strong exciters themselves. "We now find that the idea of red or yellow light increases the sensitivity of the eye to its complement (green or yellow light), but that the idea of the latter does not have the same effect."

A. C. HOFFMAN (Psychol. Abstr.).

Spinal Conditioning in Dogs. Kellogg, W. N., et al. [*Science*, 103, 49-50 (1946).]

Chronic spinal dogs were given 1,000 trials each in a conditioning experiment in which the conditioned stimulus was a shock to the left rear foot, the unconditioned stimulus a shock to the right rear foot, and the response to be conditioned the moving or flexion of the entire right hind limb. Muscle twitches of small amplitude and very short latency in response to the conditioned stimulus were obtained; it is assumed that this response is the same as the spinal conditioned response observed by Shurrager and Culler in the acute spinal preparation. However, the authors obtained not only the twitching or flexion response, but also an extension was frequently observed, this extension being of longer duration than the flexion twitch. With respect to the course of these two antagonistic responses, nothing like a typical learning curve was obtained, and no evidence of retention between experimental sessions was apparent. The authors conclude that they have not been able to establish spinal conditioning in chronic preparations; instead, the fluctuations of the response appear to be more adequately described as changes in reflex behavior.

F. A. MOTZ (Psychol. Abstr.).

Racial Group Differences in Mentality. Porteus, S. D. [*Tabul. biol.*, Haag, 18, 66-75 (1939).]

Several studies of race differences in intelligence employing a variety of tests are reviewed. In studies comparing Chinese, Japanese, and Hawaiian children living in Hawaii, the test results tend to indicate that, on the Binet type test and on test of auditory memory span, the Chinese excel the Japanese. In all performance tests the Japanese excel the Chinese. The predominantly Hawaiian and part Hawaiian groups are inferior to both the oriental groups. On the basis of these studies and other studies reported in which the intelligence of Australian, African, and Asiatic primitive groups are compared, the following general conclusions seem warranted: Real differences in mentality exist in the various racial groups, but no single race has any claim to absolute superiority for two reasons. In the first place there is such great variability in intelligence among the various divisions of each race that the differences among the divisions may be greater than the differences among races. Secondly, the development in mentality is not even. Race groups that excel on one type of test may be inferior on another type. Finally, these differences in intelligence are not to be ascribed entirely to environmental influences.

G. A. KIMBLE (Psychol. Abstr.).

Acoustic Control in the Flight of Bats. Ewer, D. W. [*Nature, Lond.*, 156, 692 (1945).]

Ewer elaborates briefly on Hartridge's comparison of the bat's localizing technique to radar.

He suggests that one function of the complex intra-aural muscle reflex in the bat may be to make use of the trailing edge of the echo in such a way that the reflected note does not seem to be continuous with the emitted one. He also suggests that the great development of the pinnae of the bat's ears may enable the bat to eliminate signals reflected from the ground and so increase the maximum range at which objects may be detected.

A. C. HOFFMAN (Psychol. Abstr.).

Acoustic Control in the Flight of Bats. Hartridge, H. [*Nature, Lond.*, 156, 490-4 (1945).]

The author discusses the details of the localizing mechanism used by bats in flight. Bats produce four different sounds: Supersonic tones accompanied by a buzz and a click, and a signalling or communicating tone of about 7,000 cycles per second. The supersonic tones usually lie between 40,000 and 55,000 cycles, a frequency range regarded as optimal for localization considering the vocal apparatus required, the attenuation of sound during transmission, and the aural resolving power required. The tone may be interrupted (probably intentionally) and the rate of these interruptions may vary. The larynx of the bat contains at least two (one for the buzz, the other for the supersonic and signalling tones) and possibly three vibrating structures (one for each of the three sounds). The possible structure of each larynx and of the mechanism producing the click is discussed. It is the conclusion of the author that the bat breathes and phonates (during both inspiration and expiration) via the nose rather than the mouth. It is suggested that during the time the supersonic tone is being produced, the ear is rendered quiescent by "the intra-aural muscle reflex" (possibly by synchronization of the muscle systems involved). How the reflected sounds are used to localize is not known at present.

A. C. HOFFMAN (Psychol. Abstr.).

2. Pharmacology and Treatment.

Toxicity of Sulfanilamide on Higher Nervous Activity. Gantt, W. H., and Marshall, E. K., jun. [*Johns Hopk. Hosp. Bull.*, 77, 104-15 (1945).]

Two dogs with salivary conditioned reflexes and two others with cerebellar motor conditioned reflexes were given sulfanilamide by mouth in doses ranging from 0.5 to 1.2 gm. per kgm. body weight. Their external behavior was unchanged with small doses; moderate ataxia occurred with larger, and marked ataxia with the largest doses. In large doses, sulfanilamide abolished weak CRs and decreased auditory and especially visual CRs, and cerebellar CRs to auditory stimuli. Unlike alcohol, it does not change the relations between the values of excitatory and inhibitory CRs but depresses all CRs. The maximum effect was usually reached within an hour after administration, and by the next day the CRs had returned to normal. Sulfanilamide does not impair cortical reflexes until the therapeutic dose has been considerably exceeded. Overdosing in humans produces ataxia and mental confusion roughly similar to that in dogs.

M. E. MORSE (Psychol. Abstr.).

Quantitative Studies on Alcohol Tolerance in Man. Influence of Ethyl Alcohol on the Sensory, Motor and Psychological Functions in Relation to the Blood Alcohol in Normal and Habituated Persons. Goldman, L. [*Acta physiol. scand.*, 5, Suppl. 16, 7-128 (1943). (Abstracted Review; original not seen.)]

Experiments on 11 total abstainers, 24 moderate and 14 heavy drinkers show a linear relation for each individual between symptoms and blood alcohol content. Symptoms of intoxication appear at a blood alcoholic level of 0.036 per cent. and 0.075 per cent., the results showing individual differences in blood alcoholic level and toxic effect. Disappearance of symptoms occurs at the same blood alcoholic levels, whether food is taken or not. With the same consumption, the abstainers show the strongest effects. Alcoholic habituation is a matter of increased tolerance due to a rise in the blood alcoholic threshold of symptoms.

W. L. WILKINS (Psychol. Abstr.).

Permeability of the Hemato-encephalic Barrier in Massive Arsenotherapy. Krichevskaya, E. I., and Lass, D. I. (Dept. Syphilology, Central Dermatol. Venereal Inst., Narkomzdrav, Moscow, U.S.S.R.). [*Am. Rev. Soviet Med.*, 3, No. 1, 38-40 (1945).]

Under normal conditions As does not pass from the blood into the cerebrospinal fluid. After the injection of various arsphenamine preparations, As may appear in the cerebrospinal fluid after 5 minutes. The highest concentration of As in

the fluid is reached in 2-72 hours. Inflammatory processes in the membranes facilitate the passage of As into the cerebrospinal fluid. The character of neurosyphilis and the kind of preparation determine the passage of As into the fluid. Intravenous injections of a concentrated solution facilitated the penetration of the barrier. The content of As in the blood after ordinary arsphenamine therapy, the passage of As into the cerebrospinal fluid, the time of the appearance, the permeability of the meninges and the concentration of As in the cerebrospinal fluid were studied on 43 patients (tabes, progressive paralysis, syphilis of the brain, syphilitic meningitis, syphilitic pachymeningitis, syphilitic myelitis, latent syphilis, epidemic chronic encephalitis, epilepsy, and Friedrich-Marie disease). Some As was detected within 30 minutes to 5 hours after injection of neoarsphenamine. After 24 hours As was not found in any case. In all the cases in which there were inflammatory changes of the membranes, As penetrated into the cerebrospinal fluid. In dogs the size of the dose and the condition of the membranes influence the passage of the barrier. Arsenic penetrated into the cerebrospinal fluid in 37 of 49 patients who received massive arsenotherapy and who developed a temperature reaction. It appears, therefore, that in four-fifths of the patients, the temperature was a factor that facilitated the penetration of the barrier. W. R. HENN (Chem. Abstr.).

Toxicological Microanalysis of Hypnotics. Hanson, Arne. (State Lab. Forensic Chemistry, Stockholm). [Svensk Kem. Tid., 56, 290-4 (1944) (in English).]

Micro methods are applied to the identification of barbiturates in tissues. Urine, after treatment with Pb (OAc)₂, and cerebrospinal fluid are acidified and extracted with peroxide-free ether. Blood is extracted after addition of 1 volume H₂O and 6 volumes of pH 3.5 buffer. Stomach contents and viscera are treated by the Stas-Otto process and extracted. The ether extracts are dried with CaCl₂ or Na₂SO₄, treated with 0.1 gm. animal charcoal and 0.2 gm. CaCO₃, filtered through a layer of Na₂SO₄ held between layers of asbestos, and evaporated. If the barbituric acid contains saturated groups, it is boiled 3-5 minutes with dilute KMnO₄ containing H₂SO₄, re-extracted, and sublimed. The p-nitrobenzyl derivative (Lyons and Dox, C. A., 23, 821) is prepared and m.ps. are determined. Sublimation temperatures and m.ps. of 17 barbituric acids and their p-nitrobenzyl derivatives are tabulated. H. L. MASON (Chem. Abstr.).

Chronic Ethyl Alcohol Intoxication in Dogs. Widmark, Erik M. P. (Medico-Chemical Inst., Lund, Sweden). [Acta Path. Microbiol. Scand. Suppl., 54, 401-12 (1944) (in English).]

One dog received 65 kgm. EtOH during 3½ years (71 per cent. of lifetime) and another received 100 kgm. in 6 years 4 months and 10 days (81 per cent. of lifetime). Both died suddenly with cardiac collapse and pulmonary edema. No other pathological conditions were observed except some fatty infiltration of the liver and abnormally high values for volatile reducing substances in the blood. H. L. WILLIAMS (Chem. Abstr.).

Experimental Investigations on Animals Showing Capillary Damage and Hemorrhage into the Brain during Insulin, Cardiazole, and Electric Shocks. Bjerner, Bo., Broman, Tore, and Swensson, Ake (Karolinska Inst., Stockholm, Sweden). [Acta Psychiat. Neurol., 19, 431-52 (1944) (in German).]

Rabbits showed localized changes in permeability and punctiform hemorrhages after shock, the changes being most marked after insulin shock and least after electric shock. H. L. WILLIAMS (Chem. Abstr.).

The Action of Narcosis on Blood-sugar Modifications. Robuschi, Luigi. [Biochim. terap. sper., 28, 153-71 (1941).]

The hyperglucemia induced by injections of metrazole is completely inhibited by the administration of chloral or chloralose. G. A. BRAVO (Chem. Abstr.).

Action of Diphenylhydantoin and Phenobarbital on Subcortical Epilepsy. Gley, P., Fournier, P., and Touchard, T. [Compt. rend. soc. biol., 139, 298 (1945).]

Slight differences in the effects of the above antiepileptics on convulsions produced by electric shock in decerebrate pigeons are discussed.

L. E. GILSON (Chem. Abstr.).

Development of Tolerance and Cross-tolerance to Barbiturates in Experimental Animals. Gruber, Charles M., and Keyser, Goldie F. (Jefferson Med. Coll., Philadelphia, Pa.). [*J. Pharmacol.*, **86**, 186-96 (1946).]

If a reduction in sleeping time can be taken as a criterion of acquired tolerance to barbiturates, dogs can acquire tolerance to butisol-Na (I) and pentobarbital-Na (II); rats can acquire tolerance to (I), (II), cyclopal (III), seconal-Na (IV), and ortal-Na; and rabbits can acquire tolerance to (I), (II), (III), (IV), amytal-Na (V), and evipal-Na (VI). A tolerance to the barbiturate, as judged by the shortened sleeping time, is no protection against the LD 50. A dog, rabbit, or rat made tolerant to one barbiturate will very likely show some tolerance to all other barbiturates. Cross-tolerance was shown in rabbits for (I), (II) and (V), and in dogs and rats for (I) and (II). In developing tolerance in rabbits the time intervals can be longer between doses of long-acting barbiturates than with short-acting compounds. To develop tolerance in rabbits to (VI) the drug must be injected twice each day. Tolerance to any barbiturate is rapidly lost after cessation of administration.

L. E. GILSON (Chem. Abstr.).

Certain Peripheral and Central Nervous System Effects of β -diethylaminoethyl Phenyl- α -thienylglycolate Hydrochloride. Abreu, Benedict E., and Troeschler-Elam, Elizabeth (Univ. Calif. Med. School, San Francisco). [*J. Pharmacol.*, **86**, 205-12 (1946).]

The drug effectively opposes the spasmogenic action of pilocarpine on the intact colon and ileum of the anesthetized dog and of morphine on the intact colon of monkey and dog. It produces marked cardiac acceleration in the morphine-treated and untreated dog; in the monkey cardiac acceleration is slight, and is less than after administration of 0.1 the effective dose of atropine sulfate. It produces signs of central-nervous-system activity resembling delirium in dogs but not in monkeys or rabbits, when employed in spasmolytic dosage. β -Diethylaminoethyl phenyl- α -thienylacetate-HCl, diphenylacetate-HCl (trasentin), and 9-fluorene-carboxylate-HCl (pavatrine), and β -1-piperidylethyl α -methyl-*p*-xenylacetate-HCl have similar but much weaker actions.

L. E. GILSON (Chem. Abstr.).

Further Studies on the Depressant Actions of Barbiturates on the Terrapin Cardiac Vagus Nerve. Gruber, Charles M., and Keyser, Goldie Freedman (Jefferson Med. College, Philadelphia, Pa.). [*J. Pharmacol.*, **86**, 297-300 (1946); *cf. C. A.*, **32**, 6742¹]

In *Chrysemys marginata*, the Na salts, dissolved in Ringer solution, were placed in the pocket formed by the pericardial sac; this exposes the whole heart to the drug. The cardiac vagus nerve was then electrically stimulated. The effects of the barbiturates were temporary; recovery occurred in 5-30 minutes after washing out with Ringer solution, the time depending on the type of barbiturate used, the concentration of the solution, and the length of time the heart was exposed to it. Ortal, evipal, pentobarbital, and seconal were the most toxic. Butisol and vinbarbital (delvinal) had an extremely weak depressant action. Ortal Na was the most potent; in 0.0005 M solution it caused complete vagus block, while the other drugs in the same concentration produced only depression. *Cf.* preceding abstract.

L. E. GILSON (Chem. Abstr.).

Hypnotic Effect of Benzoxazolone Substitutes. Lespagnol, A., and Lefebvre, Mme. [*Bull. soc. chim.*, **12**, 386-8 (1945); *cf. C. A.*, **38**, 5587^a.]

Since benzoxazolone in its constitution is related to urethan, it seemed interesting to study some of its derivatives with regard to their hypnotic activity. 3-Methyl-, 7-allyl-, m. 82°, 3-allyl-, m. 41-3°, and 7-methyl-2(3)-benzoxazolone, m. 120°, were prepared. On testing the compounds in equal amounts (1:10,000 dilution) the hypnotic effect ensued in 5 to 10, 3, 1.5 and 0.5 minutes respectively. It is interesting to note that the allyl radical loses its hypnotic potency when it is attached to a benzene ring, while the Me group attached to the benzene ring enhances the hypnotic effect.

G. J. SCHEFF (Chem. Abstr.).

OBITUARY.

LEWIS CAMPBELL BRUCE, M.C., M.D.Edin., F.R.C.P.E.

DR. BRUCE died on December 3, 1945, in his 79th year. The following account of his work and life reaches us from Dr. Henry Yellowlees.

The death of Lewis Campbell Bruce severs almost the last link with the supreme period of Scottish psychiatry in the closing years of the last century and the early ones of this. There were giants in the land in those days, and it is strange to reflect that Bruce was regarded by many of them not only with respect as an original thinker and worker, but also, and even chiefly, as a dangerous innovator and something of a revolutionary.

He qualified at Edinburgh in 1894 and had an Army career as his goal. He had the great misfortune in those days of few vacancies and severe tests to fail to gain entrance either to the Royal Army Medical Corps or to the Indian Medical Service. In the examination for the former he was the seventh candidate for six vacancies, and he was rejected for the latter on account of an old fracture-dislocation of the elbow which produced a very trifling limitation of movement. He turned his attention to psychiatry, and joined the staff of Morningside under the late Sir Thomas Clouston. Here he developed that combination of clear scientific thinking with intense energy and enthusiasm which characterized his whole life. In 1899 he was appointed Medical Superintendent of the 400-bed Perth District Mental Hospital at Murthly in succession to the late Prof. G. M. Robertson, who had been appointed to Larbert. Six or seven years later he suffered the crowning disappointment of his career when, to the general surprise, Robertson, and not he, was appointed to succeed Sir Thomas Clouston at Morningside. As it happened this apparent setback was the proverbial blessing in disguise, for Bruce, with all his brilliancy, would have been miserable in the post. He was without doubt rather embittered for a time, and one or two further opportunities of promotion were practically thrown away by him, apparently by his completely offhand "take it or leave it" manner, but perhaps actually because he was already realizing that he was the ideal man for Murthly and Murthly was the ideal place for him. Into that small country hospital beside the River Tay, 12 miles from Perth, he threw all his abilities and energies, and for 35 years made it a model of efficient and enlightened administration, a place of humane and skilful psychiatric treatment, and a source from which proceeded first-rate scientific work. He established and equipped a small laboratory which was his constant joy and pride. He trained members of his staff to do the work of laboratory technicians, prepare media, look after the animals for experiment, and so forth, and was one of the first medical superintendents, if not indeed the very first, to put out his own original work from the hospital of which he was in charge. He was fond of recounting that, in his early days at Murthly, he made contact with only one superintendent in England who took an interest in his researches, but that this gentleman wrote a couple of years later that, as the member of his staff who prepared his media had resigned, he had had to close down his laboratory!

It was Bruce who introduced the thyroid treatment of the insane. He was an enthusiast on vaccine therapy, and one of his chief lines of research was on blood changes in the manic-depressive psychosis—the subject he chose for his Maudsley Lecture in London in 1935. His scientific work never received all the recognition it deserved, partly because of the advances in knowledge and change in outlook during the last 20 years, and partly no doubt because he worked in isolation and not in association and collaboration with others. But the memorable thing about his work is not its value and results so much as the amazing pertinacity and skill with which it was carried out in a tiny laboratory, often with improvised or home-made instruments and apparatus, without the stimulus of colleagues, and in the teeth of obstruction and misunderstanding from an uninformed hospital committee.

Bruce was a devotee of scientific method and clear thinking, and his other ruling passion was the open air and every form of outdoor life and activity. He was an excellent shot, an enthusiastic curler, a keen tennis player and a very competent

medium-paced bowler. His knowledge of animal and bird life and of woodland lore was profound, but it was as a fisherman he excelled, and he can have had few equals in the gentle art in all Perthshire. He combined his scientific and sporting instincts in a uniquely delightful fashion, and the morning walk round the grounds, which was the invariable preliminary to the day's work, was a fascinating and instructive experience. In the cricket season the walk was varied three or four times a week by bowling practice in the garden. Single stumps were set up with white-wash lines at varying distances from one of them, and at these the "Chief" would bowl for half an hour on end, nominating the one on which the ball was to pitch, his assistant acting as wicket-keeper. This led to an accuracy of length which made him a really dangerous bowler, who could often be devastating to the later batsmen of the opposing team.

He had one assistant medical officer, and, as a rule, liked a change every 18 months or so. Fortunate indeed were the men who had a period at Murthly as their introduction to psychiatry. The first practical result with most of them was the completion of an M.D. thesis, more often than not up to gold medal standard.

Bruce was forthright and outspoken to a very great degree. He was often the reverse of tactful, he was matter-of-fact and unsentimental, and he not merely could not suffer fools gladly—he could not suffer them at all. Doubtless, especially in his earlier days, he antagonized those who did not know him, and certainly very few people whom he disliked remained in ignorance of the fact; but a short acquaintance with him made it clear that his impulsive ways and his sometimes caustic words were expressions of a loathing of cant or affectation and a flaming scorn of anything mean or insincere. He had no use for "sobstuff" and a bitter contempt for the shirker, but his kindness to anyone who was sick or in trouble, and his understanding and toleration of human frailties and lapses, were unbounded. His administration was strict, and his discipline may have seemed stern and even harsh at times to outsiders; but few, if any, medical superintendents can have been held in such affection by their medical and nursing staff as he. No one who worked for him could fail to realize that he was a man with whom fair play was a passion, and to whom one could safely confide one's inmost secrets and deepest troubles.

Bruce's mental and physical energy were alike amazing. The day's routine at Murthly, with its altogether delightful mixture of work and play—both at full pressure and express speed—may perhaps seem a little old-fashioned to modern neuropsychiatrists; but it was a uniquely pleasant and beneficial experience to the succession of assistants who enjoyed it year after year, until, as he characteristically remarked, the time came when they became more trouble to train than they were worth, and he carried on the work of the hospital single-handed.

Bruce never forgot that his assistant was without colleagues and somewhat isolated. The assistant was always welcome on the morning walk, if he could rise in time to join it, and also at precisely 2 o'clock every afternoon when, summer or winter, rain or shine, there were a couple of hours of outdoor activities of a remarkably varied kind. There was a standing invitation to tea at the "Chief's" house, a place at that meal being always laid for the assistant.

After the outbreak of war in 1914 he gave his committee no peace until he obtained their permission to join the Forces. He went to Gallipoli at the age of almost 50, acquitted himself gallantly and was awarded the Military Cross. On his return he ran Murthly as a war hospital for a year or two and then settled down again, with characteristic lack of fuss, to civilian life.

Bruce was a born teacher, concentrating on the physical aspect of mental disease. He had no use for psychopathology, nor did it interest him. As a clinician, however, he was in the first rank. He had many friends in the medical faculty of Edinburgh University, and made a point of keeping in touch through them with every development in clinical medicine and biochemistry. Above all he insisted upon the great principle, which is in such danger of being neglected in present-day psychiatry—namely, that it is impossible to understand the psychoses, or even to talk sense about the psychoses, unless one has lived among psychotic patients. Slovenly work or muddled thinking he abhorred, and few people would willingly risk his displeasure twice. On the other hand, few indeed of those who ever worked for Bruce left his service without feelings of gratitude and affection and none without feelings of respect. To have made himself generally recognized during so many years in that small country hospital as one of the keenest scientific minds, and certainly the most vivid personality, in Scottish psychiatry was a supreme achievement.

He retired in 1936 and carried on his country pursuits near Lockerbie in Dumfriesshire, where the local people, once they appreciated that here was a man whose knowledge of country life was unsurpassed, made him very welcome. The old impulsiveness and irascibility had become mellowed, but the clear-thinking brain was alert to the very end, and his interest in every psychiatric development was as keen as ever. The last time one of his old assistants visited him, the "Chief" put him through a gruelling examination upon the details of electric convulsive therapy, and asked a number of pertinent questions about electro-encephalography, which resulted in his giving more information than he received.

He leaves a widow, a daughter and two sons, one of whom is in the medical profession. Both saw active service abroad in the recent war, the elder being awarded the Military Cross like his father before him.

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(R.) indicates a *Review*; the title of the book reviewed is followed by the author's name, thus: "Psycho-analysis and its Derivatives, by H. Crichton-Miller (R)."

(E.) indicates the *Epitome* section; the title of the abstract is followed by the author's name, thus: "Age and human ability. Miles, W. R. (E)."

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