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MENTAL SCIENCE

(THE BRITISH JOURNAL OF PSYCHIATRY)

BY AUTHORITY OF
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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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Part I.—Original Articles.

THE TWENTIETH MAUDSLEY LECTURE: INTELLIGENCE AS A SOCIAL PROBLEM.*

By F. C. BARTLETT, *C.B.E.*, M.A., F.R.S.

Professor of Psychology in the University of Cambridge.

In 1895, as many people here are likely to know, Henry Maudsley combined two of his earlier books into his famous *Pathology of Mind*. Very near the beginning of this volume, he laid unusual emphasis upon the paramount importance of a study of social conditions in relation to human conduct in general and the varied forms of mental illness in particular. "The study of the individual as an element of social pathology," he declared, "will plainly be a long, laborious, and difficult business of the future." He was right. Fifty years have gone and, in spite of many notable contributions, it is a study still in its infancy.

Maudsley's statement, it will be noticed, was a peculiar one. He referred to "the individual as an element of social pathology." But when he went on to write a long sociological chapter which is still extremely well worth reading, he seems to have reversed this and to be thinking almost entirely of society as an element in individual pathology. I am proposing to try to go back to the original assertion in what seems to be its literal interpretation. One initial comment I must make. As an experimental psychologist it would, of course, be entirely wrong for me to claim any expert knowledge of pathology, individual or social. But there are many matters which are of common interest to the student of normal psychology and the investigator of aberrations in human development. I propose then, taking what is known or suspected about intelligence in the light of current research as my special topic, to consider how qualities which can be treated only as individual, may, by a complex interplay of influences, threaten to produce difficulties which, unless they are directed

* Delivered before the Royal Medico-Psychological Association, November 27th, 1946.

and controlled, will seriously interfere with any achievement of the balanced development of society.

All the main contributions to the systematic study of intelligence came later than Maudsley's period of activity. It is true that Ebbinghaus, a man of brilliant and original powers, had considered, invented and used an intelligence test years before. His scheme, the filling in of blanks in continuous prose, is still employed, and in fact it does involve most of the principles used by verbal tests of intelligence, and now usually illustrated in separate and specific items. Binet was developing a different technique, and Francis Galton, with his irrepressible originality and daring, had made suggestions which carried the seeds of later tremendous developments. But none of this had yet a widely recognized practical significance, and it is not surprising that one looks in vain for any specific discussion of intelligence by Maudsley. Indeed, it was not until Burt, Spearman and others, realizing the possible tremendous educational potentialities of intelligence testing, began the large scale statistical analysis of intelligence test results, that there was any wide admission that a new practical device of far-reaching social importance had appeared upon the scene. And why not? Such a device could first become effective only in a community which had long accepted a large measure of popular education.

Once introduced, the movement to test intelligence was bound to spread rapidly, and so it did. All sorts of people rushed into the field with all sorts of tests, proposed to serve all sorts of purposes. About the tests clustered theories concerning the nature and structure of intelligence which are still hotly debated. It seems fair to say that the simple earlier views, according to which intelligence was thought of almost as a single quantity, fixed in early years and remaining available until, at some indefinite age phase deterioration might set in, have to be abandoned. At any rate, if the most recent type of statistical analysis is to be accepted—which doubtless remains debatable—it seems that whatever it may be that is explored with a modern battery of intelligence tests, it is a very complex function to which some twelve different factors contribute. There is, perhaps in addition, a central " second order " factor, which Spearman called *g*, that influences all the others, but does not necessarily set them into a form of concomitant variation (1).

However this may be, the main general interest in and justification of intelligence tests is pragmatic, and in this respect their use does not in any way depend upon views about the precise psychological nature of intelligence. It is incontestable that the application of the tests has made it possible to predict successfully, in a statistical sense, certain forms of success which are widely valued in present-day society. In particular, probable academic success or failure can be foretold. But not academic issues alone are implicated. It is often claimed, and the claim meets with widespread sympathy, that the same intelligence tests will foretell, in the same statistical way, success in a very wide range of skills. For skill is a concerted response of mind and muscle which essentially depends upon an accurate and rapid perception of similarities and differences in varied settings, and this is also a leading requirement of any modern comprehensive battery of intelligence tests. And so it is by no means a visionary's dream—or as some would rather put it, an awful nightmare—that

there may come a time when everybody in the modern social group will, from early school days to his industrial or professional prime, carry about with him an intelligence index which will be used powerfully to help to set for him his status and duties in social life. Indeed, already large steps are proposed, in the most public manner, which would lead us, in this country, towards such an end. Let us therefore consider very seriously what sorts of things must be studied and known, if the social implications of a policy of this kind are to be understood.

Intelligence may or may not be an extremely complex function, but at least it is now a common practice for any comprehensive intelligence test sequence to be expressed in three different media or idioms, verbal, numerical and visual. All three, as they are used, are very highly symbolic, for the most approved visual forms, except those for use with very small children, primitive people and some mental patients, are geometrical or other figures of an abstract character. There is much to be said for the view that one of the outstanding characteristics of the intelligent person is a capacity to deal fluently and accurately with symbols. Certainly the bulk of modern educational training is based on that view, and certainly it fairly represents a position adopted and defended by plenty of first-class thinkers, like Hughlings Jackson and Henry Head. Nevertheless, it now seems almost certain that the view is prejudiced and incomplete, and that very serious difficulties are likely to arise in any society which accepts it without reserve.

So far as I am concerned, it was during the recent War that I began to be seriously disturbed by such considerations. It is well known that during the war period intelligence tests, often in conjunction with some others as well, were freely used for purposes of personnel selection. There is a fairly wide belief, and there is some evidence, that they were successful. My own direct experience of these methods was nothing like so extensive as that of many others. But there were in particular two fairly large groups of subjects with whom I had close contact: they were R.A.F. pilots, and some of the Controllers who had charge of the Operations Rooms which directed air manœuvres. Everybody agreed that both of these activities demanded a fairly high level of intelligence. In both cases intelligence tests of an approved modern form were used to assist selection, and in both cases there is no reasonable room to doubt that high scoring on the tests was associated with subsequent success, and low scoring with failure or smaller success. There were, however, a substantial number of exceptions at both ends of the scale, and any impartial examination, either of their frequency or of their character, makes it clear that these are not easily explained. They are not accounted for by the well-known fact that tests of any kind applied to men and women have a statistical significance only; or by unfavourable circumstances in training or operations; or by the fact that practically all known intelligence tests lead to bunching at the top end, so that alleged differences between the more highly intelligent, based upon test performance, have very little importance. I began to wonder whether the intelligence that deals with symbols may be radically different from that which deals directly with concrete situations in terms of those situations themselves.

About the same time other anomalies appeared. A widely used R.A.F. test for dark adaptation, which included the identification of representative realistic forms, ran into difficulties owing to the fact that such identification appeared subject to learning to a considerable extent. It was at once suggested that this was because these realistic recognition tests are largely a function of intelligence, though it is obvious that if intelligence as tested is itself affected by learning to any extent, the difficulties in the large scale use, especially of high grade intelligence tests, become enormous. However, trial revealed no consistent relation whatever between the perceptual ranking and the intelligence ranking.

It therefore became very worth while to devise experiments to discover whether grading in what may be called " perceptual efficiency " is possible, and if so, what is its relation to other functions of which the only one that now concerns us is intelligence as measured by the accepted tests. The experiments were carried out. Broadly, they required the identification of objects presented in ambiguous or difficult settings. They were conducted by independent investigators and with differing material. The results, in so far as the possibility of grading perceptual ability was concerned, agreed well. The case cannot be regarded as proved, but it is at least highly probable that perceptual efficiency can be measured, that it remains relatively constant from one situation to another, within limits of the kind of material dealt with, and that it has no consistent relationship with intelligence in the accepted test sense (2). To take a simple case, for example, the speed and accuracy of recording different dial readings when all dials and their scales are constructed in the same way has no necessary relation to intelligence (3). The same is true of the recognition of objects presented from some unusual point of view, as in aerial photography.

What about manipulative efficiency ? Here we get a step further still from tackling a problem by means of any interpolated set of symbols. We devised a representative group of experiments in which, for example, some simple mechanical arrangement embodying a familiar device was shown. The subject was then told that a readjustment might or might not be made. He was next asked to say whether the mechanism was the same or different. If he said " different " he was at once asked to put it right ; if he asserted that it was the " same " he was required to set the mechanism into action, and if he had been wrong, to make it work. There were a good many other variations on the same theme. Once again, while it cannot yet be said to be fully proved, the results show that it is highly probable that, if this technique can be said to get at manipulative efficiency, such efficiency does not vary regularly with intelligence as ranked by the approved tests. Manipulative efficiency defined in this way does not agree very well with perceptual efficiency either. One thing is interesting. There are a fair number of people who can see quickly that something is different in a mechanical arrangement, cannot say at all clearly or decidedly what it is, but can, if required, very speedily and accurately put it right (4).

Admittedly, both perceptual and manipulative efficiency present extremely complicated problems and a great amount of more controlled experiment is required, but nobody will deny that they are needed in all sorts of directions

in the modern social group, and that so long as it remains doubtful whether they bear a known regular relation to tests of intelligence, any large-scale use of the latter alone to determine status and duties must be adopted with extreme caution.

I turn now to another aspect of the same question. In the early years of the war intelligence test results were collected from a very large number of people entering the Fighting Services, together with a record of their pre-war employment. There is, of course, room for error in the employment records, but they are likely to have been substantially correct. As a sample, ten thousand of these intelligence scores were sorted into employment groups, and if we make the assumption that when a man remains in fairly regular employment there can be nothing in its demands at serious variance with his intellectual equipment, we can deduce the range of intelligence which any given trade or profession can tolerate. The only striking differences appeared at the top and the bottom of the total range. The great majority of the occupations required in a modern community are, it seems, so far as intelligence goes, available to the great majority of its citizens. This is, of course, exactly what a general survey of pre-war industry, with the almost total absence of specific selection, would lead one to expect (5).

One implication seems absolutely certain. As every psychologist who is not woefully biased would be willing to agree, practically all measures of human function are measures of range. Indeed, hardly anything else could happen. All human activities are built up in a world of change. They remain stable within a certain range of normal change, and then outside that range are apt to break down, often suddenly and dramatically. The astonishing mechanism of adaptation very often sets steps of range, and the important thing is to know when we move from one step to another. Intelligence measures are no exception, and it seems certain that for the great bulk of avocations the range differences that are important are very much fewer than the measurable differences.

To this there may well turn out to be one vastly significant exception, well-known, but up to the present very little regarded. Practically every set of intelligence tests in common use at present produces a great bunching up in the top range. So while the nature of intelligence in relation to occupation probably makes their scores not very discriminatory in the middle range, the present nature of the tests makes them even less so in the upper range (6).

Lastly, so far as the present line of reflection goes, there is a vast and so far largely unexplored field of problems concerning the effect of test repetition. This has not been an important practical question until lately, and its theoretical significance has been less fully realized than should have been the case. In both ways it has now become vital. We now know that the repetition of tests may push up a person's test score, especially with adults, far more than has been generally recognized. This does not much matter for the purposes of inter-group comparison, since the improvement curves will run roughly parallel. But if scores are used in an absolute sense to assess a person's grade in a total community it may matter a very great deal. How and how much it matters nobody knows, but until we find out the utmost caution is essential.

Let me sum up and then move briefly to a different, though related, field of thought. There is evidence, but not yet complete proof, that the present approved intelligence tests, by their preoccupation with symbolic efficiency, may entirely by-pass forms of skill which are of growing significance in an industrialized and mechanized civilization. Such tests have little discriminatory value in the middle range, and less discriminatory capacity in the upper range. Repetition of tests may perhaps so affect performance as to render interpretation of scores excessively difficult.

Now perhaps the real distribution of intelligence remains constant from age to age, in any sufficiently large population, whatever the state of popular education. Nobody knows. But certainly the apparent distribution varies if it is based upon performances requiring the efficient use of symbols which are the direct concern of education. There are several good and well authenticated recent studies which indicate that about 1 in 5 of the total present school population of this country reaches an intelligence level likely to guarantee success in University examinations (7). The same methods would certainly not have yielded the same results when Maudsley wrote his great book. It is not silly to imagine that there may come a time when the whole school population, except the mentally defective may, by the same methods, be shown equal to University educational standards. What then? Are we to conclude, as many now openly do, that all those who reach this level should proceed to a University? Obviously, apart from the fact, which I hope I have shown, that the methods may stand in need of much revision, there are other considerations which are of great social weight. We do not know for certain what vocational and professional preferences are set up by a University training. But investigations like the recent extremely interesting Cambridge study of post-graduate careers make it exceedingly clear that such preferences bear no balanced relation to the vocational and professional demands of modern society (8). Already a large number of men and women have to fall back upon second, third and fourth preferences. We may very well be approaching a state in which a very large number, perhaps the majority, will not be able to secure even that degree of satisfaction in terms of their own preferences. Indeed already every year increases the severity of the problem of the "unwanted trade." It is a problem which demands most serious research from many points of view. Among these the psychological is certainly not the least important. Yet, in this country at least, no opportunities seem to be offered or contemplated for its scientific investigation.

The situation is a strange one. The phrase "intelligence as a social problem" probably makes most of us think of the retarded and the mentally defective. It is the "good average" or the "above average" intelligence that constitutes the problem of which I am speaking. We rate intelligence mainly in terms of the symbols of words, numbers and abstract forms. We foster every educational device to make these symbols more and more widely familiar and their effective use easier. At the same time we shut our eyes to the fact that we are building an accumulation of limited preferences and a scale of social values heavily weighted towards a small group of social functions and activities. And we develop a heavily industrialized civilization, many of

whose human demands are totally at variance with these preferences and these values. The price may be a piled-up mass of individual frustration and disappointment which are the nursery of a sick society.

Intelligence is a quality of the individual. We are therefore back to a most literal application of Maudsley's prophetic phrase, "the individual as an element of social pathology."

It is easy to point these things out: futile unless the effect is a search for solutions. Certainly no sensible person would wish to reverse, even if he could, the expanding course, to change the essential media and character of education. It may be that social values will be altered, until every kind of effective skill will be recognized as carrying a similar and equal claim to what are called the good things of life. It may be—and I think this is far more likely—that society will at length be forced to study seriously the conditions of its own enormous power of productivity, and not simply to talk about it and to appoint some of its citizens to exhort the rest of them to work. Then we can have, as many people have dreamed, an education, especially an academic education, for leisure, consistent with every other kind of training that developing society may need.

Whatever the solution, it can have no sure basis except in fundamental research into the nature of men and the claims of society. Already there is the most urgent need for more penetrative and catholic investigations into the structure of intelligence and the nature and conditions of intelligent activities. Without this we can only go on groping in the dark, or applying methods in a more rigid manner than is justified.

I have chosen to speak about intelligence because it already presents an outstanding illustration of a difficulty which is developing rapidly in modern society in many directions. Every society which at one and the same time sets itself to extend, foster and encourage individual qualities, and to produce a social order which inevitably denies those qualities free expression in the case of many individuals, is asking for trouble. It matters little, for a variety of reasons, so long as the effective groups in society are small. But as the ruling groups grow larger and larger and their demands become both more compelling and more uniform for all their members, there comes inevitably a stage when such discrepancy piles up problem after problem. It seems to me a matter of most vital importance that this and other essential differences between the large and the small social group should be studied and understood. I do not know at what stage of increasing size discrepancies between the qualities and their functions which are sought for the individual, and the needs and their activities which are demanded by society, become an acute threat to social order. But I am convinced that that stage has been reached already in many respects over the whole civilized world, and that in many other respects it is rapidly approaching. There is need as never before for the kind of study which Maudsley, with great wisdom, called for long ago. Disaster can be averted and progress can be assured only if man learns at length to use those scientific principles and methods which he has discovered and of which he is justly proud, to increase his knowledge of himself and to direct his social achievements.

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TEN YEARS' EXPERIENCE OF INSULIN THERAPY IN SCHIZOPHRENIA.*

By R. K. FREUDENBERG, M.D., L.R.C.P., D.P.M.,

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INTRODUCTION.

MORE than ten years have elapsed since insulin therapy was first introduced in this country as a treatment for schizophrenia. This should gradually enable us to form a more accurate opinion as to its value. An enormous literature has accumulated on the subject. Only some samples of it, representing the different views expressed, can therefore be mentioned. It is here attempted to apply some common criteria which are indispensable for the assessment of the effects of treatment, which it is hoped may lead to a clarification of the present position of insulin therapy.

What are the difficulties in evaluating the effectiveness of this method? Is there an optimum technique for achieving the best results? Why do some investigators come to discouraging conclusions? What is the opinion of the majority of workers on insulin therapy?

A. Lewis (1945) states that "the chief reason . . . why ten years after the introduction of a new method we are still uncertain about its range and effect are to be found in the complexity and nature of psychiatric data." Many criteria for analysing results have been suggested by different workers. It is well known that the diagnostic criteria of schizophrenia are by no means uniform. As Cook (1944) states in his review on Convulsion Therapy, "Schizophrenia has no clear cut frontier. There is a no man's land of 'acute schizophrenic reactive states,' 'confusional psychoses,' 'atypical schizophrenias,' etc., which tend to run a self-limited course." The inclusion of these states in varying degree under the term schizophrenia considerably alters the number of spontaneous remissions. It is most important, therefore, that the same criteria are applied to treated and non-treated cases, used as controls. The same standards are most readily achieved if one doctor or at least the same team of doctors are employed in the work. For that reason each hospital has to rely largely on its own experience. The results reported are, therefore, often based on a small number of cases, as each therapist must perforce have limited case-material.

It is generally agreed now that the response to treatment is largely depen-

* A paper read at the Quarterly Meeting of the Royal Medico-Psychological Association on November 27, 1946, at 11, Chandos Street, W. 1.

dent on the duration of illness. Cases, therefore, tend to be admitted earlier than in the pre-insulin days. Another question is how far the enthusiastic therapist is tempted to discharge his treated patients earlier than was previously the custom, partly to try them out and partly to make room for fresh cases.

Definitions of the quality of improvement vary greatly amongst different workers (Cook, 1944). The assessment of the degree of improvement immediately at the termination of treatment may be misleading, because it is known from past experience that many forms of physical interference may result in transitory remissions. The predominantly temporary character of such remissions is confirmed in a recent study on the modification of mental illness by intercurrent physical disorders by Clow and Prout (1946). They state that " the change was of a relatively minor degree and more closely limited to the period of actual physical illness." To avoid possible errors results of treatment should be assessed 1 to 2 months after its termination.

Technique.

M. Müller (1939), as well as Rivers and Bond (1942), have shown that the technique has a very important bearing on results. Danziger (1945/6), using a statistical method, was able to demonstrate that there is a certain minimum standard of adequacy of treatment. Lipschütz, Cavel and Leiser (1939) made a special study of this problem. They used only cases with a duration of illness of more than 1 year. Patients were divided into several groups receiving different varieties of treatment. Either coma-treatment was given alone or in combination with resocialization activities. One group received only saline injections; another was subjected to resocialization activities alone. When the treatment was not carried to coma level little or no improvement resulted. The best results followed deep coma treatment combined with resocialization activities; the poorest recovery rates were seen in the group receiving only ordinary hospital care. This demonstrates that the production of comas is an important therapeutic factor, which cannot be equalled by any other method tested by the above authors.

What is the technique that should be employed? It is not intended to discuss it in detail, but only what should be regarded as adequate treatment. For detailed information on technique Sargant and Slater's book on physical therapy in psychiatry may be consulted. The production of comas is essential for the achievement of good results. They should be of sufficient depth, must be clearly defined, and a certain number of them should be administered. The insulin dosage should be increased if comas are too light. A total of about 50 comas should be aimed at, even if patients remit early in treatment. Such a total improves the degree of recovery and makes the result more lasting. Our own experience shows that the quality of results is definitely better when more than 30 comas have been given. Long treated cases could often be re-categorized from social into total recoveries after living outside for some time (Table 1).

Many workers combine insulin therapy with convulsants. Cook (1944)

emphasizes that there should be "no rivalry between insulin and convulsion therapy," as both are complementary. Most workers agree that convulsive treatment in schizophrenia increases the number of remissions, and also improves their quality as compared to spontaneous remissions. Its beneficial effect is most evident in the more florid type of schizophrenia. The majority of workers

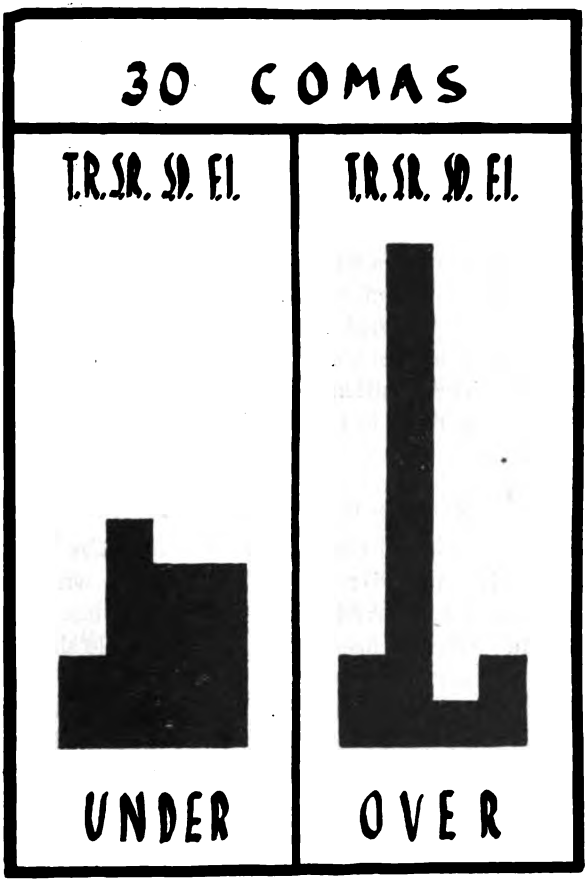

TABLE 1.—This table demonstrates that in cases able to leave hospital total plus social recoveries are obtained more frequently if the number of comas exceeds 30 per patient. Only cases with a duration of illness of up to 18 months were selected for this purpose. Each square = 1 patient.

also confirm that insulin is more "consistently beneficial in all types of schizophrenia" (Cook 1944), but Kalinowsky and Worthing (1943) maintain that results by either method are similar if the treatment has been adequately carried out. Differences in response to convulsants and insulin were demonstrated by Gralnick (1945). In a group of 158 schizophrenics treated with insulin 52·5 per cent. were discharged regardless of the duration of illness, compared with 20 per cent. of 209 treated with E.C.T. His results with insulin are much superior to those achieved with E.C.T., and he is unable to agree with Kalinowsky that schizophrenics benefit by prolonged courses of

E.C.T. The beneficial effect of E.C.T. on the affective psychoses is indisputable. As an admixture of depression, elation, apprehension and agitation are very often seen in schizophrenics, the combined use of insulin and E.C.T. may be justified. It is not yet clear, however, whether higher recovery rates are achieved by the combined method, although it is claimed by some workers (Chapuis and Georgi, 1945). It has also been our practice to use E.C.T. or cardiazol in combination with insulin. Its indications usually are:

(1) Marked manic-depressive features.

(2) Marked excitement; restlessness and stupor.

In these two symptom groups a prior course of E.C.T. or cardiazol is often given. The improvement obtained is frequently not very stable. A course of insulin comas, therefore, has been given after the preliminary convulsions.

(3) If no results appear with insulin alone after 20 comas, convulsions were added.

(4) Marked resistance to insulin may also sometimes be overcome by a fit (Mayer-Gross, personal communication).

The dangers of the combined method are not greater than those with insulin alone. In our series the total of convulsions applied has been usually 4 to 8 per patient. This combined treatment appears less harmful than treating schizophrenics with 30 or more E.C.Ts.

Results of Other Workers.

An extensive study with discouraging conclusions has been published by Penrose (1943/44). He studied 1,600 patients treated with convulsions and insulin. The group which received convulsants was 5 times greater than that treated with insulin. His conclusions refer to the whole shock-treated group, and he states that "very little support is provided for the view formerly widely held that shock treatment (E.C.T. and insulin) has any value in schizophrenia." He has the advantage of a large series of treated cases which were, however, collected from various hospitals, and therefore diagnosed by different workers. No information is given as to the duration of illness, the technique of insulin treatment, or the number of comas given. His treated material is compared with a control group in which the diagnosis was made with a new statistical method—according to age-groups and sex—including defectives, seniles and alcoholics. A great deal of overlapping of different diagnostic entities seems unavoidable with this method, and therefore control groups compiled in this way do not appear satisfactory for estimating the value of treatment (see Penrose (1943), Chart 1). Penrose did not give sufficient consideration to the indispensable criteria for estimating results. His report can, therefore, not be accepted as a final verdict on the value of insulin therapy.

The same applies to the observations of Starker, Miller and Jacobs (1939), who also come to the conclusion that insulin is not of much value. Their series was very small, and it appears that they gave insufficient consideration to the duration of illness.

Gottlieb and Huston (1943) compared the results in 66 schizophrenics with a carefully selected non-treated group of 132 patients of the same diagnosis.

They state: "Insulin does not increase the chances of recovery or shorten the duration of hospitalization." Their method of treatment consisted only of 30 injections of insulin, and the insulin dosage was decreased as soon as comas were obtained. This insufficient amount of treatment cannot be expected to produce satisfactory results. The same remarks apply to Rennie's conclusions, whose patients were treated at the Henry Phipps Psychiatric Clinic. The average number of *injections* (not comas) was only 36, which is again lower than the number of treatments given by workers who report favourably on the method.

In contrast to these unfavourable reports there are investigations which take the main fallacies mentioned previously into consideration. Large numbers of adequately selected and adequately treated patients matched against a comparable non-treated group confirm the definite value of this treatment in schizophrenia. Comparisons between treated and non-treated patients from the same hospital are the most satisfactory way of demonstrating the efficacy of insulin treatment. Only very few reports are available which comply with this condition. One of them, published by Rivers and Bond (1942), based on their experiences in the Pennsylvania Hospital in Philadelphia, tells us of 188 patients treated with insulin compared with a control group of 116 non-treated cases. The same diagnostic criteria and the same method of estimating results are used throughout. For their total number of treated cases they report a remission rate of 65 per cent. at the end of treatment, 42 per cent. at the end of one year, 36 per cent. after two years and 31 per cent. after three years, which is still twice as high as the number of remissions in the control group. They also compare results in two different groups of patients. In the first one the insulin treatment was tentative. Different physicians were in charge of it; the dosage was kept as low as possible and reduced as soon as the coma dose had been reached. In this group only 46 per cent. of the patients were recovered or much improved at the end of treatment. In the second group the insulin treatment was in the hands of one physician. Deep and long comas were produced and the insulin dosage was kept higher. Here 79 per cent. of the cases were discharged recovered or much improved at the end of treatment. The total of their insulin patients enjoyed 251 years of health out of a possible 564, and the non-treated cases 78 years out of a possible 551.

A most instructive survey was published by a Temporary Commission on State Hospital Problems in New York entitled "Insulin Therapy." Its special value lies in its size, and that all patients were treated in the same hospital. It deals with 1,228 dementia praecox patients and a non-treated group of 876 patients. This was very carefully selected, though collected from different hospitals. No other report has been compiled with the same thoroughness and care. Social service workers were used to estimate the ability of patients to live in a community at various levels of usefulness. The patients in both the treated and the non-treated groups were properly graded, even those in hospital. All those able to leave were followed up personally at home. 79·5 per cent. of the treated patients were able to leave hospital against 58·8 per cent. in the control group. The patients are divided into the usual diagnostic sub-groups: catatonics, paranoids, hebephrenics, simple and others. "In

each group a larger percentage were able to leave hospital among insulin treated patients than among non-treated patients." The success of treatment was tested apart from the ability to leave hospital, by the length of stay in hospital, the length of time those leaving hospital were able to remain in the community, and the extent to which those returning to the community are restored to usefulness. In insulin patients the period of hospitalization was 3·8 months shorter than that of the non-treated group. A larger proportion of the treated group was doing useful work after discharge. The insulin group showed a larger number of patients who did not return to hospital. Five and a half years after discharge 58·9 per cent. of the patients were at home as compared with 44 per cent. in the non-treated group. Even patients with a duration of illness of more than one year showed better results than similar non-treated patients.

Good results with insulin are also reported from the hospitals of the State of New Jersey. Since this treatment was introduced 61·9 per cent. of schizophrenics have been discharged compared with only 39·3 per cent. before its introduction.

The least discrepancy is shown between reports by experienced specialists in insulin treatment. Especially when the examination before and during treatment and the estimation of the degree of improvement, including the follow-up, are made by the same investigator. Two follow-up studies of this kind have appeared. Chapuis and Georgi (1945) report on 81 cases observed over a period of 5 to 7 years. 70 to 80 days of hypoglycaemia were usually given combined with 10 to 20 convulsions. 70 per cent. of their remissions remained stable for 5 years, and this figure was still more than 50 per cent. after 7 years. The full remissions proved the most stable. Braunmuhl reports on 563 cases. He found that most relapses occur within the first year after treatment, and that many could be successfully re-treated. Braunmuhl's relapse figures for his whole material during the first five years after discharge in cases of less than 6/12ths duration of illness are 9·6 per cent. for the cures and 32 per cent. for the improved. In cases with a duration of illness of half to one year 22·8 per cent. of the cured and 8·7 per cent of the improved relapsed. In those whose illness had lasted more than one year 28·3 per cent. of the cured and 12·8 per cent. of the improved had to be readmitted to hospital.

In Swiss and German reports the ratio between results in treated and non-treated cases is usually about 2 : 1 (quoted by Kalinowsky and Hoch, 1946). A similar relation is revealed by the figures compiled by Ross and Malzberg (1939) collected for the Department of Mental Hygiene of New York.

Results of Insulin Therapy at Moorcroft House.

The material here considered consists of 112 schizophrenics treated at Moorcroft House during the past ten years (Table 2). Results were assessed two months after the termination of treatment. Patients relapsing during that period were regarded as unimproved. Results are classified according to the definitions put forward by E. Guttmann, Mayer-Gross and Slater (1939), into total recoveries, social recoveries, social defects, family invalids and hospital invalids. Amongst the cases with a duration of illness of under one

year 80·1 per cent. were able to leave. Of patients ill from one to three years 53·6 per cent. were fit to return to the community. Where the illness had lasted more than three years only 28·6 per cent. could be discharged.

It can be seen that our discharge rate of cases with a duration of illness of under one year corresponds very closely to the American series. There,

RESULTS WITH INSULIN THERAPY.

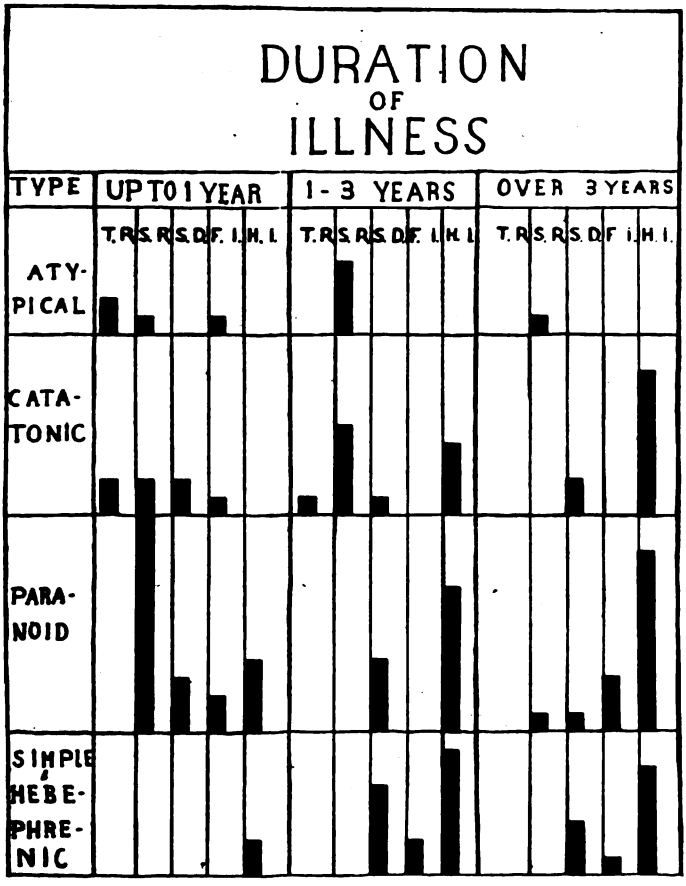

TABLE 2.—This table shows that results are dependent on the duration of illness. The number of hospital invalids increases with the duration of illness. Atypical cases do best. The next most favourable are catatonics. Paranoids follow, and hebephrenics do least well.
Each black square = 1 patient.

82·5 per cent. were able to leave as compared to 60·4 per cent. in the non-treated group. Our discharge figures for patients with more than one year's illness were less favourable.

Patients were also classified according to the clinical type to which they belong. It is seen on the chart that atypical cases characterized by an admixture of manic-depressive or confusional features do best. The next most favourable results occur with catatonics. Paranoids follow, and simple and

hebephrenics seem to do least well. This confirms reports by other workers. Results in hebephrenics appear much lower than in the New York report. There is a decrease in the quality and quantity of improvement as soon as the duration of illness exceeds one year.

Thirty-four of the patients able to leave hospital have been followed up (Table 3). Some examples of these cases may be of interest to demonstrate the quality of results of treatment. Atypical cases have so far proved the most stable, and none of them has relapsed. One patient, a total recovery, has been living a normal life for 9½ years; he has served in the Navy during the war and gained a commission. Two social recoveries have lived normally for 6 years; one served in the R.A.F. as a F./Lt., and the other married and is fulfilling her household duties very satisfactorily. Both could be reclassified as total recoveries.

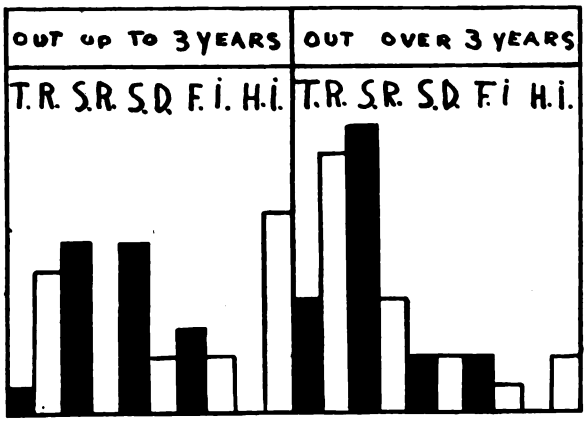

TABLE 3.—This table contains followed-up patients who had been able to leave hospital at the termination of treatment. The number of relapses is higher during the first three years after discharge. These are less frequent in cases out over three years.
Each square = 1 patient.
Black = condition at termination of treatment.
White = condition at time of follow-up.

Amongst the followed-up catatonics, one total recovery has been stable for 9½ years; he served in the Royal Artillery during the war, is happily married and has one child. Another has been running her household for the past 9 years. She has had two more children since her discharge, and has remained well in spite of exceptional emotional stress and the fact that her breakdown had occurred in the puerperium. A further total recovery has been working successfully as a surgeon for 7½ years since her discharge from hospital. One of the social recoveries has remained stable for over nine years, and is working satisfactorily as an assistant water engineer. A further one has been out nearly five years and could be reclassified as a total recovery. He has married since discharge and is doing forestry work. One social recovery relapsed after three years, and got well again after a second course of treatment. No relapses have been observed in patients classified as total recoveries, but two social recoveries and one social defect had to return to hospital.

In the paranoid group several social recoveries could be reclassified as total recoveries. One of these has lived outside for 6½ years, and is working successfully as an estate agent and auctioneer. A second has been discharged for 2½ years. She has done strenuous war work, and is now working as a teacher in a riding school. Another is studying law, having been well for over 2 years. One social defect could be reclassified as a total recovery just over one year after discharge, having lost all her psychotic symptoms. One social recovery, discharged for 1½ years, is a University student, and has passed examinations with second class honours. Three of the social recoveries relapsed after 1 year, 17 months and 3 years respectively. Two of them remain hospital invalids. One patient could be discharged as a social recovery again after a second course of treatment.

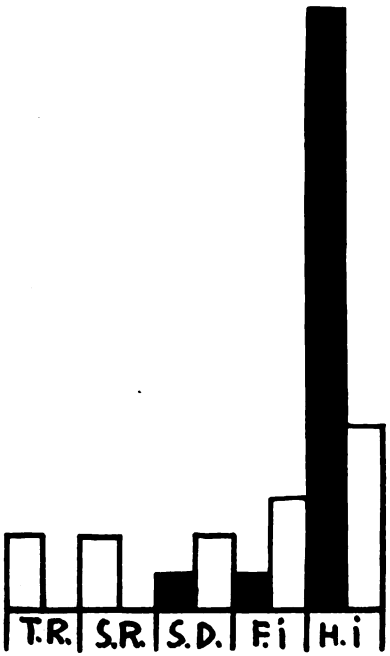

TABLE 4.—Results of leucotomy in patients unimproved by insulin.
Black = condition at termination of treatment.
White = condition after leucotomy.
The last white column on the right represents improved hospital invalids.

Our follow-up results confirm those of Chapuis and Georgi (1945), who found that total recoveries are maintained better than social recoveries, and that most relapses occur within the first three years after discharge. A betterment of the degree of improvement after discharge has also been reported by other workers (Müller, 1939).

One patient who has remained a hospital invalid after the termination of treatment made a spontaneous recovery about 8 months later and has been working as a doctor for about 7 years. He has no insight into his past psychotic attack. A second started to improve 2 years after termination of treatment,

and remained in the community for a further 2 years before she relapsed again.

The follow-up revealed that 18 patients who had shown no response to insulin had a subsequent leucotomy performed (Table 4). Of these, 16 were hospital invalids at the end of insulin treatment, 1 was a social defect and 1 a family invalid, and both relapsed. After leucotomy, 2, both paranoids, made a total recovery. They had received a full course of 50 comas combined with E.C.T. Two were discharged as social recoveries and 2 as social defects. Three became family invalids. Another 5 are very much easier to handle inside hospital and the rest are unimproved.

As it proved impossible to compile our own non-treated control group, it may be permissible to compare our follow-up results with a group of non-insulin treated patients, specially selected for their good prognostic outlook at the Maudsley Hospital by E. Guttman, W. Mayer-Gross and E. Slater (1939). Atypical schizophrenics were excluded from our material; also all

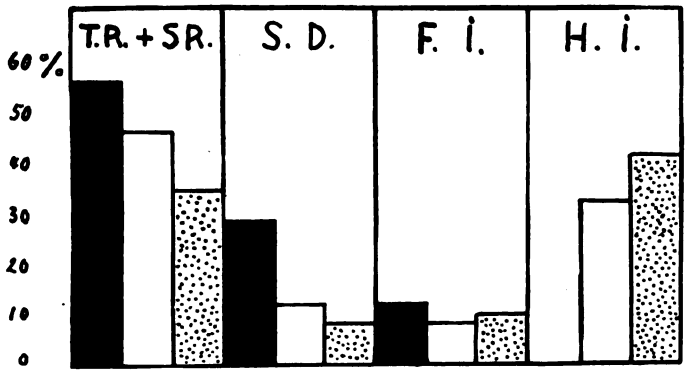

TABLE 5.—This table is made up of patients with a duration of illness of up to one year. Atypical cases are excluded.
Black = condition at termination of treatment.
White = condition at time of follow-up.
Stippled = non-insulin-treated control.

cases whose illness antedated admission by more than one year were excluded from both the insulin-treated and the control group. The total of followed-up cases, able to leave hospital at the termination of insulin treatment, composed of cases living out of hospital for nearly ten years, is compared with the above-mentioned non-insulin-treated group which had been followed up to an average period slightly exceeding three years. A comparison should actually be to our disadvantage, because the figures of Guttmann, Mayer-Gross and Slater would probably be less good had their observation extended to a similarly long period. They state that if any treatment should offer better results than the spontaneous recoveries they reported, then "this method would be definitely justified." Amongst our cases total recoveries plus social recoveries amount to 56 per cent. at the end of insulin treatment and 46·4 per cent. at the time of the follow-up as compared to 34·5 per cent. in the above quoted control group. 32·1 per cent. became hospital invalids in the insulin-treated material and 41 per cent. in the control group (Table 5). This

is further evidence that insulin treatment, if properly carried out, increases the number and quality of recoveries, assuming that the diagnostic criteria of the insulin-treated and the control group can be considered equal, and that the non-insulin-treated patients really represent the optimal material for spontaneous recoveries. Insulin is certainly not a panacea for all cases of schizophrenia, and results over a long distance are not yet very satisfactory. But so far nothing superior has been evolved, and until better methods are available it should be more generally used.

In this connection the question arises whether every hospital should take it up, or whether selected hospitals should treat all schizophrenics. This largely depends on the admission rate of patients suitable for treatment to each hospital. The ideal insulin unit is one having about 12 male and 12 female beds, for which only one nurse is required per 12 patients from 7 to 9 a.m. and two are needed on each side from 9 to midday. There should be one sister in charge in addition to the nurses. One doctor would have to spend most of the morning in such a unit. The same nursing strength would be required for about half the number of patients. Therefore a smaller number of patients would make such a unit much less economical to run. To keep the suggested unit supplied between 140 and 150 admissions of recent schizophrenics would be required per year. These could be supplied only by hospitals with an appropriate admission rate of 700 to 800 patients per year. Since many hospitals have a lower admission rate, it would be more economical to have a central unit to be supplied by several hospitals within a given region.

Prognosis.

To make insulin therapy worth while a careful selection of patients is necessary. The type of case responding best to insulin is the same as that having a good prognosis without any special treatment. It is mainly in these cases that insulin increases the number and quality of remissions, shortens the duration of the attack and assures a longer period of health. The prognosis cannot be predicted with absolute certainty, but some criteria can be successfully applied if a decision has to be made as to whether or not insulin treatment is indicated. An assessment of the prognosis is never very reliable on the basis of individual symptoms only. It is necessary to take the whole aspect of the clinical picture into account. The criteria for prognosis remain closely similar to those used in forecasting a spontaneous remission.

Previous observations on the prognosis of schizophrenia (W. Malamud and Render (1939) and O. Kant (1944)) are confirmed. Only a short summary of these findings can be given here. An acute onset is known to be more favourable than an insidious one. A gradual onset, however, does not seem to have such bad significance if the schizophrenia appears in a depressive setting. Long-standing neurotic symptoms usually associated with an insidious onset of the illness generally influence the prognosis unfavourably. They may be of the anxiety, obsessional or hysterical type.

No definite conclusions can yet be drawn as regards the influence of heredity, but patients with hereditary taint often do well with insulin. Schizo-

phrenics below the age of 15 often do not respond well or derive only very temporary benefit. Conflicting reports have been published about the older age-groups. Ross and Malzberg (1939) found that patients over 25 did better than those under 25. The onset of the illness after 40 is considered to be unfavourable by some authors (Chase and Silverman, 1941). Cheney and Clow (1941) find the best prognosis in cases below 30 years of age.

The duration of illness has so far proved to be one of the most reliable guides to prognosis. A correct assessment is often difficult. The best results are achieved in patients whose illness has not lasted longer than one year. After this the improvement figures fall rapidly. This is not the case with patients in whom long symptom-free periods occurred in the course of their illness. In our experience good results may be seen in that type of case with a duration of illness of up to eight years. Catatonics have also responded favourably even when the illness had lasted up to two years. In paranoids no total recoveries or social recoveries were obtained once the illness had endured for more than one year, except in periodic cases.

In an attempt to study their prognostic significance we have tried to list and chart the main mental disturbances found in our material under several headings: (1) Emotional disturbances, (2) disturbances of volition, (3) disturbances of motor activity, (4) disturbances of thought, (5) hallucinations, (6) delusions, and (7) the background on which the picture occurs (Table 6).

Inadequacy and inappropriateness of affect were often seen in favourable cases, whereas dull and apathetic effect, poor contact and autism are usually of bad prognostic import. Among changes in motor activity, the restless, excited and impulsive type seemed to do better than the stuporous one. The prognostic significance of thought disorder appeared to depend very largely on the background on which the picture developed. In an emotionally calm setting associated with clear consciousness this is of worse prognostic import than if it occurs with an excited, elated or depressed state, or clouded consciousness. Auditory hallucinations were often seen in recovering cases, whereas visual ones or hallucinations of smell only very rarely occurred. Florid and changing delusions showed themselves of better prognostic significance than well defined ones. In unfavourable cases there appeared to be a much more massive disturbance of all the functions of the mind than in the favourable ones, in which disorder of mental function seemed to be more diffuse. Almost every single symptom can be represented in favourable cases however. A good prepsychotic personality exhibiting manifold interests and good contact with reality usually tends to have a favourable influence on the outcome.

Conclusion.

Insulin therapy has greatly stimulated research, but the hope that something might be learnt from it about the nature and cause of schizophrenia has so far not been fulfilled. Though it has proved a step forward, it cannot be regarded as specific. Physical treatments should not side-track us from research into the basic problem of the aetiology of schizophrenia. New findings in this field might eventually lead to a more specific and still more effective method of treatment.

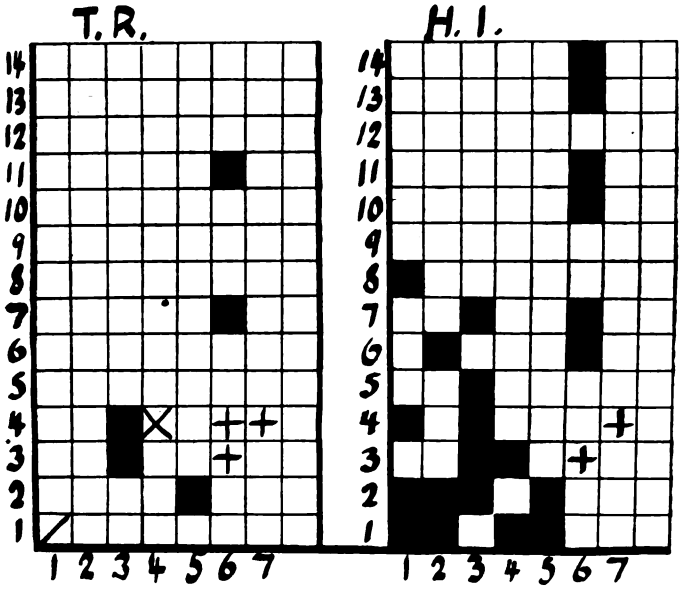

TABLE 6.—In this table the influence of symptomatology on prognosis is illustrated by two examples. A total recovery is tabulated on the left and one hospital invalid on the right. The main mental disturbances are listed horizontally and their subdivisions vertically.

Black signifies severe disturbances.
Two diagonal lines signify a moderate disturbance.
One diagonal line signifies a slight disturbance.
A plus sign indicates present.

1. EMOTIONAL DISTURBANCES.
   1. Shallowness of emotional response.
   2. Inappropriateness.
   3. Rigidity.
   4. Indifference.
   5. Over-sensitiveness.
   6. Irritability.
   7. Bewilderment.
   8. Solitariness.
   9. Dirtiness.
   10. Shamelessness.

2. DISTURBANCES OF VOLITION.
   1. Lack of decision and determination.
   2. Stupor.
   3. Suggestibility.
   4. Automatic obedience.
   5. Ambivalence.
   6. Negativism.

3. DISTURBANCES OF MOTOR ACTIVITY.
   1. Lack of gracefulness.
   2. Apathy.
   3. Impulsive action.
   4. Excitement.
   5. Strange attitudes.
   6. Mannerisms.
   7. Flexibilitas cerea.
   8. Restlessness.

4. THOUGHT.
   1. Poverty of ideas.
   2. Vagueness.
   3. Thought blocking.
   4. Lack of logical relationship.
   5. Neologisms.

5. HALLUCINATIONS.
   1. Visual.
   2. Auditory.
   3. Smell.
   4. Taste.
   5. Tactile.

6. DELUSIONS.
   1. Well defined.
   2. Indefinite.
   3. Changing.
   4. Florid.
   5. Grandeur.
   6. Self-reproach.
   7. Persecution.
   8. Hypochondriacal.
   9. Erotic aspirations.
   10. Passivity feelings.
   11. Misrepresentation.
   12. Autochthonous.
   13. Reference.
   14. Influence.

7. BACKGROUND ON WHICH PICTURE APPEARS.
   1. Infectious elation.
   2. Depression.
   3. Calmness.
   4. Clear consciousness.
   5. Clouded consciousness.

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THE MAIN MENTAL DISTURBANCES STUDIED WITH THEIR SUBDIVISIONS (see Table 6).

Discussion.

Dr. WILLIAM SARGANT: I feel it is a great honour to have been asked to open the discussion to-day. First of all, I want to congratulate Dr. Freudenberg on his paper. I cannot think of another insulin therapist in the country who can claim the same continuity of treatment experience over so long a period. He therefore speaks to us with a quite unique authority. I think his paper has been a very fair presentation of the advantages and limitations of the insulin treatment of schizophrenia.

My remarks are on my own experiences of insulin shock treatment, which now dates back to 1937. Before the war at the Maudsley Hospital it was possible to try out its effects on most types of schizophrenic illness. On our evacuation to Sutton Emergency Hospital in 1939 the

type of case that we could treat became more specialized. Many were early military cases, sent in among the fifteen thousand or so neuroses which have been through this unit in the past seven years, and the diagnosis of schizophrenia becoming obvious on further investigation. Other cases were clear-cut schizophrenics from the start, but with a symptomatology which made their treatment possible in the open wards of a general hospital, to which the neurosis unit was attached. We could not always manage the very excited and suicidal patients, but it was surprising the varied types of case we found it possible to handle as treatment was given with an increasing confidence due to increasing experience of its usefulness and limitations in such an environment. Since the end of the war we have kept a male and female insulin coma unit running at Sutton to deal with the same types of case, but in an increasing proportion of civilian admissions. These are thus getting a chance of treatment before they will always accept voluntary patient admission to a mental hospital.

On the basis of the experiences that I have had of insulin treatment for the past nine years, I find myself in agreement with most of Dr. Freudenberg's observations. For a long time now I have felt that the quality of remission, when it is obtained with insulin, is often much better than when the patient is left to struggle out of the illness helped by more conservative measures. I do not think Dr. Freudenberg made enough of this point. Perhaps the deterioration is less because the illness may be so much shortened by the treatment. In just over eleven hundred patients treated at the Brooklyn State Hospital it was estimated that no less then 286,695 hospital patient days had been saved, compared to an equivalent control group of cases from other hospitals in New York who did not get this treatment. The illness was shortened by an average of three and a half months in each patient; and it was on the publication of this report in 1944 that Governor Dewey made insulin treatment compulsorily available to all needing it in New York State Hospitals.

We know how rapid schizophrenic deterioration can sometimes be: so I have now come to regard the use of insulin treatment in schizophrenia somewhat in the same way as the use of the front-line sedation in the acute battle neuroses of the recent war. Neither treatment can be claimed as a specific cure of schizophrenia and battle neuroses. But both treatments seem able to prevent additional disintegration of nervous function when given at the right time to the right sort of case. Like front-line sedation, insulin shock-treatment should be given at the earliest moment to try to prevent any further aggravation of symptoms. Some patients will progress and worsen despite its use. But in many early schizophrenic patients the illness will be halted, or a very rapid remission may be brought about.

I also find myself in agreement with Dr. Freudenberg's views about the sort of case one should choose for treatment if facilities are unfortunately not available for all. It has been my clinical impression that results are unmistakably better when the illness has lasted only a short time. During the second year of illness they become rapidly less impressive. By the third and fourth year good remissions will have dropped to a very low percentage of the cases treated. But one occasionally gets a surprise when an apparently hopeless or longstanding case stages a substantial measure of improvement. The longer I do this treatment the less I share the dogmatism of some as to what can and what cannot be expected of it in an individual case based on broad statistical deductions. Each patient is at least entitled to careful individual study for the presence of favourable and unfavourable factors such as those discussed by Dr. Freudenberg before being dismissed as unsuitable for treatment.

Dr. Freudenberg's observations on the use of E.C.T. or cardiazol as a substitute for, or as an adjuvant to, insulin treatment has also been the same as ours. In the first year of illness we have found that cases which respond to E.C.T. have failed with insulin. In many more patients, however, it is the other way round. In the second year few seem to respond to E.C.T. alone, although a fair proportion may still be helped by insulin. Some of our most satisfying recent experiences have been in cases not responding to insulin coma, who were immediately helped by being given E.C.T. or cardiazol in the late stage of sopor or early coma. This has occurred in both the first and second year of illness. The combined treatment may also succeed where the two treatments given separately have failed. Other workers have also suggested that such a combination lowers the relapse rate.

I have been asked to say a few words in this discussion about modified insulin treatment. Over fifteen hundred courses of modified insulin treatment have been given at Sutton for various types of neurosis. We have also learned that it is no substitute for insulin coma in the treatment of schizophrenia. It may be better than no insulin at all if combined with E.C.T. But harm will be done to a proportion of cases who are given modified insulin instead of a full coma treatment because their recovery will be delayed and unnecessary deterioration allowed to happen.

One point about relapses. One has heard people say that because relapses happen after treatment it is hardly worth whole. I think this shows a lack of a sense of true proportion. Our duty as doctors is to provide the treatment that relieves our patient's immediate suffering as quickly as possible, and promotes their maximum well-being. Earl Bond's follow-up results in his seven years' survey of insulin treatment seems to answer this criticism about relapses. He found that, despite relapses, his insulin-treated group had enjoyed 251 years of health out of a possible 564 years. The untreated control group had only enjoyed a mere 78 years of health out of a possible 551.

This relapse rate and the failure of some patients to respond to insulin makes us realize, however, that this treatment is not the final answer to the therapy of schizophrenia. Complacency

with our present results must be avoided at all costs. and we must continue our search for better ways of helping these patients.

I am glad to have found myself so much in agreement with what Dr. Freudenberg has said. But, as he pointed out, disagreements about the value and limitations of insulin treatment are not now very marked among those who have themselves actually worked for long periods on this specialized treatment. It has always seemed to me that those who are still over-enthusiastic, or more commonly too full of doubt and caution, are generally those who hold such views without adequate personal long-term treatment experience of their own. I think that one of the results of this paper and the discussion to-day will be to find that there is now a fair measure of agreement among insulin therapists on what can, and what cannot, be expected of the treatment. If this proves to be the case, our next step is to see that it is made more readily available to all those who would benefit from it.

Dr. JOYCE SMITH (St. Ebba's Hospital) said: I should like to thank Dr. Freudenberg for his extremely interesting and enlightened paper. I feel that as a pioneer of insulin treatment he speaks with real authority. My own experience with insulin is more limited, but the results bear out much of what Dr. Freudenberg and Dr. Sargant have said.

As Dr. Freudenberg has stressed, the difficulty of assessing the value of insulin therapy in schizophrenics lies in the variety of techniques and of diagnostic criteria as to what is a schizophrenic, but as he says, these can largely be overcome if observation and treatment are carried out by a single doctor. For this reason I should like to quote my own observations. All the cases were admitted to St. Ebba's Hospital and all are females between the ages of 14 and 35, so that they mainly fall into Penrose's age-groups for schizophrenics. The diagnosis of schizophrenia was in all cases agreed by at least two authorities.

The number of cases treated was 119. Of these, 101 have been discharged (85 per cent.), and of these 101, 21 have relapsed and have been readmitted to hospitals, leaving 67 per cent. discharged at the end of four years. The total average length of time in hospital was 24 weeks; the average time after starting treatment was 16 weeks.

Of 52 comparable cases taken before insulin treatment was started, 25 were discharged (48 per cent.), and of these four are known to have relapsed and to be again in hospital, but no systematic follow-up has been possible. The average length of time in hospital was 36 weeks.

Technique.—I most heartily agree that the value of insulin treatment to a large extent depends on the technique. Patients must have a definite coma. In my opinion, sub-coma doses in schizophrenics are of no real benefit. The patient's physical state may improve, and if anxiety happens to be a prominent feature that may be ameliorated, but the underlying schizophrenia is untouched. Several of our patients have had sub-coma insulin, with no benefit in their mental state. One particularly striking case was a girl of 18 who had 70 units of insulin daily for seven weeks; there was no coma and no improvement. She was then given 20 comas. (coma dose 90 units), and was discharged six weeks after starting treatment. That was four years ago, and she has since trained as an engineer and has now married.

One necessary factor then is to induce a satisfactory coma. I usually give half-an-hour in coma, but one may need to vary it with each patient. Some do better with a very deep coma for ten minutes.

The post-coma stage is a very important one. For a varying time after the coma, patients are in an uninhibited, more or less lucid state in which they talk of worries and difficulties, real or imagined, which they are unable or unwilling to express at other times; so that it is very important for the doctor and the staff to make use of this time to unravel difficulties and re-educate the patient in more normal ways of thought.

Separate ward.—I think the treatment gives most satisfactory results when there is a separate ward set apart for treatment, and several patients treated together. It seems to induce states of companionship, mild rivalry and mutual dependency, which are very helpful in re-educating the patient in more normal ways of thought and conduct. Occasionally, owing to staffing difficulties, we have had to treat a solitary case in the general ward, and they have taken much longer to become sociable and form interests and companions in the ward. A question which I find difficult to decide is whether male and female treatment centres should be entirely separate.

Insulin coma treatment alone is not enough. Each person has to be treated as an entity, their particular difficulties assessed, and their environment investigated and adjusted; for this reason, in addition to the doctor, it is necessary to have staff well trained in psychiatric work, an occupation officer and a social worker.

Follow-up.—To assess the value of treatment one also wants a systematic follow-up—this can only come with the passing years. Of our 101 discharged cases:

11	have been discharged	and well	over	4 years.
24	,,	,,	,,	3 ,,
15	,,	,,	,,	2 ,,
17	,,	,,	,,	1 year.
11	,,	,,	and well under	1 year.

2 alone cannot be traced. 21 have relapsed, as stated above.

In my experience the follow-up of insulin cases is comparatively easy. Patients take a real interest in co-operating with the doctor.

Number of comas.—The number of comas needed for each case is a controversial point. We began by giving 40–50 comas as a routine, but how give on an average 30–35, depending entirely on the improvement of the patient. On the whole, I think the patients who are going to respond to treatment give definite indication of this by the 25th coma, and then need a further 5–15 comas to stabilize them. I agree with Dr. Freudenberg that many patients respond much earlier than this, but have a tendency to relapse if treatment is discontinued too soon.

Convulsion treatment.—The question of E.C.T. prior to or in conjunction with insulin is interesting. Many of our patients have had treatment by E.C.T. prior to insulin; some showed improvement, but on the whole the schizophrenic symptoms had not benefited. E.C.T. was found useful in conjunction with insulin in four types of cases:

(1) At the end of insulin treatment where the patient, although otherwise normal, was fearful of facing responsibilities and lacking in self-reliance. The E.C.T. produced an alertness and urge to cope with reality which was very striking.

(2) Those in whom improvement was stationary over several comas.

(3) Those who had difficulty in facing reality were retarded, wrapped up in fantasy, and difficult to get at, even in the post-coma stage. In these an electrically induced fit at the end of 30 minutes' coma produced very good results.

(4) Where there is marked resistance to insulin.

Complications and contra-indications.—I agree with Dr. Freudenberg as regards complications and contra-indications. The treatment is a severe one for patients and staff, but to get the best results all must be courageous. Our most troublesome difficulties, and they were far from common, were:

(1) Persistent pyrexia, apparently due to the insulin. Patients would run temperatures of 100°–103° for several days, settling and then recurring as soon as insulin was restarted.

(2) Series of spontaneous seizures. These occurred in two cases, and lasted for 48 hours. They responded to luminal and lumbar puncture, and the patient apparently benefited from the seizures.

(3) Prolonged coma. We have had only one case who remained comatose for four hours. She was considerably benefited.

It seems that the chief thing is to push on with insulin as long as the patient remains physically fit. Among our 119 cases were two pregnant patients, one 10 weeks, the other 14 weeks at the time of starting treatment. In neither case did the pregnancy suffer. The patients were discharged, went on to term, had live children and no further recurrence of mental trouble. Both children are perfectly normal, one a girl nearly 3, the other a boy now 3½.

Age of patients.—Dr. Freudenberg raises the point that patients under 15 do not do well with insulin treatment. So far our experience, although small, does not bear this out. We have treated three young girls of 14 years. One has been discharged over four years, is leading a normal and useful life, earning her living, and is now engaged to be married. Another has only been discharged six months, but is earning her living and better than she has ever been. A third has only recently been discharged.

Prognosis.—I agree with Dr. Freudenberg entirely as to the type of case that benefits, but one does occasionally get startling unexpected results; so that, ideally, till insulin coma therapy is supplanted by a more useful treatment, each case should be given a course of treatment. The cases which respond least well are those with very marked thought disorder in a clear consciousness and with little emotional upset.

The 21 cases that relapsed may be divided into three groups:

Group 1.—10 relapsed in the first year and were more or less predictable. On the whole, the results with second course of therapy have been discouraging.

Group 2.—7 relapsed over a year, and under two years after discharge—in the majority of these there was very definite stress, and on the whole they were better adjusted personalities than patients in Group 1.

Group 3.—4 relapsed two years after discharge. Again rather poor personalities who one rather expected to break down.

Of the relapsed cases, 50 per cent. were those who had a history of over one year or a history of a previous attack.

Dr. Freudenberg mentions leucotomy after insulin therapy. Among our treated cases four have subsequently had a leucotomy, namely one of our own undischarged cases, and three of the discharged relapsed cases. None of them have benefited from the operation.

I think insulin therapy is definitely beneficial in the treatment of schizophrenia, that the length of time in hospital is reduced, and that more patients can be returned to a useful life with the treatment, but that these things can only be brought about if a proper technique is followed and the whole personality and environment of the patient is studied.

Dr. W. MAYER-GROSS said: I propose to report on the results of a follow-up, over three years, of patients treated with insulin coma therapy at the Crichton Royal. The number of cases so treated until October, 1946, is 518. While we were fortunate in being able to continue the treatment throughout the war, our follow-up studies have suffered from lack of social workers

during the last two years. Hence the relatively small numbers of patients in the follow-up series. The follow-up studies have now been resumed and the results now are, as far as one can judge, if anything slightly more favourable.

Table I refers to 50 patients treated in 1940/41. They are compared with a control material collected by E. Guttmann, E. Slater and myself and published in 1938. It was then evident that the newly introduced physical methods could only be evaluated if comparative figures on the course of the disease without active treatment were available. Statistics published by Max Mueller (Muensingen) and others had already at this time proved that schizophrenia responded to insulin therapy only in its early stages, and that results became doubtful when the illness had lasted more than 18 months. Realizing the fallacy of claiming success in a disease which tends to remit spontaneously in its early stages, we tried to provide a series of controls of early schizophrenia with the best possible prognosis. Any treatment offering better results would be definitely justified.

TABLE I.—*50 Early Schizophrenics, ill one year or less, Treated with Insulin, Crichton Royal, compared with 188 Early Schizophrenics, of same duration, Not Treated, Maudsley Hospital (in brackets).*

	Number.	Per cent.
Hospital invalids	15 (77)	30 (41)
Family invalids	2 (18)	4 (10)
Social defects outside hospital	3 (15)	6 (8)
Total and social recoveries	27 (67)	54 (34)
Dead	1 (7)	2 (4)
Untraced	2 (4)	4 (2)

$\chi^2 = 6{\cdot}22$ $P < 0{\cdot}02$

From the total of schizophrenics discharged from the Maudsley Hospital in 1934/35 all patients were excluded whose illness ante-dated admission more than one year, all cases over the age of 45, and finally all those in whom there was any doubt or difference of opinion among the three workers as to the diagnosis of schizophrenia.

Another selection was given by the rule that the Maudsley Hospital only admits voluntary patients who *prima facie* have a favourable outlook. 188 patients thus found were, as far as they were not in mental hospitals, followed up by personal visits.

Among the first 112 patients treated by insulin coma at the Crichton Royal, 50 fulfilled the criteria of the Maudsley group as to diagnosis, duration of illness and age.

As can be seen from Table I, the percentage of recoveries among the treated patients is 54 against 34 in the non-treated sample while the number of invalids is reduced to 34 against 51. The differences are statistically significant. The result is more impressive if one takes into account the type of patient generally admitted into a remote mental hospital compared with the admissions to a centrally situated place like the Maudsley Hospital.

Table II gives a comparison between the two series of patients in respect to their stay in hospital during the three years of the follow-up period, indicating the statistical significance of differences. At the 6th, 9th, 30th and 36th month a significantly smaller number of treated patients was in hospital than of those not treated by physical methods. Graph 1 compares the two series in curves showing the number of patients discharged from hospital and illustrates the saving of hospital beds through insulin treatment.

It has been stated that insulin therapy, though effecting an immediate improvement, leads to a greater number of relapses. The last column of Table II shows that there is, in fact, no difference in the relapse rates of the two series. However, the numbers of relapses are rather small for a safe comparison on this point.

Critics, although accepting these numerical results, have found them relatively modest if compared with reports of early enthusiasts, and not worth while the trouble and expense of treatment by hypoglycaemia and its dangers for the patient. The answer is that, at present, no other method furnishes similar results. Neither long series of E.C.T. nor their combination with " modified " insulin or thyroid medication gives, in our experience, a comparable number of reliable remissions. It has to be remembered that the accumulation of chronic schizophrenics in mental hospitals is one of the great and urgent problems of present-day psychiatry everywhere. By taking up the hospital beds they block the admissions of early cases, thus obstructing, as in a vicious circle, preventive and therapeutic activities of the hospital staff.

What cannot be illustrated by statistics is the better quality of remissions after insulin treatment. The lively affective response, the spontaneous and active interest in the people around them and in their own future regained by the patients during the treatment cannot be measured. Everybody who practises insulin therapy and remembers what spontaneous remissions in schizophrenics were like before is impressed by this qualitative difference. One can easily understand that under this impression some workers regarded hypoglycaemia as the specific therapy of schizophrenia, which it is certainly not.

It is, in my view, a crude attempt at influencing the disturbed cerebral function. Although purely empirical and originally based on naïve and obsolete theories, it attacks what during the last decade has been established as of decisive importance in cerebral function—the carbohydrate metabolism of the cortical cell and of the central nervous system as a whole. It therefore may,

one day, be instrumental in solving the evasive problem of schizophrenia, which already Kraepelin had at one time classified as a metabolic illness.

I am indebted to Dr. Eliot and Dr. Patrick Slater for their assistance in the statistical evaluation of this material. My thanks are also due to Dr. P. K. McCowan, Physician Superintendent of Crichton Royal, for his permission to publish these observations.

REFERENCE.

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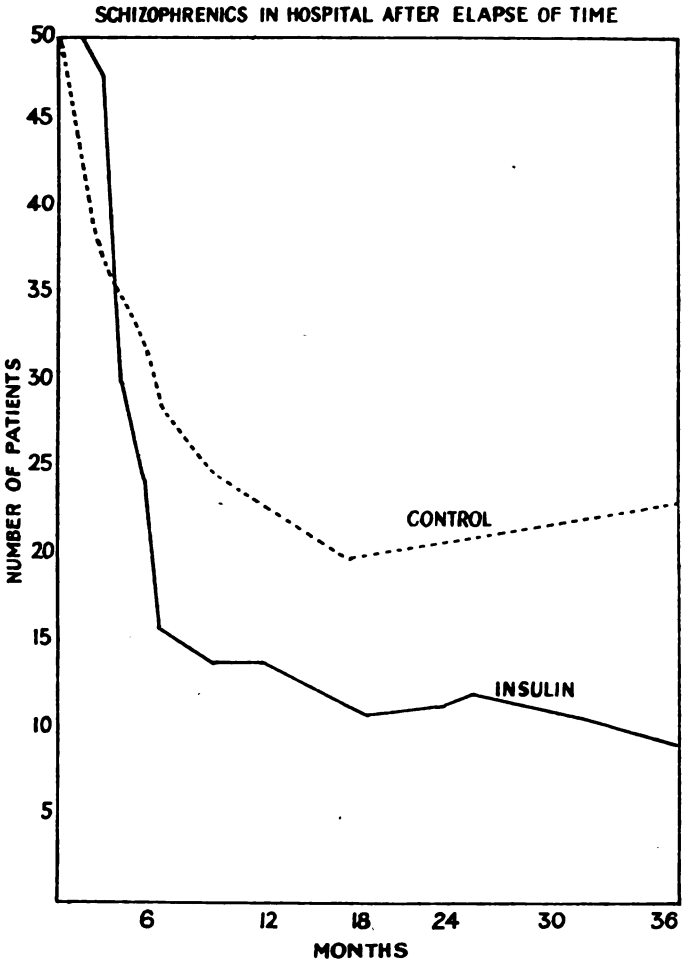

TABLE II.—*Percentage of Patients still in Hospital and Percentage of Relapses in 50 Early Schizophrenics Treated with Insulin from Crichton Royal, compared with 188 Early Schizophrenics Not so Treated from Maudsley Hospital (in brackets).*

Number of months in hospital, dating from one month before treatment (from admission).	Still in hospital, per cent.		*P.*	Relapsed for first or subsequent time, per cent.	
4	62	(68)	$>\cdot 30$	—	(3)
5	48	(63·5)	$<\cdot 05$	2	(4)
6	30	(55·5)	$<\cdot 01$	2	(2·5)
9	20	(45·5)	$<\cdot 01$	8	(4·5)
12	16	(39)	$<\cdot 05$	12	(7)
18	12	(32·5)	$<\cdot 05$	10	(7·5)
24	12	(32)	$<\cdot 05$	12	(9·5)
30	10	(32)	$<\cdot 01$	12	(12·5)
36	8	(31·5)	$<\cdot 01$	10	(14)

Dr. J. BIERER wished to bring forward two points which appeared to be of importance. First there was the question of diagnosis, and he would remind members of Langfeldt's brochure in which he differentiated schizophrenic states from the true schizophrenic process, and stated that in his opinion these schizophrenic states would in nearly 100 per cent. of cases recover without treatment. He would mention also Klaesi's paper from Switzerland, in which he stated that he had 60 per cent. of social recoveries with occupational therapy alone. It appeared therefore that it should be considered whether effort should not be concentrated on getting a clearer idea of diagnosis.

Secondly, from a research point of view, it would be more fair if instead of taking a control group of untreated patients one took, on the one hand, patients who were treated only with insulin without any psycho-therapeutic methods, and, on the other hand, a group treated with all other modern methods, including psycho-therapy. Two or three other methods could be taken into account—insulin treatment with psycho-therapy, or partial psycho-therapy—or not treated at all, but as long as the specific influence of insulin was not known it was the psychiatrist's duty to do this.

Insulin had been used for schizophrenia for 13 or 14 years, and as far as he knew the literature the percentage of recoveries varied between 25 per cent. and the famous 87 per cent. of Sakel. Since so many different results were reported, they should try to develop a system in one big centre where there were enough patients to be able to have these different forms of control. So long as there was not some such system as this he wondered whether they could come to any real conclusions.

Dr. MCINNES said that there was one question he would like to ask which had been stressed by two of the speakers—that generally speaking the insulin patients did better when treated in groups. This raised an interesting question in the discussion on group therapy and its possible relation to insulin treatment. Before putting his question to the speakers he would like to speculate on possible reasons why insulin patients did best in groups (if that were the case). It might simply be that the common association with the doctor and the nurses in the group was beneficial to the withdrawn schizophrenic types. The activities that went on in the insulin room and subsequently, especially if the group was kept together, might be of such a socializing nature as to stimulate the patients to greater contacts, to fortify their ego in such a way that they could bear the frustrations and disappointments which were inseparable from living together without breaking down or withdrawing further into their schizophrenic fastness.

These obvious things might be at work, but he also wondered whether a deeper influence was at work. It might be that the sharing of a proven biological danger might be an operative factor. There could be no doubt that however else treatment might be regarded by the patient, he must regard it at least as a profoundly dangerous undertaking to be rendered comatose five or six days out of the week for a period of six or more weeks. This was an experience which, however well it could be borne at the conscious level, could not but stimulate the most profound fears at deeper levels. It was possible that this might be a deep dynamic factor operative in creating a common group feeling, and consequently create perhaps in a rather roundabout way a possible therapeutic help.

He would like to ask the speakers whether in their opinion there was anything positive to be gained by treating insulin patients in groups; whether any of the remarks he had made were at all apposite. If that was so, had any work been done to discover whether there was a difference in the results, either numerically or qualitatively, as between the insulin patients treated singly or in twos and threes or where they were treated in groups of a dozen or more by contrast?

Dr. URSULA HICKMAN, on the subject of patients being treated in groups, said that about a year ago it had been found at Warlingham that the insulin group was getting large and unwieldy, and it was decided to split the group, keeping the more chronic patients in a unit in the main hospital, while at the same time a smaller group of mild and early cases was put in a convalescent villa. The facilities were in favour of the smaller group, the nursing and medical staff were chosen so that there was equal experience, but it was found almost at once that the progress of both groups deteriorated, and this was particularly noticeable in the smaller group of milder cases. After quite a lot of consideration the groups had to be reunited, and immediately the results improved. The insulin patients were now kept together, they were treated as a family, the nurses were not changed very often, and they were responsible for their own patients throughout the day. The patients might have to sleep in different wards, but the particular insulin nurses were responsible for their patients not only when the treatment was being given, but for their entertainment, walks, and generally supervising them throughout the day.

In the matter of combined treatment they had also had rather interesting results. Some time ago, owing to pressure, a certain number of schizophrenic patients were kept waiting for insulin treatment, and during that time they received electrical treatment. Many cases showed absolutely no improvement and then went on to insulin. A certain number showed no improvement after thirty comas. Then they received a combined treatment and a number immediately showed considerable improvement. There was, therefore, a use for combined treatment where there had been no improvement beforehand with either method separately.

She agreed with Dr. Smith that there were the four groups, particularly the first two, where the patient recovered from the acute symptoms but remained apathetic; such cases showed remarkable improvement with combined therapy. She would quote the case of a man with a five years' history admitted to her hospital. His relatives at first refused to consent to any form of treatment and then they consented to leucotomy only, and it was performed with quite considerable improvement. He could not be called recovered, however. Later the relatives at last consented to insulin treatment; he was given a full course of insulin and showed marked further improvement. He might be classed as a "family invalid" type although, as his family refused to have anything to do with him, he was still in the hospital.

Dr. SANDISON said that insulin therapy was started at Warlingham in 1938, and it was decided in 1940 to switch the technique to giving the insulin by the intravenous route followed by intravenous glucose, and later potato soup by the mouth. The hospital had been criticized on various grounds for this technique, and one of the grounds had been that recovery from the insulin coma was much more rapid when it was terminated by the intravenous glucose technique, therefore it was thought that the reintegration of the personality was not so effective. But a survey of the results of this treatment showed that 353 cases had been treated by the intravenous technique, 61 of which were more than five years ago; and of these, 36, i.e., 60 per cent. had left the hospital and had not returned, except two who had relapsed and had been in other mental hospitals. Of the remainder four died from other causes, one was a suicide, and the remainder were at this moment in his hospital, although five cases had had remissions and had been home for some varying period during the five years. Of the 36 cases which were now out, five had received leucotomy as well, enabling them to complete their social remission following insulin treatment, so that it was not quite fair to attribute the results entirely to insulin. He did feel, however, that the results obtained by this technique compared favourably with other techniques. One of the advantages was that after-shocks were practically unknown, and the majority of the male patients were quite capable of playing football in the afternoon after treatment in the morning. Only one case of after-shock following this exertion had actually occurred.

He would like to draw attention to these figures, which he felt compared favourably with those brought forward earlier in the discussion.

The PRESIDENT said that this problem had been one of intense interest, and one in which a good many had had considerable experience. At Morningside insulin treatment was commenced as early as 1936, and there was a very steady course of treatment with insulin therapy, which was later discarded. He supposed it was a reflection on his own attitude, and was an indication that he had been dissatisfied, taking it all through, with the results accomplished. He had felt that with modified insulin, together with E.C.T., or cardiazol, and with individual care and looking after, the Morningside results in recent years had compared favourably with those they had in the years of insulin treatment when everybody was taking it up so enthusiastically. After this discussion and the presentation of the papers, which were most important and impressive and had covered a great deal of material, he thought it might be wise, now that they were back on a peace-time basis and one could begin to think in terms of staff and facilities for treatment, to reinstitute an insulin unit at his hospital.

The main problem was that which Dr. Bierer had mentioned, the question of diagnosis. The important thing was what one was going to call schizophrenia and what not. He often felt that diagnosis was poor. Many cases had a rapid diagnosis made as soon as they were admitted to a mental hospital, because it was felt that treatment should be instituted at once. This was a dangerous element in hospital administration; the patients and new admissions were not given sufficient time to make an adequate recovery. The diagnosis was made within the first two or three weeks; that was contrary to the experience of those who had worked in mental hospitals all their lives. It was a danger that there was this insistence on getting rapid results, doing something actively at once, not only to satisfy the doctors and the patients, but the relatives of the patients, who asked for something active to be done. This was the problem on which Dr. Bierer put his finger—what conditions were to be called schizophrenia, as distinct from atypical manic-depression. It was in the atypical cases in which Dr. Freudenberg had shown the best and most satisfactory results, and he thought that was because one was dealing with definite emotional disturbances which corresponded essentially to the cyclothymic rather than to the schizophrenic, and it was a question of differentiation between these groups. It was a problem of psychiatric treatment and psychiatric acumen which must be kept in the forefront before one began to tabulate too many results. It was a good thing to have the problem brought to the Association and presented in such an able manner. He might be a little conservative and a little antagonistic to this, but at the same time he did feel that he must try to keep an open mind in regard to it and to study these papers and figures which had been presented with very great care.

Finally he would commend the question which Dr. McInnes raised so clearly and cogently. There was the question of treatment *en masse*, the contagious enthusiasm transmitted from doctor to nurse and to patient, which was a real psychological factor which would have to be assessed to a certain extent in addition to the actual physical treatment which was being carried out.

Dr. FREUDENBERG, in reply to Professor Henderson and Dr. Bierer with regard to diagnosis, said that he had read Langfeldt's book, and in fact diagnosed his patients largely on Langfeldt's criteria. In the final estimation all atypical cases were excluded from the series, and when this had been done, the results of treatment by insulin were still higher than in the control group.

With regard to the point whether insulin alone or environmental factors were of importance, of course it would be necessary to do more research from that point of view, and control and compare different groups who had insulin alone or psychotherapy alone or environmental influences. Some work of that kind had been done in America. Lipschutz and his co-workers studied several groups: one group treated with insulin alone; one group treated with insulin plus rehabilitation and occupational therapy; one with rehabilitation and occupational therapy only; one group had saline instead of insulin and had occupational therapy; one group had saline only; and one group had ordinary hospital care; it came out that the insulin-treated cases had the best results. The cases were, moreover, of over one year's duration of illness, so that the results were more reliable than with cases of shorter duration. It was evident that a study of that kind should be done on a larger scale.

PERSONALITY CHANGES AFTER LEUCOTOMY.

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IN this paper are given the histories of ten patients who have been treated by means of leucotomy, particular attention being paid to the study of character and personality traits.

The records are compiled from the information given by a relative or relatives, supplemented in some cases by data supplied by the patient as well. This method undoubtedly has serious disadvantages, for the information must inevitably be dependent upon the informant's veracity, powers of observation and description, memory, and conscious and unconscious subjective bias. In every case the interview took place at the patient's home, so that the interviewer could obtain a personal impression of the patient's home environment. Furthermore, the information regarding the pre-morbid personality was only obtained after the illness, operation, and recovery, and in some cases it was difficult to ascertain when the morbid changes actually began.

In this investigation, which was carried out between August and November, 1945, particular importance has been given to the pre-morbid personality, for it is felt that the evaluation of Moniz' operation must not only be based on the amount of improvement following it, but on the nature and degree of the changes between the pre-morbid and post-leucotomy personalities. It must, however, be borne in mind that some of these changes may be attributable to the illness itself rather than to the operation.

Of these ten cases, six had been certified and had been in a mental hospital for periods varying from two to six years. Of the others, B. Y— had been for many years extremely trying for her family and very miserable herself. The others, G. H. D—, G. R— and S. A— had all had periods in a mental hospital as voluntary patients, and would finally have had to be admitted to a mental hospital. In all these cases the prognosis, apart from operation, was bad.

These ten cases show considerable variations in age, social status, education and occupation, as well as in intellectual ability and temperament. Nevertheless there are certain features which they all seem to manifest in greater or lesser degree in their pre-morbid personality, and which seem to have disappeared after leucotomy.

The most outstanding feature is self-consciousness. In different ways, according to their temperament and circumstances, these people seem to have been abnormally aware of themselves. In the majority of them this self-consciousness was accompanied by shyness and reserve, and in some by

definite feelings of inferiority. In one or two cases this preoccupation with the self was undoubtedly increased by the critical and rather derogatory attitude adopted by the patients' parents (B. H— and F. H. D—).

Coupled with this self-consciousness there is a lack of social adaptation and a restriction of personal relationships. With one exception (R. J—) none of these patients made friends easily, though in some cases they showed considerable attachment to their family or to one or two particular friends. Some of the patients in this series seem to have been keenly aware of their social deficiencies, and to have been emotionally disturbed by them; while others seem to have rather prided themselves on "keeping themselves to themselves."

The majority of these cases are reported to have been conscientious and meticulous, some of them excessively so, with a definitely religious outlook, though the basis for this seems frequently to have been merely the adoption of the religious views of their environment.

In spite of their egocentricity and their preoccupation with themselves, many of them had genuine affection and sympathy for others, and were not intentionally egoistic, even when making exorbitant demands on their environment.

During their illness the egocentricity and preoccupation with themselves and their own affairs became enormously increased. It is perhaps worth quoting here Ibsen's description of the inmates of the asylum in *Peer Gynt*:

> "Beside themselves? Oh no, you're wrong!
> It's here that men are most themselves—
> Themselves and nothing but themselves—
> Sailing with outspread sails of self.
> Each shuts himself in a cask of self,
> The cask stopped with a bung of self
> And seasoned in a well of self.
> None has a tear for other's woes
> Or cares what any other thinks."

As Fosdick says: "All the way from social embarrassment to insanity, egocentricity is ruinous to real personality."

Four of these patients became catatonic schizophrenics, entirely withdrawn from the external world; two became almost completely absorbed in their own physical symptoms, one originally developed delusions of persecution before becoming an agitated melancholic, and the remaining three were depressed with feelings of inferiority and self-reproach.

When we come to study the post-leucotomy personality, there seems to be a very obvious diminution of self-consciousness which shows itself in different ways. There is less shyness and reserve, so that there is no embarrassment on meeting strangers or casual acquaintances; there is more indifference to adverse criticism, and considerably less preoccupation with bodily functions. In a few cases the patient, after the operation, gives the impression of being smug and self-satisfied.

Accompanying this loss of self-consciousness there is also a decreased awareness of the feelings of other people. Some of these patients have become noticeably tactless, apparently neither observing nor caring about the effect of

their remarks upon their hearers; S. A— has even become openly rude and offensive. There is also a shallowness in their emotional life, none of them have shown any tendency to make new friends, and in some cases the relatives complain of a definite absence of their old affection. This was particularly noted in the case of E. J—, B. Y— and G. R—. Thus the sister of R. J— says that whereas before he was genuinely thoughtful and kind towards his family, he now seems insincere in his dealings with them, and the husband of B. Y— thinks that she would not now be unduly upset if he died. The improvement in the attitude of L— to her daughter also seems to be due to a relative emotional indifference rather than to any real loving devotion to her daughter's interests. In fact, the general tendency in the post-leucotomy phase is for an increased self-indulgence and egoism, the patient unconcernedly living his own life and attending to his own needs, but at the same time taking a greater interest than hitherto in the environment and having a rather wider range of interests. Where the dynamic drive is not very strong, as in the case of the elderly patient G. R—, there is a restriction of activity due to inertia, and a willingness just to sit, though even he reads more and listens to the wireless more than he did, but with less discrimination.

In the case of G. R— and E. J—, this emotional indifference prompted the relatives to use almost identical language in describing them. The wife of G. R— said "His soul appears to be destroyed, he is not the man I once knew," and the sister of E. J— remarked "He is without soul now," and asserted that whereas before they could always appeal to his better self, now he seemed to have no better self to which to appeal. G. R— also sees no reason why he should make himself do things he does not want to do.

In some of the other patients a change has been noted in the moral aspect of their character, and in most the change is for the worse; they tend to be less truthful, less reliable and less scrupulous than they were in their pre-morbid days. Allied to this there is a definite reduction of the interest taken in religion, and one or two are quite outspoken about it, J. B— remarking that she does not believe in all that rot!

There is, however, no evidence of any increased anti-social activity or immoral behaviour, and if there is some diminution of virtue, there is no corresponding increase of vice. In none of these patients has there been observed any indulgence in sexual excess, but in some cases the marital relationship has become somewhat more normal.

Intelligence certainly seems to remain unimpaired, and where the physical drive is adequate they seem to be as successful in their work as they were in the pre-morbid days, in some cases even a little more so. The sense of personal responsibility is somewhat reduced, and worry and anxiety about the future rarely occurs, though they react normally to immediate situations.

CASE 1.—J. B—, female. Year of birth: 1919. Diagnosis: Catatonic schizophrenia. Date of leucotomy: 16.i.42.

Pre-morbid personality.—Good home, superior artisan type. Secondary school education; school certificate. Subsequently did clerical work. Brought up in religious atmosphere; used to attend church regularly. Very keen on Girl Guides and fond of games. Not very sociable; had two special girl friends but no friends of the opposite sex, and seems to have been somewhat jealous of her free-and-easy, socially

popular sister. She was excessively conscientious, and took tremendous pains to do her schoolwork well and worried too much about it. She was extremely neat and painstaking, and used to chide the rest of the family for their lack of tidiness. Reliable, kind and helpful in the home. Teetotaller, moderate smoker, no sexual experience. Shy, reserved, self-conscious, inclined to worry and anxiety, with feelings of inferiority.

Morbid personality.—Admitted to mental hospital from March–October, 1934; from April, 1937, to March, 1938; from June, 1938, to July, 1940. Finally readmitted in November, 1940. On this occasion admitted being jealous of her sister. In conversation was silly and disconnected. She was mischievous and interfering, noisy, restless, difficult, unemployable, solitary, and would not wash or dress without prompting. A course of E.C.T. in November, 1940, produced some improvement, but she quickly relapsed, and by October, 1941, was mute, catatonic, and semi-stuporose.

16.i.42: Leucotomy. Discharged. Was reported to be rather awkward with strangers, not very sociable and jealous. Rather slow and not very competent.

Post-leucotomy personality.—Considerable improvement. Since her discharge has taken an examination in typing and passed it, and has been working as a typist for over a year; likes it quite well, but is slightly worried by the noise of the machines. Still goes to church occasionally, but now says she does not believe in "all that rot." Takes no part in any sport, and has not resumed her old interest in the Guides. Seems more self-centred. Has one girl-friend with whom she goes out occasionally, but does not seek outside friendships or company. No evidence of any sexual libido. A little domineering with her sisters. Does not worry so much about the tidiness of her room, though still keeps it in good order. Tactlessness an outstanding feature; whereas previously she would always think twice before speaking, now she says what she thinks and makes the most tactless remarks without seeming to notice or care. Has ceased to worry and shows no anxiety, but occasionally seems to reproach herself, saying she has brought trouble and disgrace on the family.

Summary.—This patient's illness supervened before she had achieved a mature personality—while she was still in the adolescent phase. Of rather above average intelligence, her main interests were those of the schoolgirl, and she had evinced no overt interest in the opposite sex. (No information is available *re* masturbation.) Brought up in a church-going atmosphere, she seems to have been extremely conscientious and with a strong sense of responsibility, coupled with a painful awareness of her own shortcomings and jealousy of her sister, which gradually led her to retreat from the harsh world of reality to the inner life of the schizophrenic.

Following the operation she is now capable of living at home and has again become a wage-earning citizen, but is more self-centred than she was, and less considerate of other people. Tactlessness has become an outstanding characteristic, and seems to be allied with an indifference to other people's feelings. She also appears rather self-satisfied, and has no desire to make new friends, resume her old interests or take up new ones. She is still tidy, but the excessive meticulousness has disappeared, and she evinces no worry or anxiety. Although she still conforms occasionally to the church-going habits of her home, this is no longer from any inner conviction, for she now says that she does not believe in any of that rot.

CASE 2.—F. H. D—, male. Year of birth: 1916. Diagnosis: Hypochondriasis. Date of leucotomy: October, 1943.

Pre-morbid personality.—Only child of elderly parents. Father neurotic since the last war; very contemptuous of patient; repeatedly accused him of being no good. Father said to have been clever, and patient admired him but was afraid of him. Mother reputedly fond of patient, but much influenced by her husband, and a rather fussy, excitable type; both parents of French extraction. Good education: Clifton College; Oxford, two years; did not take a degree. Worked with London Transport and then went into the Army, 1939. At home, always quite friendly, generous and affectionate, fairly considerate and sympathetic, but very shy, reserved, obstinate, rather egoistic, suspicious and mistrustful. Moderately ambitious but rather lazy, and always faddy about his food and possessions. Serious-minded and "very gentlemanly." Fairly conscientious, truthful, religious, worrying, anxious, inclined to self-pity and with definite feelings of inferiority. Took a moderate interest in sport; connected with the Fighting French organization.

Some masturbation; libido said to be deficient, but had some hetero-sexual experience. Had several women among his friends, but there was never any emotional attachment on his part.

Morbid personality.—1940: Began to complain of abdominal symptoms; sent to General E.M.S. Hospital, then to E.M.S. Neuro-psychiatric Hospital. Invalided out of the Army. Had been thoroughly investigated by a large number of doctors. Complained continually of digestive disturbances and constipation; completely absorbed by his symptoms. Admitted on four separate occasions to a private mental hospital as a V.P. Was given three E.C.T., but was a very difficult patient, continually complaining, and treatment was discontinued. On the fourth occasion was admitted in July, 1943, leucotomy performed in October, 1943, and patient discharged two weeks later.

10.v.44: Apparently had a severe major fit.

Post-leucotomy personality.—Very considerable improvement. Got a job as French master in a prep. school; was there for one term, and then got his present job as French master in a co-ed. school. Married, March, 1946, to a French girl—a distant relative whom he met only a few months ago. Studying for a degree. Gets on better with both parents, *because now he does not mind anything his father says.* He is more self-satisfied, and is neither shy, reserved, nor self-conscious. His feelings of inferiority have lessened considerably, and he appears more ambitious and persistent. He has become rather placid, and a little absent-minded, but whereas before he was very self-absorbed and spent most of his time day-dreaming, he now lives right in the present. He is less lazy and apathetic, more independent and critical, less religious, but more truthful, and far less given to worry and anxiety. His excessive preoccupation with his bodily functions is markedly decreased.

Comment.—Both hereditary and environmental factors seem to have played a part in the production of this patient's illness. The derogatory attitude adopted by his neurotic father, coupled with his own shyness and reserve and a lack of real force of character, made him become increasingly preoccupied with himself, until ultimately his bodily functions became almost his sole interest. He was very sensitive to other people's opinions, and keenly aware of his own deficiencies and inferiorities, and compensated for these by withdrawing more and more from active life into one of phantasy, whence the impression that he was lazy. He was egocentric, though fairly conscientious, truthful and religious.

Since the operation he has become much less self-conscious, being no longer hurt by his father's criticisms of him, and his behaviour at home is more satisfactory. His excessive interest in himself has been replaced by renewed interest in work and finally in marriage. Freed from the paralysing effects of his own sense of inferiority, he now appears less lazy and apathetic, more independent, even more truthful and definitely more self-satisfied, though less interested in religion than before.

CASE 3.—V. B—, female. Year of birth: 1909. Diagnosis: Schizophrenia. Date of leucotomy: 9.xii.41.

Pre-morbid personality.—Devoted parents and on good terms with her sister. Elementary school education, then typist. Fair number of social activities; belonged to tennis, hockey and swimming clubs. Many women friends, but no other boy friend than her husband, to whom she was engaged for nine years and whom she married in 1935. No children, and relationship with husband seems to have been unsatisfactory. She was not very passionate, and coitus was infrequent, but she became very upset by her husband's growing indifference and suspected he was in love with someone else. Abstainer, moderate smoker, rather shy and reserved, but placid, good-tempered, friendly, kind, considerate and tolerant. She was conscientious, meticulous and very religious, worrying, anxious and apprehensive.

Morbid personality.—Became more and more preoccupied with her own worries. Admitted to mental hospital 26.iv.37–8.i.38.

27.xi.39: Readmitted. Talked continually of her own miseries and troubles, and blamed her husband for everything. She became very resentful and suspicious, and was finally asocial, exclusive and very unstable.

13.xii.41: Leucotomy.

7.ix.42: Discharged.

Post-leucotomy personality.—Since her discharge has lived at home with her parents and is separated from her husband. Got a job as a typist, but complained of her head and shoulder aching, and gave it up after two months. Since has helped with the housework and the family grocery business. Her old friends have moved away and she makes no effort to make new ones, and does not seem to be very upset by her husband's desertion. Does not worry like she used to do, but very occasionally seems a little apprehensive about what will happen to her when her parents are gone, and does not want people to find out about the mental hospital or about her husband. She is not so religious as she was.

Summary.—This girl came from a sheltered home, in conventional suburban surroundings, with the education, occupation, social activities, moral and religious outlook of her environment. She was of the worrying, conscientious, rather frigid type, and this probably was a far from negligible factor in the marital friction which arose. Her growing suspicion of her husband's fidelity and the unhappiness resulting therefrom finally assumed such proportions that she became psychotic. Since the operation she has successfully readjusted herself to the sheltered home environment, and seems very content with the ordinary everyday routine. She is more self-contained, and makes little or no effort to make friends, nor is there any strong sexual urge, nor any real concern over her husband's defection and the loss of her marital status. She is reported to be less religious than she was.

CASE 4.—H. L—, female. Year of birth: 1884. Diagnosis: Melancholia with persecution delusions. Date of leucotomy: 26.i.43.

Pre-morbid personality.—Elementary school education, then children's nurse until she married, 1907. Husband in the Police Force. Very fond of her home, had few interests outside it and did not make friends. Very fussy and meticulous over her house and garden. Husband died of G.P.I. about 22 years ago. Patient had a breakdown following this and an early menopause at the age of 35. Following her husband's death she centred all her interest and emotions on her only child, and became exceedingly possessive; wanted to know everything her daughter did, invariably accompanying her everywhere. She was very quiet and reserved, but ambitious and determined, kind and affectionate, but very domineering to her daughter. She was conscientious, meticulous, truthful and religious, worrying and anxious.

Morbid personality.—Her illness seems to date from the time when a bomb exploded near her in April, 1941. She turned against her daughter, whom she had previously idolized, and accused her of stealing and of being in with a gang of thieves, and finally attacked her. She became depressed and unable to concentrate. She was admitted to a private mental hospital as a V.P., and transferred to a municipal one in December, 1941, and was finally certified. On admission she was still voicing ideas of persecution; she was being watched by the police; her daughter robs her and is immoral. Later she became agitated and developed ideas that her daughter had been murdered, and finally became more agitated, waving her arms in despair and accusing herself of being a wicked woman.

26.i.43: Leucotomy.

1.vii.44: Discharged.

Post-leucotomy personality.—Since discharge has again lived with her daughter, who is a school-teacher, but no longer clings to her or tries to rule her and dominate her. This naturally makes life very much easier for the daughter. She is amiable when she meets people, but does not seek friends. Her former gardening activities have not been resumed, she says because she must not work hard like that. She is neither very ambitious nor determined, nor as proud as she was. She is still quiet and rather reserved, but a little more impulsive than before. She is less interested in religion.

Summary.—A woman of average ability, whose range of interests was largely restricted to her own home. She was deeply attached to her husband and daughter, but the latter seems to have been subordinated to the mother's ego and was treated as a projection of it and not allowed to have a life of her own. (It is possible that the husband was treated in the same way, but there is no information on this point.) The patient's ego-ideal (including her ideal for her house and daughter) was fairly high, and she exerted considerable energy in trying to achieve the standard she

had set herself. Engrossed in her own affairs, she seems to have had little interest in other people or events. Her equilibrium was first disturbed by her husband's death, and later by the bombing. During her second breakdown she turned against her daughter, whom she had previously idolized, and developed delusions of persecution. (These may, perhaps, have had their foundation in the daughter's natural reaction against her mother's excessive domination.) These were later replaced by delusions that her daughter had been murdered, and she became very agitated and self-reproachful, accusing herself of being a wicked woman, and evincing strong feelings of guilt. After the operation this agitation and sense of guilt disappeared. Her daughter finds her much easier and pleasanter because of the diminution of the patient's ambition, domination and possessiveness, which seems to have been replaced by a much more contented acceptance of life as it comes. She is less religious than formerly.

CASE 5.—B. H—, female. Year of birth: 1914. Diagnosis: Schizophrenia. Date of leucotomy: 11.xii.40.

Pre-morbid personality.—Home relationships not very satisfactory. Father a parson (C. of E.), and parental outlook rather narrow and repressive. Much less intelligent and more difficult than her three brothers, of whom she was jealous and whom she exasperated at times by her behaviour. School record suggests that she was rather below average intelligence. Had very little contact with father, and extremely attached to mother, though at times showing great antagonism to her. Tried nursing in a children's hospital, but is said to have been very upset by some real or imagined advances by the night-porter. Stayed at home and helped in the house. Her natural interest in poetry and music was discouraged by her parents, and they were disappointed because she was slow in learning, inclined to be indolent, careless, unreliable. Worrying, anxious, and with feelings of inferiority, she was kind, affectionate, and demonstrative, but inclined to be jealous, envious, passionate and tactless, shy, reserved, self-conscious and egoistic. Very religious, eventually fanatically so, falling down in the road and calling upon God.

Morbid personality.—Onset of symptoms about 1936, finally necessitating certification and admission to mental hospital in same year; she became resistive, negativistic, destructive, and seemed continually in a state of morbid apprehension, frequently reiterating, " What am I to do ? " During her stay in hospital, treated with insulin, hormone therapy and E.C.T. Had 77 treatments over a period of eleven months. Reacted well at first, becoming mentally stable for periods of 3–5 weeks. Later remissions lasted only a few days. During remission went home on leave, but shortly became unmanageable.

11.xii.40: Leucotomy.

15.ii.41: Discharged.

Post-leucotomy personality.—Since her discharge has had two simple jobs, first delivering papers, and secondly in a bakery, but this was not very successful. Much less difficult than she used to be, less bad-tempered and more affable, but not making any real friends. She gets on well with people and is no longer shy or self-conscious. Very attached to mother. No evidence of any sexual urge. A little inconsiderate (will sing a hymn tune over and over, ignoring requests to stop), and unreliable (will leave the job she is doing in order to sit down and read a book). Incontinence has been rather troublesome in this case, and she is rather self-indulgent, and inclined to eat other people's rations as well as her own if they are not locked away. No sign of worry or anxiety, and is less troubled by feelings of inferiority. Is now only moderately interested in religion.

Summary.—Severe emotional difficulties seem to have been occasioned in this girl, who was rather below average in intelligence, by the home atmosphere and the attitude shown to her by her parents. They seem to have had little insight into the nature of their daughter's difficulties, which were exaggerated by the narrow standards imposed and by the moral condemnation of her shortcomings. The mother's attitude to sex tends to be prudish and repressive, and the patient was probably very ill-prepared for the problems of adolescence. Unable to cope with her emotional difficulties, the patient developed an extreme religiosity which culminated in schizophrenia. Since her discharge she has readjusted herself to the home atmosphere, and seems quite contented with the narrow circle in which she lives. The father has retired and financial circumstances are rather straitened. Has

neither the intellectual ability nor the training for any sort of responsible job. She is affable and friendly, but does not seem to have any urge to make friends. She is happy, self-contained, less self-conscious and more indifferent to her mother's criticisms of her, and so more placid and not so difficult. She is definitely less interested in religion than before.

CASE 6.—S. A—, male. Year of birth: 1888. Diagnosis: Chronic melancholia. Date of leucotomy: 11.iv.44.

Pre-morbid personality.—Record of early life not very complete. Apparently came of middle-class family and had public school education, but never achieved any great success either there or in his later life. Was rather a rolling stone and went to America, but never settled anywhere for very long. Seems to have gradually come down in the world, and was finally working as a motor mechanic. Subject to recurring attacks of depression, the first occurring at the age of 18. Married in 1910 a woman whom he felt was socially and intellectually inferior to himself and who has gradually become very deaf, so that conversation with her is now very difficult. He had two children, boy and girl. The boy is said to have considerable musical ability, but there is much friction between them, and patient despises his son for turning from classical music to jazz. The daughter made an unsatisfactory marriage with a man much older than herself, and had a mental breakdown after the birth of her child. Many conflicting traits in patient's character. He was very slow, pleasure-loving, fond of spending, not very keen on work, but also religious, conscientious, dogmatic. Made very few friends but was attached to a Methodist parson, in whom he confided a great deal, probably because he was the only acquaintance he considered his intellectual equal. Proud, but with feelings of inferiority, of despair, self-pity and self-reproach, and inclined to worry and anxiety.

Morbid personality.—First attack of depression occurred at the age of 18 and lasted about 18 months. Second attack at 27 and was in mental hospital, U.S.A., for one year. Attacks have tended to recur about every ten years, lasting for varying but progressively increasing periods of time. Present attack began eight years ago.

1932: V.P. in mental hospital for short period. Continually complaining of depression; obsessed with the idea of death. Could not bear to be alone; could not do anything on his own. Troubled by insomnia. Had managed to keep at work most of the time, but was becoming progressively incapacitated by his symptoms.

Post-leucotomy personality.—Has had three jobs since operation, each a better job with more pay. Wife finds him more difficult. Quicker in his movements and seems to have more initiative. Is no longer shy and talks more easily to people, but does not seem to have made any special friends and keeps himself withdrawn from his work associates, considering them uncouth and ignorant. Now more bad-tempered, sarcastic, intolerant, quick to criticize, tactless and inconsiderate. Takes advantage of his wife's deafness and says rude, impossible things about her in front of other people. He is more self-satisfied and no longer has feelings of inferiority, nor does he show anxiety or remorse, though he himself feels unhappy over his isolation, which is aggravated by his wife's deafness, his daughter's illness and his disagreement with his son. Libido is normal and coitus with wife more frequent. His interests now are chiefly wireless programmes dealing with music or the theatre. Less concerned with his personal appearance, and careless about washing and shaving. Will not go to church now; says he doesn't believe in religion; doing Christian acts is his idea of religion, not going to church.

Summary.—The discrepancy between this patient's ideal of himself and the actual facts of his life seem to have played a determining part in his psychosis. Failure to achieve his standards resulted in hopeless brooding, depression and self-reproach, this depression being accentuated periodically, but becoming more and more persistent as time went on. He never seems to have had sufficient aptitude, initiative, determination or self-control to achieve success. Proud and self-absorbed, but far from self-satisfied. Since his operation he has become much more self-satisfied, but much more inconsiderate and outspoken about the environmental conditions in which he finds himself. At the same time he is actually slightly more successful in his work than before. He is less religious.

CASE 7.—Male, G. R—. Year of birth: 1877. Diagnosis: Melancholia. Date of leucotomy: 3.xii.43.

Pre-morbid personality.—Elementary school education, subsequently shop assistant in gentlemen's outfitters. Army 1914–1918. On good terms with his family, and had many acquaintances of both sexes, but no very close friends, and married late in life, 1925. Happy, friendly, taking part in local activities, church, whist-drives, theatres. Very keen and industrious gardener. Conscientious, meticulous, scrupulous, fairly religious, affectionate, sympathetic and considerate, fairly quick-tempered and impulsive, and inclined to worry and with some feelings of inferiority.

Morbid personality.—In March, 1942, had a quarrel with his management, and had to give up the job which he had held for 18 years. This distressed him very much and although he got another job as a temporary Civil Service clerk, he felt he could not cope with it. By August, 1942, he was restless, eating and sleeping badly, was unable to concentrate and had lost interest in everything. In November, 1942, he was admitted to a private mental hospital as a V.P. for two months, and then was in an ordinary nursing home for four months. In November, 1943, a course of insulin sub-coma was tried, but with no improvement. E.C.T. was not considered advisable in view of his general condition.

3.xii.43: Leucotomy.

17.xii.43: Discharged; there was already considerable improvement.

Post-leucotomy personality.—Has held no jobs since his operation, although attempts were made to persuade him to return to his old occupation; but in view of the fact that patient has reached an age when the majority of people tend to retire his refusal to take up work again is not very significant. He is, however, unduly content to sit back and do little or nothing, and leaves almost all the responsibility of the home to his wife. If she tries to push him into doing something he becomes irritable, sees no reason why he should force himself into doing things, and just wants to be left alone. Less considerate and thoughtful, not helpful, and evinces very little real interest in anything. Pleasant and affable when he meets people, but shows no enthusiasm for going out for social evenings or meeting people, and does not spontaneously converse, though answers questions pleasantly and intelligently. Will go to the theatre with his wife, but makes no comments, and quickly seems to forget about it. Reads more and listens to the wireless more, but seems less critical and discriminating, listening to anything. Takes no interest in the house or garden now. Patient himself says he feels very well, is no longer nervous and does not get depressed, and is quite satisfied.

Summary.—Before his illness the patient seems to have been a respectable, conventional citizen, of average ability. Reliable and conscientious in his work, but with no outstanding ambitions, drive or initiative. He enjoyed his work as a shop assistant and worked for many years with the same firm. The same conventional moderation obtained outside his work. He had no obvious vices, and his virtues were of a somewhat passive nature; friendly, with a large circle of acquaintances, but no very warm friendships; affectionate but not very passionate. He did not marry until he was 47, and although a little frustrated by his wife's frigidity, he cheerfully accepted this and was not unduly upset by it. (Even before his illness it seems probable that his wife was the dominant partner.) His pleasures were very simple, his main hobby being his garden, and he took a moderate interest in religion and attended church. There was very little aggressiveness in his character, and when the break with his firm came he was unable to adopt a fighting role, and became overwhelmed by his difficulties, being unable to eat, sleep or concentrate properly, and becoming increasingly preoccupied with his own inadequacies—physical, mental and moral. Since the operation the lack of energy and absence of drive has become very pronounced, probably due in part to his age, and in part to a diminution of his sense of obligation. He sees no reason why he should bother himself to do things he doesn't want to do, and has become less conscientious, less meticulous, less scrupulous and less considerate than he was. His wife is finding it very difficult to readjust herself to this change, and she says that his soul appears to be destroyed, and that she feels he is not there as the man she once knew!

CASE 8.—R. J—, male. Year of birth: 1905. Diagnosis: Catatonic schizophrenia. Date of leucotomy: 19.xii.41.

Pre-morbid personality.—Secondary school education. Good school reports, but took no outside examination. Moderately athletic, indiscriminate reader and wireless listener; fond of music-halls, moderate drinker, heavy smoker. Family relationships satisfactory; got on quite well with parents and sister. Very sociable; many men friends and normal hetero-sexual interest in women. Married at the age of 28; seemed to get on fairly well with wife. Commercial traveller; worked for several firms, bettering himself on each occasion; final salary about £400 p.a. Always envious of people with money and planning to make a lot for himself, but was not thrifty, and when he got money would waste it on having a good time. Friendly and affectionate, but inclined to be tactless and domineering, and rather vain of his appearance. Moderately conscientious and truthful, but inclined to be impulsive and erratic, and so somewhat unreliable. Tended to have feelings of inferiority, and was apprehensive and inclined to worry. Was not interested in religion.

Morbid personality.—August, 1935, had a nervous breakdown when he attempted suicide by drowning in the bath at a London hotel. At the end of April, 1936, became wildly extravagant in his talk and behaviour. Suddenly bought a café, valued at £2,000, without having the money for it, but nevertheless managed to raise £1,000 towards it before going into hospital as a V.P. on July 10. He remained impulsive after admission, but gradually his conduct deteriorated and he became solitary, disorientated, mute and catatonic.

Leucotomy: 19.xii.41. Within a month of the operation he was conversing rationally, but remained idle and lacking in initiative. Showed little concern when told his wife was seeking a divorce.

Discharged: April, 1943.

Post-leucotomy personality.—Since his discharge has changed jobs two or three times; latterly employed as a clerk by the Admiralty. Inclined to be lazy; took this job because it was easy work and good pay. On good terms with his family, but with lack of any emotion. His wife has divorced him, but he does not seem to worry about it at all. Has a number of friends, but all people seem more or less alike to him and he feels little or no gratitude to those who have helped him. Now rather negligent of his appearance and even of personal cleanliness. Even more of a spendthrift than he was; while his money lasts goes to cinemas and music halls, but when it is gone is quite content to spend the rest of the week going to bed early and reading. Rather smug and self-satisfied, with no feelings of inferiority. Very self-indulgent, less conscientious, less truthful, more unreliable. Lies unconcernedly and does not mind if he is found out. Sister says that whereas before he was genuinely thoughtful and kind towards his family, he now seems insincere in his dealings with them. Before they could appeal to his better nature when they thought something should be attended to and he seemed reluctant to do it, but now he seems to have no better self to appeal to and can never be bothered.

Summary.—The patient seems to have had a divided personality long before the onset of the actual psychosis. On the one hand he appears extremely extraverted and with many external interests, but on the other hand his subjective introversive tendencies are revealed by his vanity, his feelings of inferiority and apprehension, his ambition and his envy of people with money. Finally he seems to have had a manic outburst, during which he entered into wild financial schemes, followed by a wave of depression and self-criticism, when he attempted to commit suicide. After admission to hospital his conduct remained impulsive for some time, but slowly lapsed into a mute, catatonic state. Following the operation intellectual recovery preceded volitional recovery, and for many months he remained contentedly idle. Since discharge he has again become a reasonably useful member of society, but is still rather idle and self-indulgent, lacking in responsibility, rather indifferent emotionally, and not very reliable. His extroverted traits remain, but his introverted ones have disappeared. He has never at any period of his life evinced any real interest in religion.

CASE 9.—B. D—, female. Year of birth: 1887. Diagnosis: Involutional melancholia. Date of leucotomy: 21.i.44.

Pre-morbid personality.—Elementary school education. Foster-mother at Cottage Homes 18 years. Family relationships said to have been quite good; one sister and large family of brothers. Little interest in opposite sex; one special

woman friend and many female acquaintances. Never joined any social club, mildly interested in fiction, wireless, cinemas and music halls. Quick-tempered and excitable; very generous, affectionate, fairly sympathetic, but rather spiteful. Shy, reserved, rather self-conscious. Found the boys in the Home rather difficult and unruly, but had a way which cowed most of them until her breakdown, Hated the family cat, and when in a temper would kick it or starve it. Was always worrying about religion; sister used to find her religion rather annoying; rather showy, she used to try and put everyone else right. Used to get on the family's nerves with her " musts " and her " oughts." Very intolerant of noise.

Morbid personality.—At the end of 1940 became progressively more depressed, lost interest, and wished to die. Her menstrual periods had stopped at the beginning of the year. She developed delusions of extreme wickedness, and when admitted to a mental hospital in April, 1941, was retarded, deeply depressed, self-reproachful, refusing food and unemployable. The depression could be terminated by short courses of E.C.T., but these were always followed by a relapse.

Leucotomy: 31.i.44.

Discharged: March, 1944.

Post-leucotomy personality.—Since her discharge lives with her sister and helps in the house, but indifferently and reluctantly. Is rather lazy and does not want to work; has no sense of responsibility or obligation to others, and resents it when her sister tries to make her do things, and says she is being bossed. Is now inclined to be sullen rather than quick-tempered, but on the whole is much more placid than she used to be, and any discord in the home now is caused by patient's lack of initiative and co-operation, and seeming disinterestedness. Is now rather self-indulgent, not always truthful, unreliable, artful and dishonest in small things, and is not so generous and affectionate. She is rather self-satisfied, and no longer shy and reserved. Less particular about her toilet and personal appearance. Has resumed her friendship with her woman friend, but has not made any new friends. Now makes a great fuss of the cat. Can stand any amount of noise. More outspoken, and less upset by what others say to her.

Summary.—A woman of average intelligence and limited education, with no outstanding abilities. She seems to have been rather a hard, somewhat bad-tempered woman, who was able to hold her job as Foster-mother at the Cottage Homes for many years, but who seems to have shown little real affection for or understanding of the children under her care. Her family evidently found her a little difficult at times. Shy and self-reserved, she seems to have had little interest in the opposite sex, limiting her friendships more or less to one woman friend and several women acquaintances. The psychosis was involutional and showed the typical symptomatology. Increasing preoccupation with herself led to loss of interest in external things, and to self-reproach and self-accusation with delusions of extreme wickedness. Since the operation she has become self-satisfied, less self-critical, a little less truthful and reliable, and more self-indulgent. There is also some lack of initiative and apparent laziness, together with lack of concern and consideration for others, but this is, on the whole, outweighed by her increased amiability.

CASE 10.—B. Y—, female. Year of birth: 1905. Diagnosis: Hypochondriasis and depression. Date of leucotomy: 5.iii.43.

Pre-morbid personality.—Elementary school education. Mother died when she was 15 and she took over the household duties. Father reputed to have been a drunkard, but patient liked him when sober. Elder sister went out into the world and " did well for herself," and patient mothered the younger one. Got on well with her brothers, but they did not approve of her marriage, and gradually they drifted apart. Said to have been an extremely feminine, gentle personality, not very self-reliant, friendly, affectionate, considerate, and sympathetic, but shy, timid, self-conscious, and reserved. She was conscientious, meticulous, truthful and religious; inclined to self-pity, apt to worry and with feelings of inferiority. Relationship with her husband was good, but mainly because of his extreme tolerance and indulgence. Made no friends outside the family; never went anywhere without her husband; would not go in a train and seldom in a bus. No real interests, listened indiscriminately to the wireless and occasionally went to the cinema. Sexually frigid; never had any children because she was afraid of childbirth and intolerant of noise.

Morbid personality.—It is difficult to draw any dividing line between the premorbid and morbid personalities. There was a history of ill-health since the year preceding her marriage at the age of 22. Patient attributes it to her brother's disapproval of her marriage. She became anxious, unable to eat and sleep properly. Three years later she became more profoundly depressed and suicidal, and had to go into a nursing home. About 1931 began to suffer with pain in her jaws, which was only aggravated by extraction of her teeth. This pain continued, and she could only sleep with sedatives. September, 1940, a course of E.C.T. with considerable improvement, but still demanding sedatives because of the pain; effect wore off after six months. In 1942 she began to complain of pain in her abdomen and back, like toothache.

5.iii.43: Leucotomy. Considerable improvement followed, the pain became bearable and finally disappeared, and she had no further medicine.

Post-leucotomy personality.—Less dependent on her husband, but is also less truthful, less kind and considerate and more quick-tempered. Does not worry at all about the estrangement from her brothers. She is rather self-indulgent, tactless, critical, obstinate and intolerant. Uses very strong language at times, which she would never have done before. Has no friends outside the family and does not seek any, but will start a conversation with anybody—a thing unheard of before the operation. Much more independent; goes shopping by herself and will travel by bus or train; had developed a passion for the cinema and listens to the wireless a great deal, using it entirely for her own pleasure and caring nothing if it annoys other people. Reads more, but indiscriminately, light books preferred. Sexual frigidity much diminished. Husband thinks that now patient would not bother to defend or support him, whereas formerly she would have stuck by him through thick and thin. He thinks she would not be unduly upset if he died, but would be quite capable of going to the cinema within a week. Never wants to go to church.

Summary.—A woman of average intelligence and little education, whose interests, originally centred in her family, became increasingly concentrated on herself. Disapproval of her marriage by her brothers seems to have led to emotional conflicts, which finally issued in depression and hypochondriasis. She was strongly attached to her husband and her family, but very dependent on the former and did not assume normal adult responsibilities. Keenly aware of her own feelings, she showed some consideration and sympathy for others, though her own feelings and her own interests took precedence over all others, until she became conscious of little beyond her own pains and anxieties. Since her operation this preoccupation with herself has gone, and films, shops, wireless programmes and books claim her attention and interest; but although less self-preoccupied she is more egoistic and self-indulgent, and has as little regard for the feelings of others as she has for her own, and there is a definite diminution of emotional depth, though her superficial contacts with other people, including her sexual relations with her husband, are much easier and freer. There is also a definite loss of interest in religion.

FEAR FACTORS IN FLYING PERSONNEL.

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Section I.—Introduction.

Interest in the psychological concomitants of flying was greatly stimulated by the outbreak of war in 1939. The rapid increase in size of the Royal Air Force and the ever-increasing "airmindedness" of the general public led to a far wider realization of the growing importance of this comparatively new field of enquiry.

The necessity for the study and treatment of mental illnesses occurring among flying personnel was recognized at an early stage. Special centres were opened in this country for the diagnosis and treatment of psychological disorders in the Royal Air Force, with special reference to those occurring in air-crews. Many of the medical officers working in these centres were handicapped by their total ignorance of aviation, and the consequent difficulty in understanding and appreciating the various stresses to which flying personnel are exposed. In addition, many of the cases referred to these centres were well advanced, and, in those days, specialist officers had few opportunities of seeing early cases, or of gaining an insight into living and working conditions on operational stations.

It was considered that a useful contribution to our knowledge of the psychological effects of flying might be made by means of an investigation of fear factors in pilots and members of air-crews living and working on a typical bomber station.

Fear was selected as the subject to be investigated because it figured prominently during informal conversations with air-crew personnel. It is not proposed to offer any definition of fear, or attempt to explain its mechanism, but rather to present, in order of importance, those factors which stimulate fear (as understood by the layman) in healthy young men engaged in the dangerous occupation of night bombing.

The clinical material considered here was obtained by direct questioning of flying men who were well known to the writer, and among whom he lived and worked for over two years. Many are now dead or missing.

In order to achieve some degree of standardization, it was necessary that personnel selected for questioning should conform to certain rigid conditions, which will be described in the next section.

Section II.—Method of Obtaining Data.

It was decided that flying men as near "normal" as possible should be used, so that the influence of factors not connected with flying might be eliminated as far as was practicable.

To this end, the following restrictions governed selection, and only those men who fulfilled the conditions listed below are included in the total of three hundred cases submitted.

(1) Completion of a minimum of ten operational sorties.

(2) Negative personal history for any form of "nervous" illness.

(3) Negative family history (father, mother and siblings) for any form of "nervous" illness.

(4) Never reported sick for psychological reasons, or considered mentally ill by a superior officer or medical officer, or regarded as lacking in confidence or moral fibre.

(5) Never removed from flying duties, or given less arduous ones, because of fear, or any other psychological reason.

(6) Frank admission of fear while flying, with decision to carry on with flying duties notwithstanding this fear.

(7) Willingness to co-operate in this investigation, and to give careful introspective consideration to the subject.

It will be appreciated that these restrictions narrowed the field of inquiry very considerably, and that for practical purposes all the men questioned may be regarded as "normal" individuals, who experienced "normal" fear reactions.

Three hundred flying men were asked, individually, to prepare a list, in descending order of importance, of hazards concerning which they experienced fear while actually engaged in operational flying. Each list was then discussed at length with its author.

During the early stages of the investigation it became apparent that there were wide variations of opinion both regarding the actual factors selected, and also their relative importance. In addition, marked differences appeared which seemed to depend on the particular flying duty upon which the individual was engaged. This latter complication had not been foreseen, and when this was realized, it was decided to question equal numbers of men engaged on different flying duties, so that a balanced result might be obtained.

Five different flying categories were selected: Pilot, Navigator, Wireless Operator, Flight Engineer and Air Gunner. The total of three hundred cases was composed of sixty of each of these categories.

From the three hundred lists obtained, twenty factors which were mentioned most commonly have been selected for consideration. These factors were arranged in order of importance, as shown by their frequency and positions on the three hundred lists. They were then examined in relation to the five separate flying categories mentioned above, and again arranged in order of importance for each of the five categories, as shown by the sixty lists from each category.

Section III.—Fear Factor Tabulated.

Table A.—*Fear Factors in Order of Importance, as Assessed by Three Hundred Flying Men.*

1. Fog.
2. Flak.
3. Searchlights.
4. Engine failure.
5. Fear of showing fear.
6. Lack of confidence in other members of the crew.
7. Disfigurement.
8. Clouds and rain.
9. Enemy fighters.
10. Non-completion of operational tour.
11. Ice.
12. Fire.
13. Inexperience.
14. Bad flying country.
15. Frostbite.
16. Oxygen defects.
17. Airsickness.
18. Landing at a strange aerodrome.
19. Collision.
20. Aircraft faults.

Table B.—*The Same Factors, Assessed by the Same Men, but arranged in Order of Importance in each of Five Different Flying Categories.*

1. Pilots.

1. Fog.
2. Flak.
3. Searchlights.
4. Fear of showing fear.
5. Enemy fighters.
6. Engine failure.
7. Ice.
8. Bad flying country.
9. Clouds and rain.
10. Disfigurement.
11. Landing at a strange aerodrome.
12. Lack of confidence in other members of the crew.
13. Fire.
14. Non-completion of operational tour.
15. Inexperience.
16. Frostbite.
17. Collision.
18. Oxygen defects.
19. Aircraft faults.
20. Airsickness.

2. Navigators.

1. Fog.
2. Clouds and rain.
3. Flak.
4. Searchlights.
5. Enemy fighters.
6. Fear of showing fear.
7. Ice.
8. Bad flying country.
9. Engine failure.
10. Lack of confidence in other members of the crew.
11. Airsickness.
12. Landing at a strange aerodrome.
13. Collision.
14. Disfigurement.
15. Fire.
16. Non-completion of operational tour.
17. Frostbite.
18. Inexperience.
19. Oxygen defects.
20. Aircraft faults.

3. Wireless Operators.

1. Flak.
2. Fog.
3. Searchlights.
4. Engine failure.
5. Fear of showing fear.
6. Enemy fighters.
7. Lack of confidence in other members of the crew.
8. Clouds and rain.
9. Disfigurement.
10. Ice.
11. Non-completion of operational tour.
12. Fire.
13. Inexperience.
14. Frostbite.
15. Bad flying country.
16. Landing at a strange aerodrome.
17. Aircraft faults.
18. Oxygen defects.
19. Airsickness.
20. Collision.

4. Flight Engineers.

1. Engine failure.
2. Flak.
3. Aircraft faults.
4. Fog.
5. Enemy fighters.
6. Fire.
7. Fear of showing fear.
8. Lack of confidence in other members of the crew.
9. Ice.
10. Searchlights.
11. Disfigurement.
12. Clouds and rain.
13. Inexperience.
14. Non-completion of operational tour.
15. Frostbite.
16. Bad flying country.
17. Airsickness.
18. Landing at a strange aerodrome.
19. Oxygen defects.
20. Collision.

5. Air Gunners.

1. Flak.
2. Enemy fighters.
3. Searchlights.
4. Lack of confidence in other members of the crew.
5. Aircraft faults.
6. Airsickness.
7. Disfigurement.
8. Fire.
9. Frostbite.
10. Engine failure.
11. Fog.
12. Oxygen defects.
13. Clouds and rain.
14. Non-completion of operational tour.
15. Inexperience.
16. Collision.
17. Fear of showing fear.
18. Ice.
19. Bad flying country.
20. Landing at a strange aerodrome.

Section IV.—Observations on Table A.

1. *Fog.*—Fear of fog was described as a sense of helplessness, apprehension, and of being lost. The knowledge that accurate flying instruments were available inside the aircraft did not appreciably lessen this fear. Even experienced flying men often become convinced, when flying in fog, that their instruments are inaccurate, and that they are not flying on a straight and level course. They imagine that the aircraft is climbing, diving, banking, turning, or flying upside down. After any aerial manoeuvre, personnel are not satisfied that normal flight has been resumed. Aircraft movements which may be due to changing wind currents, such as pitching, yawing or rolling are imagined or exaggerated.

In general the sense of equilibrium may become greatly disturbed, and there is a strong temptation to fly by instinct rather than by instruments.

2. *Flak.*—This fear was seldom analysed, and personnel found great difficulty in describing what characteristics of flak chiefly concerned them. Different types of flak, such as light and heavy; different concentration, such as occasional and intense; different heights at which encountered; and proximity of bursts, were not usually considered separately.

The fear of flak is a general fear of the aircraft being hit.

3. *Searchlights.*—Enemy searchlights only are considered. It is the feeling of being trapped which makes this factor so important. Temporary dazzling by searchlight glare is a secondary consideration.

Tinted goggles, darkened anti-glare windows, or curtains, do little to relieve mental tension, the crew being well aware that, though relieved of dazzle themselves, they are still conspicuous from the ground.

There was a noticeable tendency for the less experienced flying man to place this factor lower in their lists. That is, a man who had completed, say, twelve operational sorties, would regard the hazard of searchlights as being relatively less important than would a man who had completed, say, thirty sorties.

4. *Engine failure.*—This factor appears surprisingly high on the list, when the reliability of modern aero-engines is considered. This investigation was carried out entirely on a unit where four-engined aircraft were used, and the importance attached to engine failure may well vary considerably on single and twin-engined units.

The occurrence of some relatively minor engine trouble was common, and frequently resulted in non-completion of a sortie, and early return to base. The difficult decision whether to carry on or turn back is the responsibility of the captain of the aircraft, and wide variations, in apparently identical circumstances, were noticeable. The distinction between prudence and timidity in these cases is a very fine one.

5. *Fear of showing fear.*—This was another surprising result. It was a subject never discussed, or even mentioned, generally, during informal conversations in Messes or Crew-rooms, but which often appeared during intimate individual talks. Many outstanding flying men experienced this fear in a severe and acute form. An excellent pilot related how on one occasion when approaching a heavily defended target, and anti-aircraft shells were bursting all around, he shouted to the bomb-aimer, "For God's sake drop them here and let's get out of this." A few moments later he found that his inter-communication telephone was switched off and that none of his crew could possibly have heard him. His relief at this discovery was so intense that he had no difficulty in continuing to the centre of the target area. It is interesting that none of the men questioned were ashamed of fear, but only of showing it.

6. *Lack of confidence in other members of the crew.*—The best crews were composed of men who had complete confidence in each other's ability and integrity. If one or more members of a crew were considered "shaky" by the remainder they were a potent cause of uneasiness and apprehension.

The different duties in a crew had a marked effect upon individual liability to suspicion by other members of the crew. This point will be elaborated in Section V.

7. *Disfigurement.*—This was another condition not readily discussed. Disfigurement by burning was invariably the disability feared. This did not appear to be an expression of vanity in the majority of cases. It was feared rather because men thought it would decrease the prospects of successful employment, or of matrimony, after the war.

8. *Clouds and rain.*—As in the case of fog, and, indeed, bad weather generally, this was really a fear of becoming lost. It is interesting that clouds and rain, while generally considered together on the majority of lists, were kept quite distinct from fog, and also were placed much lower in order of importance.

9. *Enemy fighters.*—During the period of investigation the aircrew personnel questioned were engaged almost exclusively on night bombing. This paragraph, therefore, refers to enemy night fighters. It was only on bright, clear moonlit nights that fear of fighters was experienced. Under these conditions, the emotion was intense while over enemy occupied country, and over the sea.

Many flying men stated that this fear was most useful in keeping them alert on the return journey, when fatigue was liable to impair efficiency.

10. *Non-completion of operational tour.*—The last five sorties of a tour became progressively more difficult than their predecessors. This fact was well recognized, even by men who were only part of the way through their first operational tour, and had, therefore, no personal experience of the closing stages.

Men who have completed one or more operational tours agree that fear of non-completion of the tour becomes progressively more intense during the last five sorties. There are no particular hazards which are peculiar to these sorties.

11. *Ice.*—Accretions of ice on the wings are referred to particularly under this heading. They may form a serious addition to the total weight of the aircraft, rendering climbing or even level flight impossible.

Modern improvements in methods of nullifying the effects of ice will probably reduce the importance of this factor.

12. *Fire.*—This factor was described as fear of fire occurring in the aircraft, whatever its cause. The possible origin and results of such fire were not usually consciously elaborated, with the exception of factor No. 7 (Disfigurement). This, although a result of fire, was considered separately, and assessed as being of greater importance.

Aircraft fires are of common occurrence, and the majority of flying personnel have witnessed at least one such during their training period, and before joining an operational squadron.

13. *Inexperience.*—Although this was given as a cause of fear by many of those questioned, opinions differed widely regarding its importance. There are certain advantages in being new to the job. The inexperienced man is ignorant of the seriousness of many hazards encountered. With increasing experience, the flying man learns to assess the relative importance of different emergencies.

On the other hand, the newcomer is more likely to panic when confronted by sudden unexpected danger, and to imagine or exaggerate unpleasant eventualities.

All the men questioned were experienced at their work, having completed a minimum of ten sorties, and it is an interesting sidelight on the essential frailty of human nature that such a factor should exist at all.

14.—*Bad flying country.*—Under this heading are included natural hazards such as mountains, sea and forests, and man-made hazards such as cities and balloon-barrages. Although given as a specific fear factor, discussion revealed that flying over difficult country lead to a general increased mental tension, and alertness, rather than a definite fear of any particular result of such conditions.

15. *Frostbite.*—Mild degrees of frostbite, chiefly of the fingers, but also

affecting the ears, nose and toes occurred frequently during the winter months. Air-crews are well aware of this danger, more especially as it is one of the subjects upon which lectures to all flying personnel are given by medical officers. They appreciated the insidious onset and possible serious effects of this condition.

Better heating of aircraft, and improved personal protection by means of electrically-heated clothing, are doing much to minimize this hazard.

16. *Oxygen defects.*—The vital importance of an adequate oxygen supply is well recognized by experienced flying men. This subject, also, is frequently stressed by medical officers in their regular lectures to air-crews, and, in particular, the spurious sense of well-being which may, in reality, indicate the early stages of oxygen deficiency.

Headaches, dizziness, and nausea, occurring while flying at heights above 10,000 feet, were frequently attributed to faults in the oxygen supply system. In addition, air-crews complained occasionally of unpleasant odours emanating from the oxygen masks.

In point of fact, these odours were never proved to be due to contaminating impurities in the oxygen supply, but were caused by a " rubbery " smell from the mask itself, or to engine fumes which had gained access through an ill-fitting mask.

17. *Airsickness.*—With experienced air-crews, airsickness is not a common disability under normal flying conditions. Personnel peculiarly liable to this disability are usually rejected during training. In particularly bumpy weather, or violent evasive action, any member of a crew may experience nausea, or actually vomit.

Airsickness renders a man incapable of carrying out his duties with maximum efficiency, and fear of being rendered inefficient is the real underlying factor.

18. *Landing at a strange aerodrome.*—Changing weather conditions, shortage of petrol, damage to the aircraft, or many other reasons often necessitate diversion of aircraft to stations other than their own. The difficulties of landing at night on a strange aerodrome are often regarded as the " last straw " after an arduous and exhausting flight. Added to this is the feeling that the sortie has not really been completed until base has been reached. A meal, a few hours' sleep, and a daylight return to base are regarded as poor substitutes for a straightforward " out and home " trip.

19. *Collision.*—Concentrated bombing necessitates the convergence of large numbers of aircraft over the target area at the same time. Collisions do occur, and are often witnessed by the crews of other aircraft not involved. This factor is only important for a short period out of the total duration of the sortie, but occurs when other fear factors, such as flak and searchlights, are also at their maximum intensity.

20. *Aircraft defects.*—This heading includes every part of the aircraft, such as fuselage, instruments, and armaments, with the exception of the engines, which received much higher priority (Factor 4). It is a tribute to the aircraft manufacturing firms that this factor should appear so far down the list.

The fear that " something will fall off " is common during the beginner's first few flights. It is interesting that this should persist among experienced men with hundreds of flying hours to their credit.

Section V.—Observations on Table B.

1. *Pilots.*—The pilot is usually, although not always, the captain of the aircraft. As such, his responsibilities are numerous and exacting, quite apart from those connected with the actual flying of the machine. Upon the pilot rests, ultimately, the safety of the crew and the aircraft. Sound judgment and rapid decisions on many subjects, such as advisability of turning back to base, emergency landing, baling out by parachute, and other vital matters, are essential.

It would be natural to expect problems affecting the team as a whole, and those more intimately concerned with leadership, to influence pilots more than other members of aircrews, and this supposition is supported by the variations shown in the pilot's list of factors as compared with the general list.

Thus, fear of showing fear to other members of the crew takes precedence over engine failure in the pilot's list. Fear caused by lack of confidence in other members of the crew drops from sixth place to twelfth ; because the pilot, more than any other member of the crew, is independent in action.

Ice and bad flying country appear relatively higher ; these are essentially " team " hazards by comparison with disfigurement and fear of not completing the tour, which are essentially personal.

Landing at a strange aerodrome is largely the pilot's added responsibility, and therefore appears much higher in his list.

Airsickness appears last. The pilot is occupied all the time the aircraft is flying, and this position for airsickness supports the theory that concentration on essential duties diminishes the likelihood of airsickness.

In general, it may be said that the pilot's list is a less individual and more team-spirited one than the average.

2. *Navigators.*—The navigator represents the eyes of the aircraft. He tells the pilot what course to steer, what atmospheric conditions are to be expected, the exact position of the aircraft, the most favourable height at which to fly, and gives him much other important information. His chief responsibility is that the aircraft shall not lose its way. The importance of the navigator in an aircrew tends to be minimized by non-flying personnel. His is a specialized, highly responsible, and exacting post demanding constant vigilance.

Factors which particularly affect his duties, and increase his difficulties, might be expected to appear prominently on the navigator's list. Thus clouds and rain take second place instead of eighth. Bad flying country rises from fourteenth place to eighth, while engine failure drops from fourth to ninth place. Airsickness is placed eleventh instead of seventeenth ; this is difficult to explain. When no second pilot was carried many navigators were in the habit of sitting next to the pilot for part of the sortie. Here they were in a similar position to the front-seat passenger in a motor-car, who is notoriously " edgy " and desirous of driving himself. Possibly this awareness of the probable evolutions about to be performed, which is not shared by other members of the crew, may be a partial explanation.

Fear of landing at a strange aerodrome is placed twelfth instead of eighteenth. This can be explained on the grounds that it is the navigator's duty to direct the pilot to such an aerodrome—by no means an easy task in bad weather.

Fear of collision rises from nineteenth place to thirteenth. Again, this may be related to the navigator's better visibility by comparison with the remainder of the crew.

3. *Wireless operators.*—The Wireless Operators' list in Table B corresponds more closely with Table A than any of the other lists.

Recent technical advances in radio-location and allied sciences have greatly increased the responsibilities and importance of the wireless operator. During the period of investigation (1941–43) these improvements were being brought into general use. Wireless operators were becoming busier, and their speciality regarded as a full time occupation, rather than one which could be combined with other duties, such as those of air gunner.

This period was, then, one of transition. In the earlier part of it, the wireless operator was normally the member of the crew who made himself generally useful in many activities apart from his own particular work. Such duties as the care of sick or wounded members of the crew, minor repairs and adjustments to unserviceable equipment inside the aircraft, the distribution of refreshments, and other diverse occupations often fell to his lot.

In so far as any member of an operational crew can be regarded as a passenger, the wireless operator most nearly approximates to this. Apart from his radio contact with the outside world, the wireless operator is entirely dependent for his immediate safety and well-being on the other members of the crew. He is thus more likely to acquire a dispassionate attitude to the immediate problems of flight, and to rely more completely on others for the best solution of these, than are the remainder of the crew.

The factor of aircraft faults, which rises from last place to seventeenth, is related to responsibility for the efficiency of his intricate equipment during flight, and does not require further comment. No other observations are indicated in this category.

4. *Flight engineers.*—The complexity of modern aircraft engines, and the increasing use of multi-engined aircraft, led to the establishment of a special flying category, that of flight engineer. These individuals became responsible for the efficient maintenance of the engines during flight, and were provided with their own complicated and imposing array of instruments, quite distinct from those confronting the pilot.

The comparative novelty and the absorbing interest of this work to mechanically-minded young men led to intense keenness to excel, and, as a class, flight engineers were remarkable for their enthusiasm and initiative. Many authentic stories are recorded of aircraft landing safely in spite of apparently insuperable difficulties largely due to the ingenuity and resourcefulness of this member of the crew.

The list of fear factors provided by flight engineers shows interesting and significant variations from the general list. Engine failure takes first place, as might be anticipated. Aircraft faults rises from twentieth place to third. This indicates the flight engineer's concern for the aircraft as a whole, in addition to his particular interest in the engines.

Aircraft fires originate from an engine more frequently than from any other source. Hence fear of fire rises from twelfth to sixth place. Searchlights drop

from third to tenth place. This is difficult to account for. Possibly the intense interest and absorption in their duties which were so characteristic of all flight engineers questioned resulted in a comparative indifference to external factors not directly affecting engine performance. This indifference was, of course, only partial, as shown by the importance attached to other external factors. The same reason may account for the lowered position of disfigurement, which falls from seventh to eleventh place.

5. *Air gunners.*—Perhaps the most noticeable characteristic of air gunners was their marked individuality, for which there are two main reasons.

In the first place, the age limit for air gunners was higher than that for other members of the crew. This led to older men holding these posts, and gunners between thirty and forty years of age were common, and even men of forty and over were by no means rarities.

In the second place, the air gunner's position and his duties in the aircraft tend to encourage individual responsibility. The rear gunner in particular, unable to see the other members of the crew, and dependent on inter-communication telephone for any contact with them, naturally tends to become self-reliant.

Long hours of solitary confinement, spent in a turret which permits a minimum of movement, develop detachment of outlook and a self-sufficiency not found to the same extent in other flying personnel. Some air gunners become introspective, and most tend to philosophical ruminations upon the meaning of life in general and the war in particular.

In the air the gunner's main duty is to ward off attack by hostile aircraft. Enemy fighters as a fear factor rises from ninth place on the general list to second on the air gunner's list.

Lack of confidence in other members of the crew rises from sixth to fourth place, probably because as a result of their position, many gunners are unable to see what the rest of the crew are doing.

Aircraft defects, which include faults in turret mechanism as well as in the guns themselves, rises from last place to fifth. This result might be expected when the gunner's duties are considered.

Airsickness rises from seventeenth place to sixth. There are several reasons for this. Aircraft movements are experienced most vividly at the extremities, therefore nose and tail gunners are more susceptible to airsickness than other members of the crew. The temperature inside these turrets is often lower than that inside the aircraft as a whole, and this may be an additional cause. Some difficulty in regulating the oxygen supply to the rear turret was experienced during the period of this investigation, and partial anoxaemia may have been a contributory cause. The cramped position necessitated by the size of the turret was another factor.

Frostbite rises from fifteenth to ninth place. This disability was relatively commoner in gunners than in other members of a crew, as a result of their more exposed positions.

Engine failure drops from fourth to tenth place. This is an indication of the air gunner's tendency to detachment and concentration on his own problems, already mentioned.

Fog drops from first to eleventh place. Enemy fighters are not likely to be encountered in foggy weather, and the gunner is not concerned with the problem of steering a course through fog.

Oxygen defects rises from sixteenth to twelfth place. Satisfactory oxygen supply to turrets, especially the rear turret, presents certain mechanical difficulties. These have now (1945) been largely removed, but at the time of this investigation (1943) there were definite indications that some gunners were not always getting an adequate supply of oxygen. This fact was well known among flying personnel, and in the case of gunners, led to greater concern on this score than was usual.

Fear of showing fear drops from fifth place to seventeenth. This can be explained by the fact that both front and rear gunners are almost or completely invisible to the remainder of the crew for the major part of the sortie, and certainly so during the most dangerous part.

Ice appears eighteenth on the list instead of eleventh. This factor, which affects so seriously the efficiency of the aircraft in flight, is more a problem for the pilot and flight engineer than for a gunner.

Section VI.—Predisposing and Modifying Factors.

Any investigation which attempts to measure or explain human emotions is inevitably influenced by such emotions. Results are modified by the individual mental characteristics of the investigator and his subjects to a degree that cannot be estimated with any accuracy. Clearly it is impossible to eliminate these variables entirely. Psychological studies, by their very nature, cannot be truly scientific in the fullest sense of the word, at any rate with our present knowledge. Psychology is not an exact science—some say it is not a science at all. Our standards of normality in the mental sphere are ill-defined, and there is no general agreement upon them.

Notwithstanding the rigid conditions which governed selection of personnel for this investigation, hereditary, personal and environmental influences could not be excluded, or even gauged with any pretence of accuracy.

The numerous factors, personal and general, in their daily lives which predispose to and accelerate psychological wear and tear in flying personnel have been, and are being studied by other workers. This paper is confined to normal men, in whom there was no discernible evidence of mental trouble, and no attempt is made to cover this vast field.

Reference will be made only to a few of the more important general factors which noticeably affected the men questioned.

Personal experience or observation of dramatic and dangerous flying adventures render an individual particularly susceptible to fear of similar experiences in future. We may say that his threshold for that danger is lowered, or that he has become conditioned to it. Thus a pilot who has escaped from a burning aircraft is particularly susceptible to fear of fire while flying; an air gunner whose turret has been hit by enemy bullets is particularly susceptible to fear of enemy fighters; a navigator who has watched two aircraft collide in the air is particularly susceptible to fear of collision. These and

comparable experiences were encountered frequently during the investigation, and were regarded as inevitable variables.

There are many factors which contribute to fatigue, and such fatigue is of great psychological importance among aircrews, both during flight and on the ground. In flight, such matters as aircraft noise, vibration, engine fumes, cold, unsuitable clothing, cramped positions, hunger, inadequate oxygen supply, and many others could be mentioned, but are considered to constitute a study of their own.

On the ground, predisposing factors may be either general or pre-operational, and there is considerable overlap between these two. General factors include such matters as sleep, exercise, food, working hours, leave, living conditions, squadron morale, personal, domestic, financial and social affairs, including expectation of promotion or decoration.

Essentially pre-operational factors include type of target and anticipated opposition, efficiency or otherwise of preparations for the sortie, and most important, adherence or otherwise to a strict time-table. In this connection the adverse effects of delayed or abandoned sorties were most marked.

All these, and many other factors, had an undoubted effect in every case, and offer a wide field for further investigation. They are mentioned only to illustrate the complexity of the problem of psychological trauma in aircrews, and cannot here be considered in detail.

Section VII.—Conclusions.

Fear is a natural emotion experienced by all aircrew personnel during operational flying. It is not usually attached, during flight, to any particular hazard, unless that hazard has been encountered in a severe form previously, appears imminent, or actually occurs.

Considerable introspective effort is required on the part of flying personnel to attach fear to particular dangers, and when this is done, marked variations in assessment of importance of causative factors appear. These variations would seem to depend upon actual flying duties, as well as upon individual idiosyncrasies.

The fear factors considered here relate to a particular set of environmental conditions only, that is, night bombing of enemy-held targets in Europe by heavy bombers based in England. More recent work in the Far East suggests that a markedly different selection of factors occurred there.

The numerous personal and environmental factors which inevitably modify all psychological reactions are impossible, at present, of precise assessment.

There is great scope for investigation in this and related fields of aviation medicine. Such work should be carried out ideally by medical officers who harbour the twin interests of psychology and practical flying. Only in this way can the advantages of trained introspection be utilized to the full.

THE "CREATIVE SPELL" OF SCHIZOPHRENICS AFTER LEUCOTOMY.

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I.

THE artistic activities of schizophrenics are said to be dependent upon the quality of their thought disorder. The thinking regresses from the conceptual, to a perceptual or visualistic level; symbols do not stand for a meaning, but become identical with the meaning itself. The logic alters from the deductive, to the affective type. These disturbances express themselves in magic thinking, which in its turn gives impetus to magic actions resulting in the artistic products of the schizophrenics. It seems that the creative spell coincides with the thought disturbances just described, and that the artistic products are, as Kris (1946) pointed out, pure magic.

The formal elements of the schizophrenic paintings have been recognized by a tendency to fill in the space, by their over elaboration and stereotypy; in reproducing parts split from wholes, at the same time in pictorial condensations in reproduction; in prevalence of the symbolic elements, in production of obscene pictures and in loss of form and colour sense.

The schizophrenic personality is changed after the operation of prefrontal leucotomy by the production of a circumscribed brain lesion. These personality changes are reflected in the artistic activity of the patients and an attempt is made in this paper to evaluate the changes in connection with the artistic products. The report below is confined to a detailed description of two particular cases.

II.

Prior to a description of the cases the nature of the brain injury should be discussed. A "low orbital" prefrontal leucotomy was performed on both cases (Dax and Radley Smith, 1946). This cut lies in the frontal lobe, at a level of Brodman areas 24 and 32 on the medial—8, 9, 46, 45, 47 on the convex—11, 12 on the basal surfaces of the hemisphere. It severs the thalamo-cortical radiation to areas 10, 11, 12, partly to 13, and partly the uncinate fasciculus. According to Dax and Radley Smith, this operative approach interferes with the integrative functions of the "emotional cortex." The present writer (Reitman, 1946) emphasized that the operation gives rise to a triad of symptoms, characterized by euphoria, extraversion and over activity. These postoperative clinical symptoms show clear cut differences from the symptoms produced by leucotomy at other levels.

The artistic products of patients with brain injury of various localization exhibit a certain orderliness, a tendency to avoid empty spaces, and perseveration, whilst there is a disordered colour choice present. Schilder (1934) described changes of configuration in the artistic products of patients suffering from organic brain diseases. He found that there is a tendency to curves instead of angles, that the figures may be contracted or expanded and elongated, and that adjoining configurations may be completely separated from each other. It will be seen that these disturbed figure-background relations feature significantly in the material analysed below.

III.

CASE 1.—A female patient, aged 19½, a hairdresser, was admitted in 1945 suffering from hebephrenia. She had had no illness before her present breakdown, which commenced 4 months before her admission. She became dreamy, felt always tired, was inattentive, could not concentrate, was inaccessible to psychological treatment. Later she developed persecutory ideas, and some childish ideas of reference.

The patient came of a fairly good stock and her premorbid personality was adequate. The family history was less satisfactory; the father was temperamental and deserted the mother. Patient had one brother and they were devoted to each other, and from her brother's utterances, incestuous relationship was suspected. Her school years were uneventful; she was never brilliant, but after leaving school she took up hairdressing, which she enjoyed and did successfully.

On examination, she was dissociated, dreamy and vacant; she giggled in a childish manner, grimaced a lot and exhibited bizarrisms and ambivalent attitudes. She had frequent short attacks of screaming. She received insulin treatment (42 comas), followed after an interval by a course of 15 electrical convulsions, without improvement; in fact her mental condition deteriorated. She became more vacant, had marked emotional blunting and intellectual dulling. In view of her progressive deterioration, 6 months after her admission, a leucotomy was performed of the type already described. She had an uneventful convalescence and 10 days after operation the clinical triad, so typical for this type of operative approach became apparent. She improved progressively and 5 months after the operation she was discharged, making a full social readjustment; 7 months after her discharge, she maintained her recovery.

Before the operation she was several times asked to draw, but she constantly refused, until after much persuasion she drew a man and a house, in a conventional childish manner. She could not use a brush and paint. 6 days after the operation she consented to attempt a " painting," which she completed the same day. (Fig. 1.) Whilst it shows many of the typical characters of the schizophrenic painting, its interest lies in the fact that the emphasis is more in the background than in the foreground. In the background four phallic symbols are depicted and some of these background paintings amount to obscenity. They are, however, merely " doodles " with the brush and give a colourful background rather than " parts split from the whole." The patient's immediate comment on this picture, as well as on the following ones was: " That's how I feel." Ten days following the operation she completed her second picture. (Fig. 2.) The change in this is apparent. The emphasis is no longer in the background, but is shifting towards the foreground. Though the outlines of the legs are half lost in the background, they can clearly be distinguished, and the frightened figure in the foreground dominates the painting. Her third painting was completed three days after the second one and it took her two days to do it. She seemed to lose interest in painting, but was over active in many other ways in the ward and in the occupational department. The top end of the painting now carries her initials as well as her Christian name; it does not represent anything but decorative elements. The foreground is dominated by two heads of the ' Wot! No. . . . ' variety, as seen in the well-known cartoon. The two well-arranged heads are not overpainted and gaze through the picture, almost as a piece of sanity entering into her

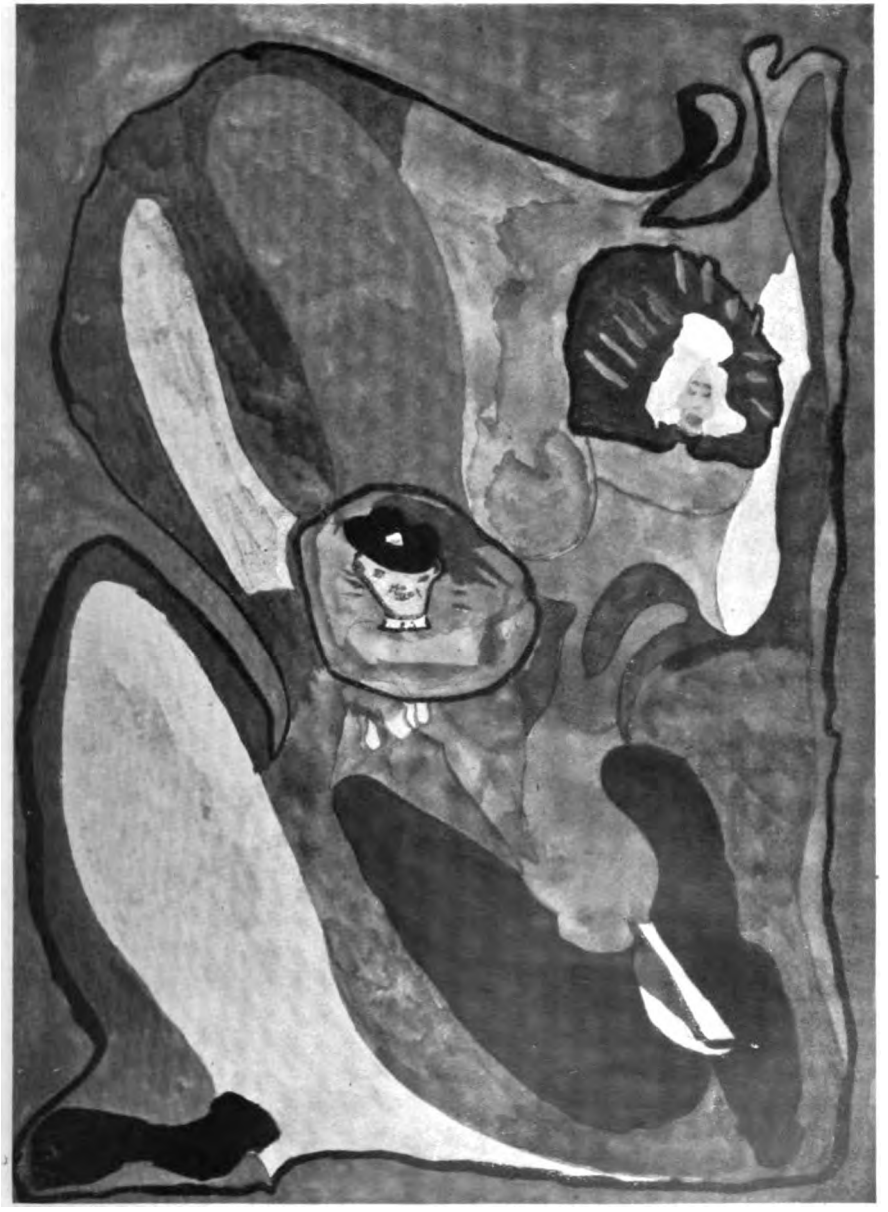

FIG. 1.

FIG. 2.

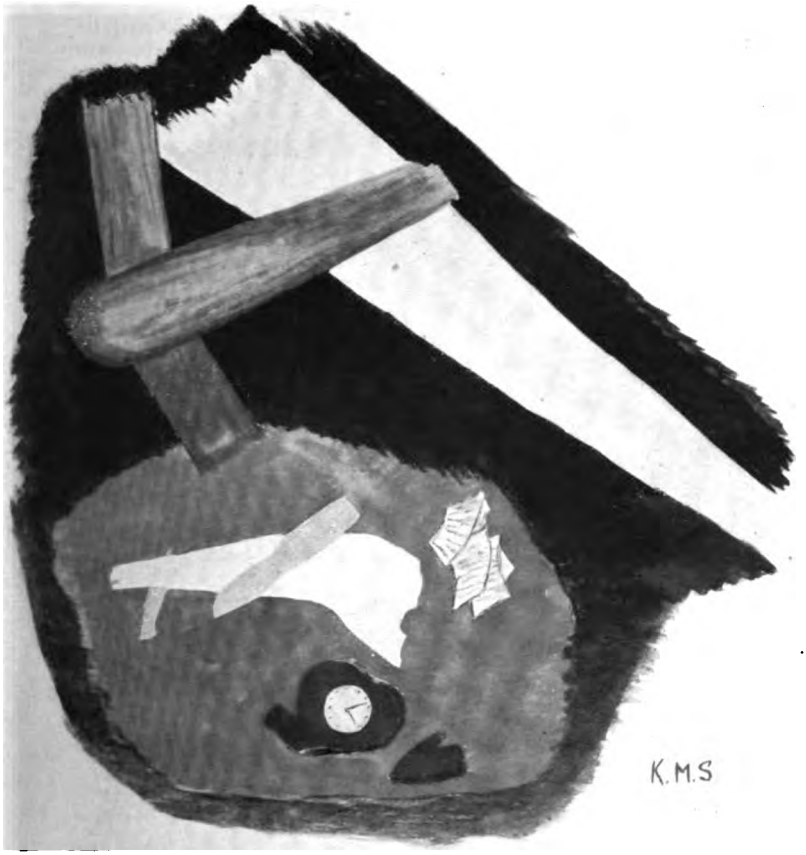

FIG. 3.

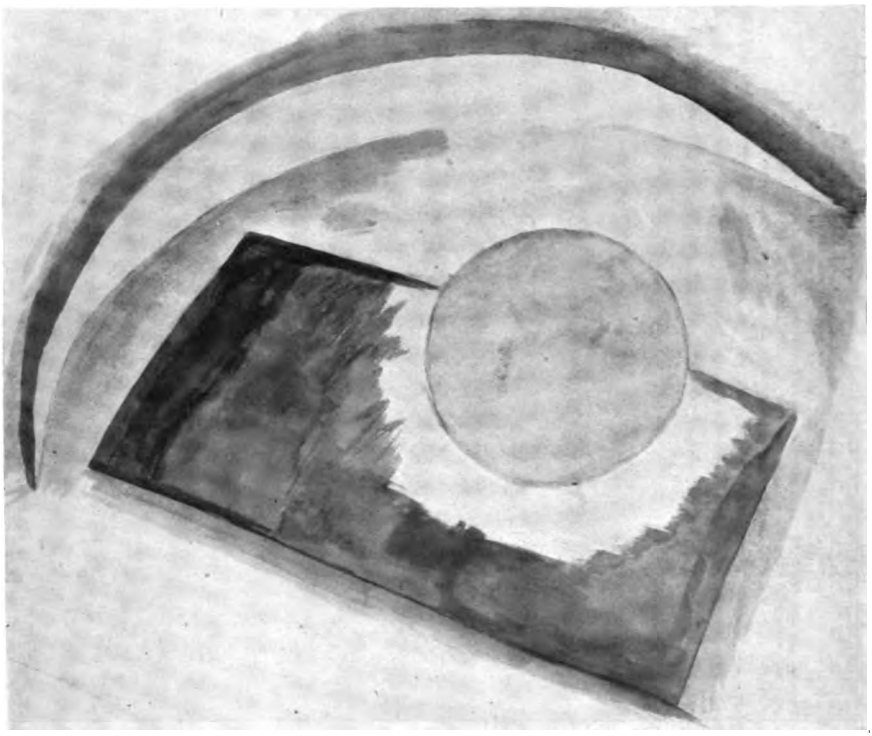

FIG. 4.

creative spell. Indeed, this was her last artistic product. After much persuasion she tried to copy a koala bear, then she painted a girl's head with yellow hair, without background and in a childish fashion. She refused to do any more and has never painted since. Six weeks later her three paintings were put before her; she could not believe she had painted them and had no idea what they meant, but pointed smilingly to the two heads in picture three, drawing attention to the 'Wot! No . . . ' cartoon ideas. It seemed that the only contact she could take up with her creations was the "sane" link. Later on she underwent sodium amytal hypnoanalysis, when again she was questioned regarding her painting. She accepted rather submissively that the drawings were her own but in No. 3 picture she remained indifferent regarding her two head figures. No. 2 picture she explained in a drowsy way as "an inferiority complex." "This one," she said, "is squashed beneath those huge feet. There is nothing really to be afraid of; it is just an inferiority complex." The No. 1 picture was presented last. She remained silent for a long time and her responses were inadequate. Then she started to talk about her brother, but stopped abruptly. After much encouragement she suddenly "recognized" the background paintings as phallic symbols: she became resistant to further hypno-analysis; she suddenly admitted mutual masturbation whence her knowledge of the background paintings originated, but denied that this was done with her brother. She remained resistive and hypnoanalysis did not elicit further data. Afterwards, however, it seemed that the procedure caused a slight setback, but in a few days she proceeded with her improvement. In view of the disturbing influence of the hypnoanalysis, it was not repeated and direct discussions did not yield further information and she denied recognizing anything in No. 1 and No. 2 pictures. In other words, in her undisturbed conscious state all emotional contact with her depicted subconscious experiences was lost.

It is a controversial question whether one should have gone on with psychological exploration in this case. We felt that to explore her deep psychological structure would have been coupled with emotional upsets, endangering her progressive recovery. Two conclusions, however, can be made in view of the available material. Firstly, that the operation activated a creative spell of a typical schizophrenic art. Secondly, that this creative spell represented an abreaction and its psychopathological factors had a deep significance for the patient. Thus, it was a complementary and a spontaneous re-adjusting factor, with diagnostic significance. The acute "perceptual" spell and its abreaction was followed by conceptual thinking and emotional re-adjustment.

CASE 2.—A female music teacher, aged 27, admitted in 1946, suffering from schizophrenia. During the year prior to her admission she gradually became alienated from her whole environment, suffered from depersonalization, was vague and vacant. She made a suicidal attempt, though she neither felt suicidal nor was depressed. Her illness progressed, she became autistically inclined and completely inaccessible to psychotherapy. She giggled and cried without reason. She was admitted to an Emergency Hospital where the diagnosis of schizophrenia was made, and she was given insulin shock treatment. She developed reactions of the spontaneous hyperinsulinism type, and after 13 comas her treatment had to be terminated. She commenced E.C.T., had 8 shocks, did not respond well and in spite of risks it was thought best for her to recommence insulin treatment and she had 25 further comas. She developed a state described as depressed, sullen and taciturn and she made a vague suicidal attempt. As the patient seemed refractory to treatment, she was advised to come to Netherne with a view to having a leucotomy operation. When admitted, she seemed detached, dreamy, showed schizophrenic thought disorders, smiled vacantly, alternating this with a tearful condition.

Her pre-psychotic personality was a good one, her I.Q. bordered on 150. There was no mental illness in her family but her father is a chronic neurotic and there

has been a marked antagonism between him and the patient since her earliest childhood. She took her matriculation and started to study music and later to combine her musical work with teaching. She was always shy; a devout Anglo-Catholic; she had no sex experiences, though she was once in love but " nothing came of it."

After 21 days' observation, orbital leucotomy was performed. She had an uneventful convalescence and 9 days after operation she displayed the favourable reactions of the cases who respond well. At the time of writing, her personality readjustment is getting more and more complete and she is busy arranging her own future. She plays for hours on the piano and anybody who wants to listen to her " is welcome."

Prior to the operation, she was asked whether she would play the piano. In a tearful way she refused it, being as she said unable even to touch the keys, and that in any case she could not play before an audience. She was unable to give an explanation as to why. It was suggested to her to try and express her feelings in drawings; the idea fascinated her, and resulted in five pictures, of which two are reproduced. Fig. 3, as it was ascertained post-operatively, features fly-bombs, searchlights, a shelter with a grand piano, a broken clock and shattered musical notes. (In her first post-operative night she was confused, talking of fly-bombs, of a near miss, calling someone's attention to the broken clock, etc. Later she admitted her fears of being hit by the fly-bomb, but denied actual experience of a " near miss.") There is no need for deeper interpretation of such drawings. They represent fairly typical schizophrenic products, as so often discussed in the extensive literature on this subject.

The picture (Fig. 4) was done 4 days after the operation. The colour sense in it is better than in her former painting, but its formal elements are more " deteriorated," and its presentation is near to a diagrammatical, over-simplified picture. Eight days after the operation she painted a picture of a girl in a pleasant flowery surrounding, looking up to heaven, from where music was coming to her. The whole presentation was childish and unartistic. She herself said that it had not satisfied her and that she would rather try to express her feelings in composition (Except when studying, she never did any musical compositions.) This she did and her musical products will be discussed below. Before doing so, however, one more remark should be made regarding her drawings, which were discussed with her 14 days after the operation: her remark on Fig. 3 was, " It's pathetic "; and on Fig. 4, which she refused to believe was hers, " It's a mess." Since she began her music again she has not attempted any more drawings.

She produced five musical pieces, one of them is reproduced here. (Fig. 5.) Of the four not reproduced, two were very artificial, without any meaning for the patient, and the other was merely a musical joke.

The main character of her musical works lies in its conventional patterns. Whereas her drawings were deteriorated so far as their formal elements are concerned, in music she did not deteriorate into " modernisms." The tempo, however, in her first composition is alien. The second composition shows improved key sense, and the harmony of the composition is better than that of the first one; it is scholarly and well composed. Thus, though she showed a progressive improvement in the formal elements, artistically her work deteriorated in the third, fourth and fifth compositions. The reproduced composition had a great emotional meaning for her throughout her stay at the hospital, the others she discarded as dishonest and without much meaning. As far as their content is concerned, the euphoria and harmonical extraversion are the main characteristics. It is significant that with her progressive recovery and personality re-adjustment, she gave up composition and returned to her original interest: interpreting music, i.e., piano playing.

Although music reflects just as well as drawings do on the psychotic symptomatology (formally: the flight of melodies in mania; perseveration of

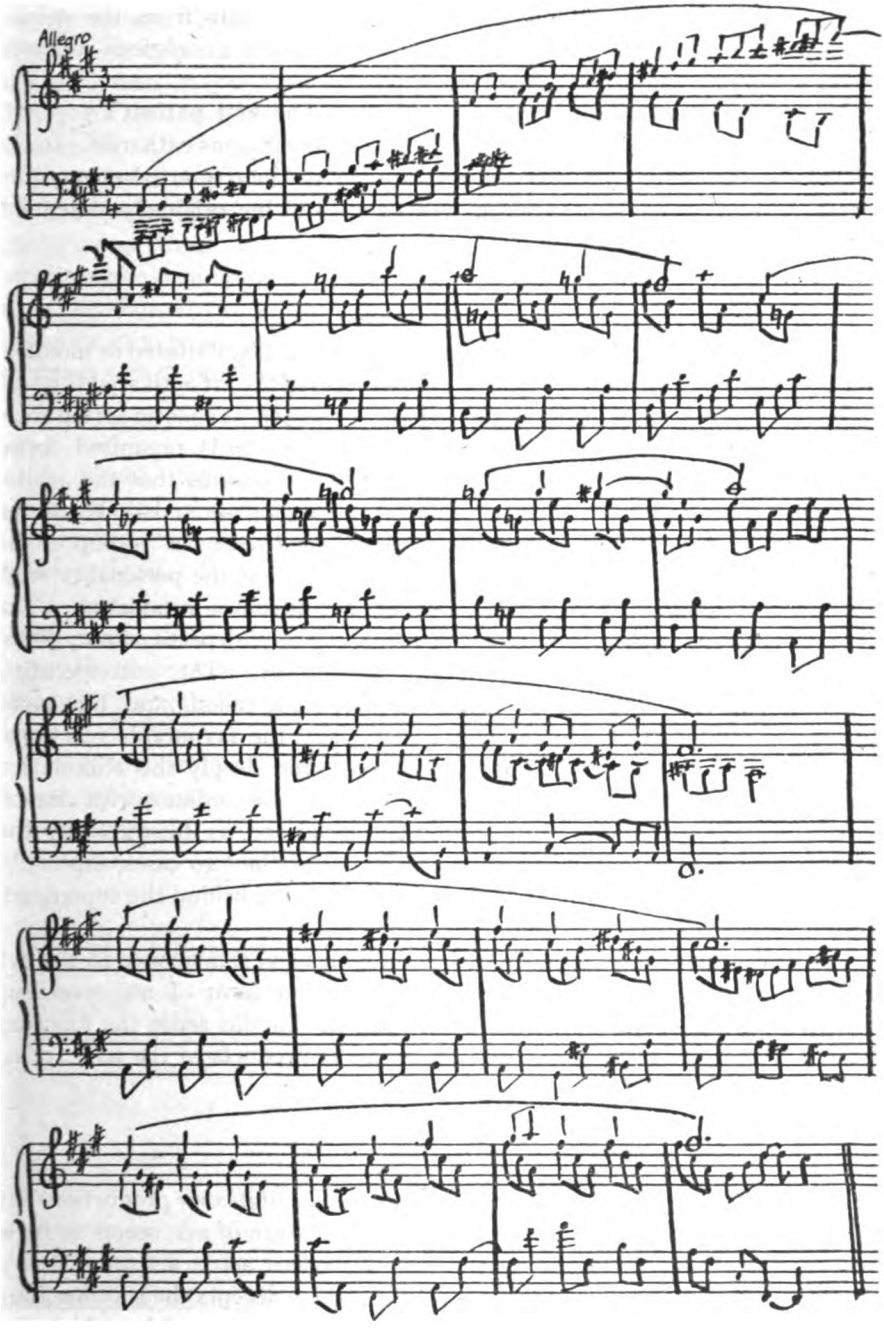

FIG. 5.

notes, flatness of melody in schizophrenia, etc.) the reproduced compositions are free of those characteristics, and they already reflect on the post-operative mentality of the patient. This music can hardly be interpreted on a neurological level, though its euphoria and extraversion may result from the orbital leucotomy. From a teleological viewpoint it represents a conscious cathartic phenomenon of a fleeting nature.

In this lies its dissimilarity to Case No. 1. The first patient's products remained on subconscious level and gave her a non-conscious catharsis. In the present case the leucotomy did not activate her productive art, but modified it only, and her modified musical art was a conscious but original and genuine self-expression.

IV.

The common factor in these cases is the creative spell activitated or modified by the operative brain injury.—The typical features of the art activated through the operation were firstly its disorganised form-sense, and its chaotic appearance. Secondly, this art showed a rapid development towards organized form-tendencies, towards normal symbols and patterns. It seems that the orbital leucotomy gave stimulus to the personality, developing its artistic reactions. As these two patients were recruited from the "good response" group of the orbital leucotomy case material, they also illustrate that the personality with this type of operation does not deteriorate, but becomes stimulated. The present author has emphasized that the vague, dreamy, depersonalized, dissociated types react favourably to orbital leucotomy. The post-operative clinical triad, the euphoria, overactivity and extraversion, and the rapid personality reintegration denotes only superficially the favourable reactions. The two cases just presented illustrate, however, how deeply this stimulative effect of orbital leucotomy affects the personality. In accordance with clinical observation, the personality reintegration is a rapid one, as illustrated by the quick development of normal form-tendencies. But the two cases, especially Case 1, also gave an indication of the emotional tension behind the superficial, dreamy, dulled clinical appearance.

The emotional tension indicated offers an additional significance to the art products of these two patients. They subserved a form of non-conscious abreaction, giving a relief for the hidden tension. In this sense the function of these artistic products closely accords with the products of the true artist, hence they may be called genuine art products.

V.

The aesthetical question as to whether the spontaneous productions of psychotics do represent art, or are merely of the nature of art, seems to be a question already answered. The tendency of modern art is a turning away from reality, and this culminates in surrealism, which accepts the subconscious as the only reality. The surrealist artist does not try to transform his subconscious experiences into accepted symbols; this would be an analytical approach. The surrealists depict their subconscious as they state it is

experienced. Their failure is obvious from the facts just stated: the subconscious is not the only reality, and its artistic representation must necessarily be in recognizable symbols, because such are the true experiences of creative artists. But it is now agreed that the subconscious (and what it involves) is a free subject for artistic representation and if it is represented in an artistic way, it is justified. Most of the surrealistic products, however, are lacking in spontaneity, are artificial and do not reflect on true mental experiences.

The similarity between the presented drawings and surrealistic art products does not need elaboration. It seems that whereas the products of known great artists reflect their subconscious mechanisms, in psychotic artists the subconscious speaks directly, and its unusualness may not bar it from being called art. Yet none of the attempted explanations give an answer regarding the capability of patients to produce art; they only endeavour to draw attention to factors giving impulse to artistic activities.

Summary.

(1) Artistic products of two schizophrenic patients, who underwent leucotomy are analysed.

(2) In Case 1 the leucotomy induced a "creative spell" which subserved catharsis.

(3) In Case 2 the leucotomy modified and reorganized the patient's creative spell.

(4) The importance of creative activity after leucotomy is stressed, and the aesthetical value of the art products is discussed.

I wish to express my thanks to Dr. E. Cunningham Dax for his kind help and suggestions, and to the Editor of this Journal for enabling the paintings to be reproduced.

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THE DEPERSONALIZATION SYNDROME.*

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DEPERSONALIZATION, or feeling of unreality, is a symptom which may occur as part of several psychiatric conditions, such as hysteria, anxiety and obsessional states, and some forms of schizophrenia and endogenous depression. The true derealization-depersonalization syndrome, however, in which the unreality symptom is the primary disturbance, is a quite peculiar and distinctive condition, which has received scant attention in most psychiatric textbooks and which appears to be becoming increasingly common in practice.

The first accurate descriptions of the condition were given by Mayer-Gross and Mapother, and by Guttmann and Maclay in their paper in the *Journal of Neurology and Psychopathology* (1936), in which the authors described the effects of mescaline sulphate on a series of depersonalization patients and their therapeutic response to the drug. The syndrome may be defined as a form of affective disorder in which feelings of unreality and changed personality are the most prominent symptoms.

The usual age-incidence of the condition is the 20 to 30 age-group, although one form may sometimes occur in the later years of life. The onset may be acute, following a severe emotional shock, as seen in some wartime cases, or gradual and insidious following prolonged stress or as an endogenous depressive state. It commonly occurs in personalities of the sensitive, intelligent, and affectionate type, and is much more common in the introverted imaginative than in the extraverted personality. It is never found in dull and backward individuals, and is also unusual in the inadequate schizoid personality type.

The depersonalization syndrome is characterized by five cardinal symptoms —namely, reality disturbance, affective disorder, thought disturbance, cephalic paraesthesia, and absence of projection features. To these a sixth might be added, that is, a high degree of responsiveness to anoxic therapy.

The unreality feelings, as pointed out by Mapother, are of two kinds: Depersonalization, or feeling of changed personality, and derealization, or feeling of unreality of the outside world.

The depersonalization symptom is commonly described by the patient as a feeling that his body has become changed in some peculiar way, and seems to be no longer his own, or feels as if dead. Other patients say that they feel as if turned into wood, rubber, or other such inert substance. He may also complain that his personality itself is altered, and that he feels changed into a different person, or as if he were two or more different people. He may

* Read at the meeting of the Northern and Midland Division of the Royal Medico-Psychological Association on October 10, 1946, at Winson Green Hospital, Birmingham 18.

state that his thoughts are strange, and of a sensation of being detached from his body, as if floating in the air; his thoughts and acts seem to him to be carried on mechanically as if he were a mere machine or automaton.

The derealization symptom is usually described as a feeling that the outside world has become mysteriously changed, so that people and objects appear to the patient to be unreal, far away, lacking in normal colour and vividness, or even actually distorted in shape. Patients often say that they feel as if they were going about in a trance or dream, or as if there was a sort of veil interposed between them and the outer world. Some patients complain chiefly of derealization, while in others the feeling of loss of personality is the principal symptom; more commonly, however, the syndrome is a combination of both derealization and depersonalization phenomena.

The affective disturbance is distinctive and rather characteristic. It is usually a quiet, depressed, apathetic state accompanied by a marked degree of perplexity and bewilderment, due to the strangeness of the unreality feelings. It is not the dull, confused, restless condition seen in katatonic and confusional patients, nor does it resemble the profoundly depressed, retarded state of the acute depressive. It differs equally from the tense and anxious misery of the anxiety neurotic, and the fearful, apprehensive state seen in the agitated depressed patient. A common complaint in derealization patients is the feeling of emotional poverty, with inability to experience the normal gradations of emotional feeling; they are no longer able to enjoy food and other normally pleasant sensations, and experiences normally charged with emotional reaction no longer evoke any normal affective feeling or response.

Of sensory features, cephalic paraesthesia is a constant and distressing symptom. It is commonly described by the patient as a peculiar and unpleasant sensation referred to the head; common terms used to describe it are "numbness," "emptiness in the head," or feeling "as if the brain was dead, or had stopped working," and it is always accompanied by great difficulty in concentrating and thinking clearly.

The thought disorder is one of slowness and difficulty in thinking, which differs from true retardation in being subjective rather than apparent to the examiner. Patients usually describe it by such expressions as "my mind feels a blank," or "my thoughts will not come." Characteristic is a marked impairment of the power of mental imagery; the patient complains that his ideas do not come to him readily and his mental imagery, both visual and auditory, lacks its normal vividness, so that he is unable to conjure up mental pictures of familiar faces, scenes, and voices in the normal way.

Projection features, such as hallucinosis, delusions, and ideas of passivity and reference, are never seen in the true derealization syndrome. Clouding of consciousness and disorder of abstract thinking are likewise absent, and memory, insight, and judgment are not impaired. Although patients sometimes find difficulty in describing the peculiar sensations of unreality in words, there is no language disorder of the schizophrenic type.

On the motor side, there is generally some degree of underactivity and lack of spontaneity, but katatonic motor symptoms and true psycho-motor retardation are absent.

Other symptoms include insomnia, which is not, as a rule, severe, loss of appetite, and some deterioration of physical health in the severer cases. Anxiety symptoms, functional pains, and agitated states are not common in derealization patients, although they sometimes occur as symptoms secondary to the distressing unreality feelings. Fears of insanity, again due to the strange and terrifying derealization feelings, are not uncommonly found.

The derealization state is a condition which causes great suffering and incapacity, and in all but the mildest cases the patient is usually completely unable to work, on account of the difficulty in thinking and distressing mental and bodily sensations. In the severest cases the appearance of perplexity and bewilderment in combination with the marked depression and lack of volition may give the impression at first of a confused, almost stuporose condition, which, however, is in marked contrast to the degree of insight and rapport revealed on closer examination.

Suicidal tendencies are not as a rule common in derealization patients, but they may occur sometimes in the severer forms of the condition.

A rather different form of the syndrome is sometimes seen in patients in the involutional period of life. In this form, the unreality feelings are not nearly so marked, and are associated with a variety of bizarre somatic paraesthesias and hypochondriacal complaints, the thought disturbance being absent and the emotional reaction one of querulous anxiety. This type has, on the whole, a worse prognosis and is much less responsive to electroanoxia than the form just described.

The course of the untreated derealization-depersonalization syndrome is apt to be prolonged, usually of several months to a year or more. The ultimate prognosis, however, is generally good, as it tends to clear up completely in time, recurrence being uncommon, while personality deterioration of the schizophrenic type is never found.

As regards its nature and pathology, the derealization reaction may be regarded from the psychopathological point of view as a form of withdrawal from reality and a means of escape from an intolerable situation in a sensitive and intelligent personality. The unreality sensations would appear to be the expression of a subconscious renunciation by such a personality of the outer world and its realities which have become unbearable. It would seem that this does not involve such a radical personality upheaval as the typical schizophrenic reaction or such a profound degree of dissociation as in the latter condition.

From the organicist point of view the syndrome belongs to the dysoxic group of metabolic brain disorders, since it exhibits typically the dysoxic features of depression, slowing of cerebration, unpleasant mental and bodily sensations, and marked responsiveness to anoxic therapy with non-response to hypoglycaemia. It may be considered as a special form of dysoxic reaction in which the thalamic centres and their cortical connections are chiefly involved, particularly those systems which subserve the functions of conscious awareness and interpretation of somatic sensations and relation of the self to the external world. The higher association systems, acoustico-psychic and visuo-psychic areas, and frontal lobe motor systems are spared; hence the absence of features

such as disorder of association, aural and visual hallucinosis, and katatonic disturbances. The absence of mental deterioration would appear to indicate that the dysoxic process is of the reversible or benign type, as in the case of the depressive states.

Physiologically, the unreality state may occur in certain conditions of acute emotional crisis—for instance, acute grief reactions and ecstatic religious experiences in mystics and suggestible subjects. These conditions may be due to a temporary and reversible upset of the cerebral oxidation processes. Derealization feelings may also be found in states of severe physical exhaustion, due to overwork or physical stress, as in soldiers under battle conditions. A more severe form sometimes occurs as part of a post-infective exhaustion state.

Of specific toxins which produce a derealization syndrome, the best known are the dibenzopyran or cannabis drugs, and the phenylethylamine or mescaline compounds, of which the last-named was employed by Guttmann and Maclay in their experiments on the therapy of derealization states.

In dosage of 0·1 to 0·2 gm. mescaline produces in the normal human subject a condition strikingly similar clinically to the derealization-depersonalization-syndrome. The symptoms include feelings of unreality as already described, slowness and difficulty in thinking with alterations in mental imagery, and peculiar sensations in the head. The affective reaction may be one of apathy and mild depression, but is more often one of euphoria, the only respect in which the intoxication differs from the endogenous syndrome. With this dosage, clouding of consciousness, hallucinosis, and other gross symptoms are not found, so that the condition induced is clinically almost identical with the derealization state seen in psychiatric patients.

It has been found by Quastel and others that the drug has a specific depressant effect on the oxidation mechanism of the brain cells, and this and the characteristic response of the endogenous unreality state to anoxic therapy would suggest that the physiological mechanism in this condition is similar to that of mescaline intoxication, that is to say, a disorder of the cellular oxidation processes. This, of course, does not necessarily mean that the endogenous syndrome is caused by the action of a toxic amine on the brain-cells; there is no clinical evidence to suggest that such toxins are present in the blood of derealization cases. It would rather appear that the pathological basis of the derealization syndrome is a metabolic upset of the cerebral oxidation processes occurring as a response to psychological or other stress in a constitutionally predisposed personality.

The differential diagnosis of the derealization-depersonalization state rests upon the characteristic association of symptoms already described, namely, unreality feelings, cephalic paraesthesia, affective disorder, thought disturbance, and favourable response to anoxia, with absence of hallucinosis and delusions, and good insight.

The commonest condition for which the syndrome is mistaken is the dysoxic form of schizophrenia. The distinguishing features of the true derealization state are the absence of the projection symptoms, disorder of language and thinking, and mental deterioration, with the presence of good rapport and insight. An important point is that the affective reaction of the derealization

syndrome is always appropriate, and shallowness, fatuity and incongruity of thought are never found.

It is distinguished from the acute depressive states by the absence of true psychomotor retardation, guilt ideas and delusions of unworthiness. As already pointed out, the typical depersonalization syndrome is not common in the involutional period.

In psychoneurotic conditions, feelings of unreality may sometimes occur, but they are, as a rule, not nearly so prominent as the other symptoms, and the characteristic combination of the five principal derealization features is not found in these conditions. Obsessional thoughts and actions or hysterical sensory and motor phenomena are, again, not symptoms characteristic of the depersonalization syndrome.

The severer depersonalization states on superficial examination often strongly suggest an acute confusional or stuporose katatonic state. In the former condition, however, clouding of consciousness and memory disorder are absent, as are also the other features commonly associated with confusional states, namely, hallucinosis, impaired comprehension, and habit disorders. Katatonic conditions may be distinguished by the presence of such features as motor rigidity, impulsiveness, negativism, and hallucinosis.

Of organic conditions, the only common one which might be mistaken for a severe derealization state is the Parkinsonian syndrome. In the more severe depersonalization reactions the apparent apathy, volitional poverty, lack of spontaneity, and facial expression may produce a clinical picture strongly resembling the post-encephalitic state. Careful neurological examination and the absence of true derealization symptoms in the last-named condition, however, should readily settle the diagnosis.

The response to drugs in the depersonalization syndrome is very characteristic. It is one of the most difficult of psychiatric conditions to influence with drugs of any type. Sedation and continuous narcosis are largely ineffective in alleviating the symptoms, while sympathetic stimulants of the benzedrine class either have no effect or render the patient tense and agitated without relieving either the depression or the unreality feelings. Powerful euphoriants, such as mescaline and cannabis, are likewise either without effect or actually intensify the symptoms. In Guttmann and Maclay's series of cases it was found that in the great majority of cases tested with the drug (mescaline), the feelings of depersonalization and depression were made worse. In a small number of patients, whose symptoms were mainly those of derealization rather than depersonalization, some improvement both in the power of visual imagery and the derealization feelings was apparent. On the whole, it would appear that drugs of this type have little or no practical applications in the treatment of this disorder.

Hypoglycaemic therapy is, on the whole, also ineffective in the derealization syndrome, as it is in the great majority of dysoxic states.

The treatment of choice in the depersonalization syndrome is electroanoxia. A course of six to seven applications administered twice weekly is often sufficient to effect a complete remission in the milder forms of the disorder. In severe cases, however, a total of ten to twelve treatments may be required.

Relapse, although by no means unknown, is much less frequent than with the katatonic and pure depressive states.

The secondary symptoms, such as sleeplessness and loss of appetite, may be relieved by the usual symptomatic measures, such as barbiturates in full doses at night and bitter tonics to promote appetite. Usually, however, these symptoms clear up rapidly on inception of anoxic therapy. Psychotherapeutic methods alone are of little avail in the active phase of the disease, but may be of value in the recovery stage when remission of the acute features has been effected by means of electroanoxia.

Residual symptoms usually include a slight degree of loss of concentration and impaired memory, mild spells of depression, and persistence in a very attenuated form of the unreality feelings. These may be treated by appropriate occupational and psychotherapy, and usually tend to resolve spontaneously in the course of a few weeks. In tense and anxious patients mild sedation, such as bromide in doses of 20 grains *t.d.s.*, or luminal, ½ grain *t.d.s.*, is often of help; while for those in whom lack of energy and mild depression are the principal residua, benzedrine 10 mgm. twice daily usually gives relief.

Summary.

1. The derealization-depersonalization syndrome and its clinical features are described.

2. Its relation to the dysoxic brain disorders and the mescaline encephalopathy is indicated.

3. The course, pathology, and treatment of the conditions are described.

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THE NATURE AND TREATMENT OF "WRITER'S CRAMP."

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WRITER'S cramp, *crampe des écrivains*, scrivener's palsy, graphospasm or mogigraphia may be defined as a condition of inco-ordination of the small muscles of the hand which appears only when attempting to write. The various names given to this condition emphasize that cramp or spasm is the predominant feature, and Osler thought that it was an early symptom. As the principal nerves and muscles are often intact and movements of a wider range can be carried out efficiently, the condition appears to be a functional disturbance of co-ordination.

Writer's cramp, was known in the days of quill pens, having been first described about 113 years ago by Sir Charles Bell, and an account of scrivener's palsy was published by Benedikt.

Among the ætiological factors, overwork and excessive use of the hand for writing has been stressed by more than one neurologist Janet (1903) however included the condition among the symptoms of "psychasthenia," of which he considered it to be a variety. Osler thought that it was due to a physiological disturbance of a localized area of the brain responsible for the movements involved in writing, and a somewhat similar view was held by Collier (1914), who stated that it was due either to a breakdown or to a disordered action of a part of the central nervous system, situated probably in the optic thalamus. He (1933) was emphatic that neurosis did not enter into the picture; that it was commoner in young people during training, and that the highly skilled workers were also liable to develop it under conditions of general ill-health, after excessive hours of work or on recommencing work at full pressure after ceasing work for a long period. According to him, personal idiosyncrasy, probably on account of some inherent weakness in the nervous mechanism, was more important than long years of occupation. Strümpell (1931) pointed out that this condition was often associated with a nervous constitution, and that neurasthenic symptoms were often present in persons suffering from writer's cramp. Pritchard (1937) says a "state of cramp" or disabling spasm is the primary condition, and that anxiety symptoms, if present, are secondary to the motor disability. Culpin (1931) was the first person in this country to point out that almost all the subjects of writer's cramp are suffering from psychoneurosis, and that it is common in persons suffering from nervous symptoms whose occupation does not involve much writing. Culpin, Farmer and Smith, who carried out an investigation on behalf of the Industrial Research Board (1927), came to the conclusion "that the commonest picture of a cramp subject was

the combination of severe psychoneurotic symptoms and poor muscular efficiency." Their research also demonstrated that cramp bears the same relation to other symptoms in the same patient as do such recognized psychoneurotic manifestations as stammer, tremors, and functional paralysis.

Clinical Material.

This paper is based on a study of 1,880 patients suffering from neuro-psychiatric symptoms admitted to my wards during the period 1941 to 1946. Prior to coming to us, some had been under treatment in general hospitals, but all had been examined by one or more senior psychiatrists, who had referred them for further investigations and treatment. These patients represented a fair cross-section of the general population, and before joining the Forces they came from various skilled, semi-skilled, and unskilled occupations, as well as from nearly all the learned professions; there were company directors, practising solicitors, school teachers, journalists, novelists, a bank manager, a bibliographer, a trainer of wild animals, and an " approved " candidate for Parliament ! It was the routine practice of Mill Hill Emergency Hospital to ask each patient on arrival and before he was seen by a physician to answer in his own handwriting a simple questionnaire about his family, his personal history, his work record and his main symptoms. This practice was continued in the case of patients who were under my care in other hospitals. As these sheets were collected before the patients were interviewed, they had no reason to suspect that their handwriting *per se* was being studied. A scrutiny of these papers revealed that 171 patients had some disturbance of co-ordination, resulting in temporary changes in handwriting. The bibliographer, who had only a few days' service, and who claimed that before being conscripted he used to write for several hours daily, showed no changes in his handwriting at all.

The ages of these 171 patients ranged from 18 to 42, the average being 24·7, which is slightly higher than the average age of the 153 patients collected by Gowers, who found 52 in the age-group 10–20, and 50 in the group 20–30. Only 6 of our patients were clerks, whose duties involved much writing, while the remaining 165, or 97 per cent., were non-clerical workers whose occupations did not involve much writing. These persons could be considered in three groups: (1) Those suffering from acute anxiety, and whose " cramp," though bad enough to prevent them from writing much, was discovered accidentally as mentioned above. Many of them were too ill to write anything, and were not even aware of the temporary changes in their handwriting. A few had refrained from writing letters to their relatives, ostensibly for such reasons as that they could not concentrate or had headaches, or that their hands shook while writing. The majority of our patients were in this group. (2) Patients suffering from chronic and mild neurosis, whose predominant symptoms were connected with anomalies of motor functions. Some of these men complained of pain and stiffness in the hands, and a few used the word " cramp," and said that their attention had been drawn to the changes in their writing. (3) Persons suffering from organic diseases of the central nervous system. From a study of these patients, an attempt has been made in this paper to correlate the various clinical forms of " cramp " with the neuro-psychiatric conditions observed in

them, although a rigid separation of the illnesses into anxiety state, hysteria, depression and so on was found difficult and unprofitable, since nearly every patient had some features of each.

Classification of "Writer's Cramp."

Head (1910) classified writer's cramp into (1) primary or true, i.e., associated with the person's profession and therefore truly vocational in character, and (2) secondary, due to neuro-muscular weakness of the hand, unassociated with the person's profession. Gowers described a motor or spasmodic and a sensory or neuralgic form. There are obvious objections to each of these classifications. A useful classification appears to be: (1) Psychogenic—which manifests itself in three clinical forms, e.g., (*a*) the tremulous form, (*b*) the spastic form, and (*c*) the ataxic form. (2) Physiogenic, which causes the paretic or paralytic form. As cramp is not always found in these persons, the word "disturbance" seems to be more appropriate.

(1) *Psychogenic Writing Disturbance.*

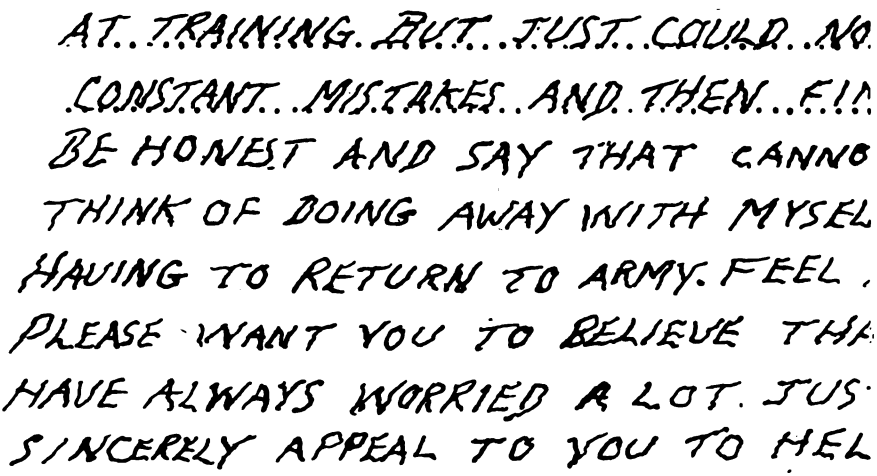
(*a*) *The tremulous or wavy form of writing disturbance.*—Here the writing shows some characteristic features; it tends to become angular and the contours are less free and easy. Careful examination reveals minute waves, due to the fine tremor of the hand, and this wavy pattern persists even in apparent straight lines. In some cases, owing partly to faulty judgment and partly to clumsy execution, the point of the nib may be caught in the paper, causing much spluttering of ink, and in severe cases if the person persists in attempting to write, the paper may be perforated. In order to hide his disability the person may try to write in capital letters, but usually there are no irregularities either in the size of the letters or in the spacing between the lines.

The majority of persons in whom this form of writing disturbance was seen were suffering from neurosis with predominantly acute and severe anxiety, which is in line with the finding of Culpin (1924), that the cramp subject was more often of the anxiety than of the hysterical type. The anxiety was the result of severe stress, such as exposure to intense enemy action, unexpected and sudden awareness of marital infidelity, separation from home, etc., and in these patients it appeared as though there was a temporary disintegration of the personality patterns, causing numerous symptoms which could be described as stutter of various parts of the body. Some of the other concomitant symptoms were actual stutter, tremor of the limbs, frequency of and precipitate micturition (stutter of the bladder), frequent blinking, and nystagmus (Pai, 1944). Although a few complained of pain in the hand while writing, there was neither stiffness—unless tremor is considered as rigidity spread thin—nor cramp.

For the purpose of this paper it is not proposed to give statistical details of their previous histories, but suffice it to say that many admitted having suffered from neurotic symptoms in childhood, and some had previously broken down with nervous symptoms like stutter, enuresis, etc. All could be described as of the anxious and highly-strung type. When they were treated for the anxiety state, either by continuous narcosis or by heavy sedation for a week or two,

with modified insulin treatment in a few cases, there was general improvement in their condition, their somatic symptoms subsided, and their handwriting reverted to their previous patterns.

CASE 1.—Male, aged 33, admitted on 8.xi.44. He complained of trembling of body and limbs, severe stammer, frequency of micturition, inability to settle down in his unit, and intense dread of returning to army life; he described himself as a "bundle of nerves" since being called up eight weeks previously. There was a family history of alcoholism and psychopathy, and he had, in his childhood, suffered from general nervousness, numerous phobias and stammer. He had no friends, and did not play any games at school, where he was often bullied by his mates. After three or four deferments he was called up on Sept. 14, but almost immediately broke down with anxiety symptoms, and on the recommendation of a psychiatrist, was down-graded to B1. This did not improve his condition, and despite treatment, his stammer got worse and he suffered from constant body tremor, insomnia, and loss of weight. He was therefore again seen by the psychiatrist, who referred him to us. On examination he was an asthenic individual of poor physique who had obviously lost much weight. Though intelligent, he was apprehensive, very tremulous and mildly depressed. He complained of difficulty in writing, but after much coaxing was persuaded to write, which he did in capital letters. (See Fig. 1.)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SINCERELY APPEAL TO YOU TO HEL

FIG. 1.

After heavy sedation, small doses of insulin (Pai, 1944), and discussion, his condition improved—he regained his lost weight, the tremor and stammer subsided and the temporary changes in his handwriting disappeared. On 18.xii.44 he was returned to his unit.

The changes in handwriting are dependent on the severity of the anxiety symptoms and not on the intensity of the stress responsible for the anxiety. This is well illustrated by the following case, whose breakdown was unconnected with the immediate stresses of war, such as exposure to bombardment, air-raids or mortar-fire.

CASE 2.—Aged 18½. Service, 1 week. Priority admission on 20.ix.46. The psychiatrist who referred him stated in the course of his letter: " . . . He was not a good scholar and 'always away from school because I was delicate and nervous.' He was a cinema projectionist, but had to give it up because of "nerves" and shooting pains in the back of the head. He then had open-air jobs, such as milk roundsman. He began to have terrible headaches two or three days before call-up, and in the first week of army training collapsed and had to be brought to the M.I. Room on a stretcher. His mother is also very nervous. His parents are separated and he has been living with some mates' parents. His symptoms are so severe that he requires early hospital therapy. . . ." On admission he complained of extreme nervousness,

shooting pains in the back of his head, tremor of body and limbs, nightmares, stutter, frequent blinking, pain in the eyes and insomnia. He admitted many neurotic symptoms in childhood, especially stammer, nightmares and enuresis, until the age of 12. He had always been a nail-biter, and persisted in this habit. On examination he was an asthenic youth of poor physique, who could hardly keep still on account of trembling from head to foot. He stuttered badly, blinked frequently, and exhibited fine tremor of outstretched hands, with palmar sweating. He was anxious, apprehensive and lachrymose, and at first refused all treatment, saying that

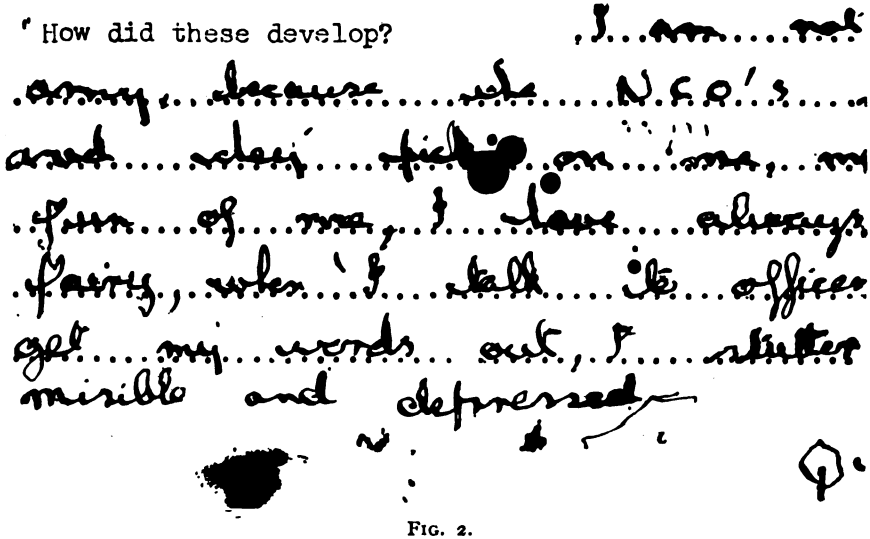

FIG. 2.

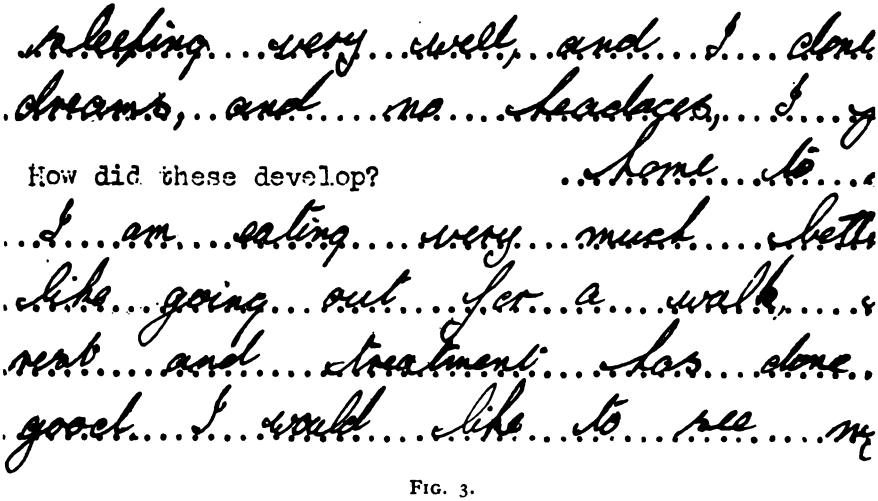

FIG. 3.

he dreaded taking medicines, or even remaining in bed for the purpose of deep narcosis.

In order to establish rapport it was necessary to convince him that his symptoms could be removed. Under hypnotic suggestion the blinking became less frequent, and this induced him to accept further treatment. With four days' rest in bed and prolonged narcosis all his symptoms subsided, the tremor and stammer disappeared and his writing reverted to its former pattern. Fig. 2 is a specimen of his writing on admission, and Fig. 3 after four days of sedation. The letters "b" and "f" show the changes well.

Various tests which depend on muscle co-ordination and equilibration have been suggested by Robins (1946) for spotting anxiety neurosis. Although there are no short cuts in psychiatric practice, for those who prefer "tips," the above-mentioned change in handwriting, when present, is a useful index of the severity of the anxiety state and is also helpful in assessing progress. It is also a simple test for differentiating hysterical tremor of outstretched hands from tremor due to anxiety, as in the former condition no such calligraphic changes (wavy pattern) are usually observed.

(*b*) *The spastic form or genuine cramp.*—In this variety the writing tends to be smaller but the letters are distinctly legible. It is uncommon to find spluttering of ink or perforation of paper, as the nib is unlikely to be caught in the paper. The main objective features depend on whether the spasm or "cramp" is confined to the thenar and the interossei muscles which grip the pen, or whether it also involves the flexor muscles of the fingers which move the hand when writing. The extent and severity of the spasm and the corresponding difficulty in relaxation vary in different persons. In mild cases there may be subjective feelings of stiffness, accompanied by fatigue and inability to write more than a few lines. In moderate cases the spasm of the muscles gives the impression that the pen is clutched too tightly, and delay in lifting the fingers causes the writing to become slow, laboured and smaller. Occasionally, owing to tonic contraction, the person might not be able to write at all. In one of our patients the spasm was so severe as to cause locking: whenever he attempted to write, the pen was jerked aside with some force by the extreme flexion and adduction of the right thumb and the contraction of the other fingers over it, which resulted in a tightly clenched fist—a condition somewhat similar to the "lock-spasm" described by Weir Mitchell. One of Culpin's patients is said to have broken the pencil in an attempt to write, and similar severe cases have been reported by other physicians. In order to overcome this disability, the sufferer often employs various devices and tricks to grip the pen in grotesque ways. Sometimes he supports the right wrist with the left hand, or firmly presses the wrist on the table and moves the paper with the left hand. In some patients the unequal spasm of opposing groups of muscles causes the pen to be slowly rotated so that they write with the edge of the nib.

All the patients in whom this form of writing disturbance was found were suffering from predominantly hysterical reactions, and they belonged to the shy, diffident, timid type, as opposed to the anxious and highly-strung type of the previous group. In the case of some there was a history of spasmogenic (Houston, 1929) traits in childhood—instead of stammer they suffered from tongue-tiedness when exposed to stress. Every one complained of numerous symptoms and general fatigue, but the signs of anxiety, such as fine tremor of outstretched hands, palmar sweating, frequency of micturition, stammer and nystagmus were absent. The spastic form is probably commoner in persons with spasmogenic tendencies.

In view of the long duration of their complaints and the predominantly hysterical reactions the successful treatment of these patients is not easy. Heavy sedation, with or without insulin treatment, may not achieve any tangible results, as these persons do not complain either of insomnia or of loss

losing control of myself: as regards tongue and thought: strangely conscious of heart-beat and nervous fear. Stare that encircles my forehead: nasal catarrh: blest excitement. something in ear-drums before going to sleep. Thought working independently of will. Hearing hasty.

FIG. 4

When behaviour was analogous to that rage and fear when its phantasies of omnipotence and (internal and external) and the good and objects in it reality: then it cries, shakes and screams with anger that it cannot have the complete control it desires and by which from which it wishes with complete forgetfulness past. (1)

FIG. 5 (1).

When behaviour was analogous to that by rage and fear when its phantasies of omnipotence and ca (internal and external) and the good and objects in it, reality: then it cries, shakes and screams with anger that it cannot have the complete control it desires and by which from which it was has with complete forgetfu

(2)

FIG. 5 (2)

of weight. To be really effective, treatment should aim at (*a*) the removal of any underlying conflict by the usual psychiatric methods such as hypnosis, analysis, ether-abreaction or narco-analysis, together with psychiatric social work

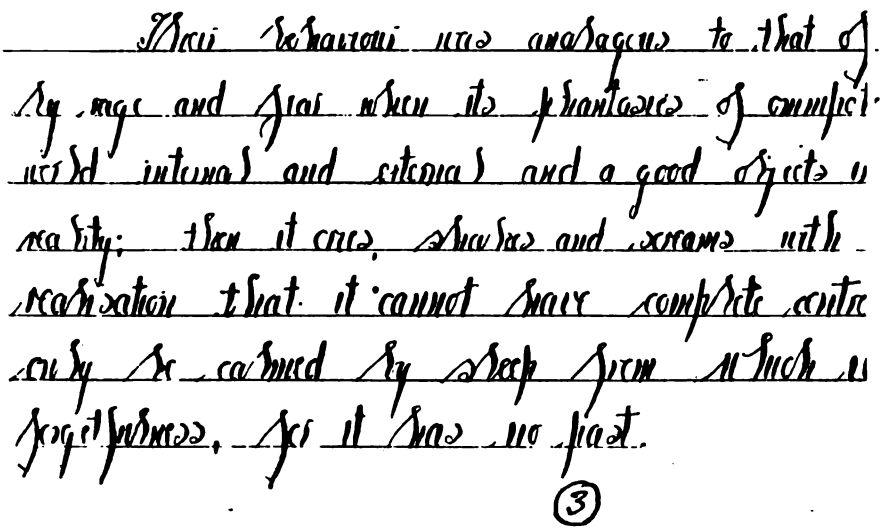

FIG. 5 (3).

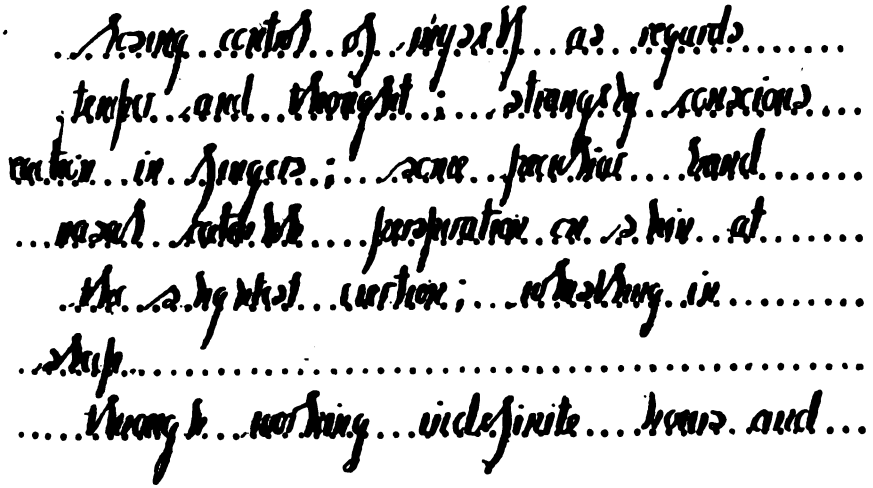

FIG. 5 (4).

and so on; (*b*) relief of spasm by hypnosis or by giving barbiturates intravenously; and (*c*) prevention of habit formation by repeated hypnotic suggestions and daily supervision and correction of handwriting. Both for producing rapid relaxation and for making repeated suggestions, hypnosis is the method of choice and gives excellent results.

CASE 3.—Aged 21. Admitted on 22.x.44. The Army Psychiatrist who referred him, stated: "His O.C. says that he is frequently absent from duty on account of ill-health. His M.O. states that this man alleges that he has been previously seen by a psychiatrist. . . . He states that he cannot control his fingers and he gets dizziness. When walking along a road he is inclined to have the feeling of falling to the left, although this is occasionally transferred to the right; the houses appear to move up and down. . . . He has always been shy and self-conscious. He then states he has queer fits of depression, which are becoming more frequent. During these attacks everything is futile and he loses all interest in life and in his surroundings. . . ." His history showed that after matriculating he began training as a fitter, but gave it up after a few weeks because he found it too heavy. He then stayed at home and helped in the kitchen. In September, 1942, he began to complain of feeling tired, pain and cramps in the legs and pain (? cramp) in the chest. About July, 1943, he was called up, but began to report sick, complaining of cramps, undue fatigue and pains in the chest, for which there was no obvious physical cause. He was therefore down-graded to Cat. C2 (Home Service only). In 1944 he began to complain that he could not control his fingers, that he had cramp in his hands, and that his handwriting was getting smaller. O.E. he was a slim, asthenic youth who, according to the intelligence tests, was of superior intelligence (Grade I). While writing it seemed as though his right hand was glued to the paper, and on account of the spasm of the flexor muscles there was difficulty in lifting the thumb and forefinger; the excursions of the pen were very restricted, the writing was slow and the letters very small. It was not surprising that despite his good education and high intelligence, the Army could not make much use of him even for Home Service. He was treated by sedation and was also given barbiturates intravenously, without any benefit. When he was made to write with a pen inserted through a cotton reel the writing became slightly larger but there was no quickening in the tempo, which continued to be very slow indeed. As soon as he discarded the cotton reel and attempted to write with an ordinary pen the writing became smaller again. When he was given daily hypnotic suggestions for five days there was gradual and progressive relaxation of the muscles, the movements of the fingers became free, the excursions wide and the letters increasingly larger in size. In order to test the results of treatment he was given clerical work in the psychological department of the hospital, where he worked hard for several hours daily without showing any tendency to relapse, and he also took part in organized physical training and games. Some of his emotional problems were straightened out. He maintained this improvement and also gained in weight without any insulin therapy. He was returned to his Unit, where he was afterwards reported to be working efficiently. Fig. 4 shows his writing on admission, and Fig. 5 (1), (2), (3), (4) shows the results after hypnotic suggestions given on successive days.

(*c*) *The ataxic or jerky form.*—Here the writing is characterized by irregularities in shape and size of letters, as well as inequalities in the spacing between the lines, which may diverge towards the right side. Owing to excessive contraction of the *extensor muscles* the fingers are lifted too high, the movements are erratic and jerky, and the excursions wide and irregular, giving the impression of uncontrolled execution. It is quite possible that a person's inability to keep his fingers firmly on the pen might be due not only to excessive contraction of the extensor muscles, but also to a primary weakness of the will to write and a secondary lack of confidence in the ability to write. Persons in whom this form was seen were also suffering from predominantly hysterical reactions. These patients derive benefit from active exercise of the flexor muscles, which is best carried out by asking them to take part in organized physical training and games. Massage and exercises should not be carried out in a physiotherapy department, as such a procedure will fix the person's attention on his disability, and might lead him to think that something is structurally wrong with the parts concerned.

CASE 4.—Aged 35. Service, 1 year. Referred on account of constant dull ache in right arm with acute pain whenever he has to use it, inability to write on account of " cramp " and shortness of breath on exertion. He admitted numerous neurotic symptoms in childhood. After attending a secondary school he studied architecture for a while, and then without completing the course began to work as an architect, earning £7 per week. On account of his work his call-up was postponed twice, but in February, 1944, he was conscripted into the Army, where he soon passed the Army Architectural Draughtsman's course. He was, however, not mustered as a draughtsman, and was employed on non-clerical duties, which he intensely disliked. About June he began to complain of fatigue and pain in the right arm and hand,

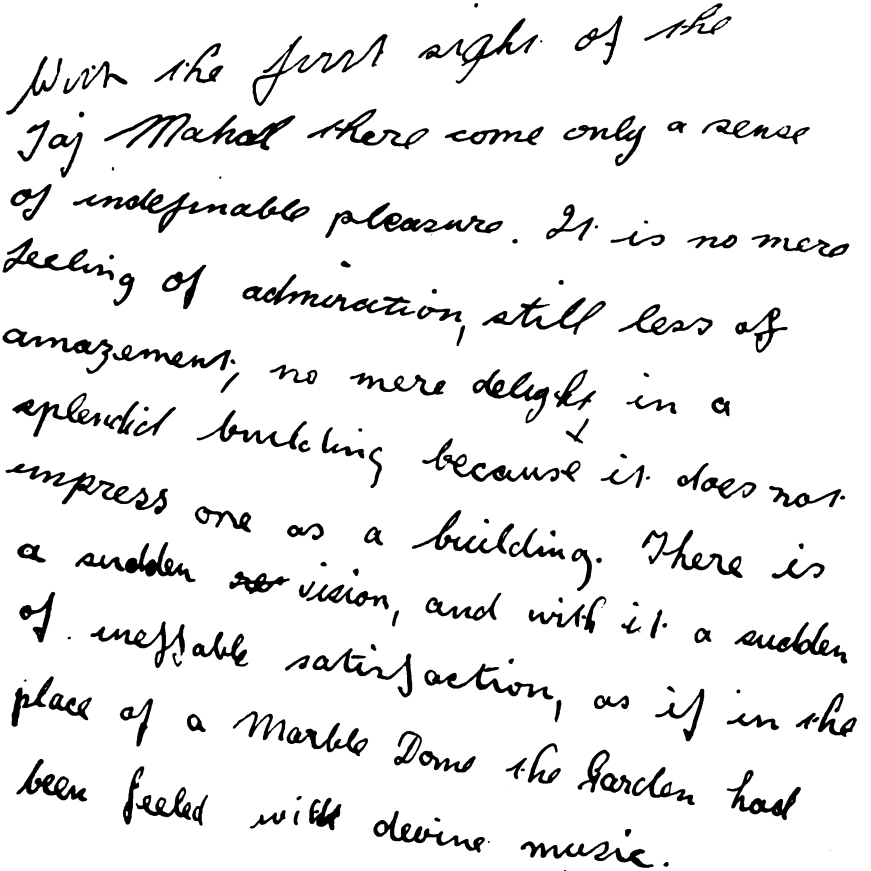

FIG. 6.

and four months later he was admitted to a hospital, where he was treated for " tennis elbow," but without any relief. While still in the hospital he was then examined by a psychiatrist, who correctly diagnosed his trouble as hysteria and referred him to us. On admission he stated that he had practically done no duties for nearly seven months. He was very disgruntled and full of grievances against the Army, because he felt that he had been neither selected for a commission nor paid as a draughtsman. Fig. 6 is a specimen of his writing obtained after a good deal of persuasion and encouragement. It would be seen that there is a gradual improvement in the writing, and the lowest line almost conforms to his previous pattern, indicating that the flexors were beginning to contract efficiently and harmoniously. Under hypno-analysis it was discovered that his symptoms

developed at a time when his officers were discussing the question of employing him on clerical duties in the Company office, but still without giving him the trade rate of pay authorized for a draughtsman. As soon as his symptoms subsided, as a result of hypnotic suggestions and physical training, he was returned to his Unit with a recommendation to employ him on duties commensurate with his education and capacities.

(2) *Physiogenic Writing Disturbances.*

Among the various organic causes responsible for a condition identical with "writer's cramp" may be mentioned chorea, disseminated sclerosis, paralysis agitans, parkinsonism, progressive muscular atrophy and post-vaccinal encephalomyelitis. In chronic conditions the inco-ordination and disturbances in writing are not so well marked as in diseases of sudden onset and rapid progress. The clinical condition may be called the "paralytic form" of writing disturbance. Owing to the paralysis and weakness of the muscles of the hand, writing becomes a great painful effort and is very tiring. The letters, which are difficult to recognize, are large and irregular in outline with sharp corners and right angles. In this indistinct and rugged scribbling, arcs, contours and semicircles are conspicuous by their absence or are often expressed as straight lines and angles. By emphasising the essentials and simplifying form a tendency to stylization (Kretschmer, 1934) may be found. Sometimes the words look like the Bakäiri figures on the rind of a gourd (Wundt, 1913), the whole writing resembling the very early efforts of a child learning to write for the first time.

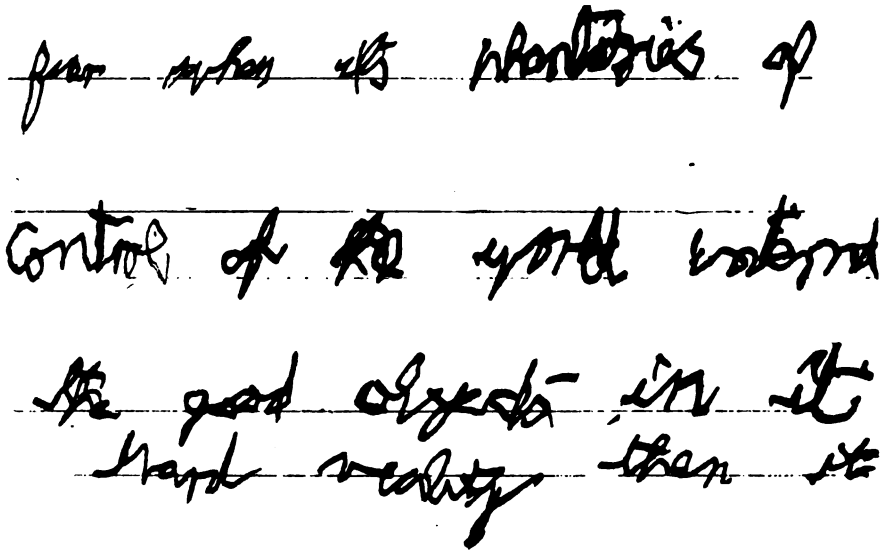

FIG. 7.

CASE 5.—Aged 18 years. Service, 3 months. Referred with a note: " . . . Dull, slow in learning, fails to understand orders. Complains of loss of power in arms and legs. Constantly falling down." On admission he had difficulty in talking, and his speech was slurred. He complained of difficulty in swallowing both solids and liquids, numbness of right side of face, weakness of legs, inability to stand or

walk—duration, 3 weeks. Slurred speech of two weeks' duration and double vision of one week's duration. O.E. he had extensive physical signs of lesions in the C.N.S. compatible with a diagnosis of acute post-vaccinal encephalomyelitis. He was therefore transferred to a special neurological hospital, where he died six weeks later. Fig. 7 is a specimen of his handwriting.

The changes in handwriting seen in patients suffering from various psychotic conditions, such as G.P.I., schizophrenia, manic-depression and so on, are outside the scope of this article.

Discussion.

The importance of this subject lies in the fact that "writer's cramp" has been included among the Dangerous Trades for the purpose of the Workmen's Compensation Act. In America and France, where employers are not bound to pay compensation to workers suffering from this disability, its incidence is almost negligible. In Italy it has not received much notice even in the medical literature (Morselli, 1921; Binswanger and Siemerling, 1927; Fumarola and Mòglie, 1936). Although this condition is supposed to occur only among those whose occupation involves much writing, this study confirms Culpin's observation that it also occurs in persons suffering from neurosis, whose work does not involve much writing—in other words, the so-called "writer's cramp," instead of being an occupational disease, appears to be only a symptom of neurosis. From the above case-histories it would also be seen that in our patients the "cramp" developed, not after excessive hours of writing, but when they were faced with the prospect of being employed (without suitable remuneration) on duties involving much writing. The term "writer's cramp" would appear to be a misnomer, as in the first place the condition is commoner in non-professional writers, and secondly, cramp or spasm is not found in all persons complaining of this symptom. "Writing disturbance" is a suitable and more accurate term, as it describes the symptom without giving any indication of the ætiology.

As regards treatment, those physicians who have postulated a physiological basis for this symptom have prescribed prolonged rest and complete abstention from writing for periods which have varied from a few weeks to nine or more months (Jelliffe, 1935; Sadler, 1936; Saunders, 1940). Walshe recommends complete rest from writing for six months. French neuro-psychiatrists who, like Culpin, have emphasized the part played by psychological stress in the production of this symptom, have advocated methods which could be summed up in Janet's admirable words: "Education, excitation and guidance." They claim good results from a system of gymnastics (Kouindjy, 1906), combined with educational treatment as suggested by Montarani (1909). Even when the affected muscles are unaltered in shape and size massage appears to be beneficial, although the exact mechanism of its action is not understood (Gilles de la Tourette, 1899). Breathing exercises as recommended by Pitres (1901), have also been found useful. But the object of all these methods can equally well be attained by organized physical training, team games, group discussions and educational therapy facilities, available at any modern psychiatric hospital. Every person complaining of "cramp" for which there is no organic cause should be considered as a psychiatric patient and treated accordingly. Hypnotic

suggestion, which has been successfully used for the removal of numerous symptoms (Bernheim, 1886; Sidis, 1911), might be used as a therapeutic measure in the case of persons showing hysterical reactions.

Summary.

(1) 171 out of 1,880 (or approximately 1 in 11) patients suffering from neuro-psychiatric conditions showed some inco-ordination of the muscles of the hand resulting in writing disturbances.

(2) Those in whom the tremulous form of writing was found were suffering from acute and severe anxiety neurosis.

(3) Those in whom the spastic or cramped form of writing was found, as well as those who showed the ataxic or jerky form of writing, were suffering from neurosis with marked hysterical reactions.

(4) Those who showed the paralytic form of disturbance, characterized by slovenly and almost illegible writing, were suffering from organic diseases of the central nervous system.

(5) The term "writing disturbance" has been suggested instead of the name "writer's cramp," which appears to be a misnomer.

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INTELLIGENCE OF MALE NON-INSTITUTIONALIZED EPILEPTICS OF MILITARY AGE.

By Major JACK G. SHEPS, R.C.A.M.C.

THE intelligence of epileptics has been studied by many investigators. Some of these studies were confined to children, some to patients in institutions, others to out-patients and a few to private patients. Some studies included institutionalized and non-institutionalized patients with no effort made to consider the two groups separately. The out-patient material was assumed to represent the best cross section of epileptics, but as Somerfeld-Ziskind and Ziskind (1) point out, patients who are not helped by the treatment tend to stop attending clinics. This bias in the material is reflected in the wide variations of the results; for example there is a range in the reported mean I.Qs. of from 113·5 to 78. There appeared to be a definite need for a study based on a wider group, representing all types of epileptics. Examination of whole sections of the population, carried out during the recent war, afford a unique opportunity for this study, for the group was absolute, and there were no selective factors except sex, age and institutionalization.

This study is based on data derived from the administration of the Canadian Army Intelligence Test (Revised examination M) to call-ups and recruits. The only epileptics of Army age not examined were married men between the ages of 30 and 40 who did not seek to enlist. All other non-institutionalized male epileptics between the ages of 18 and 40, and those up to the age of 45 who enlisted, were examined. Complete records were not kept in the early days of the war, and these records date from the middle of 1942. However, physical standards were revised at about that time, prior medical rejections were not valid, and all those previously rejected or discharged were subject to call-up. It is felt that this material represents a good absolute sample of non-institutionalized male epileptics of military age in one military district. With few exceptions, all men in Canada are discharged in the military district in which they enlisted, and so cases of men accepted and later discharged for epilepsy were readily available.

Military District No. 2 in Canada consists of roughly the middle third of the Province of Ontario. In the south it is highly industrialized and thickly populated, with two large cities, Toronto and Hamilton. Towards the north a section of rich agricultural land is followed by sparsely settled timber and mining country. The exact ratio of rural to urban population could not be obtained, but 13 per cent. of the male enlistments were rural.

Four hundred and eighty epileptics were seen in Military District No. 2. Complete data was not available on all, and the type of epilepsy, except for

"idiopathic," was not stated. For some, only total "M" scores and age, and for some, age alone, were available. However, complete data was available for 20 men who took the French Form A, 123 who took the English Form A, and 226 who took the English Form B.

The average age was 22 and the distribution of ages as follows:

15–19	88 cases
20–24	135 ,,
25–29	125 ,,
30–34	61 ,,
35–39	20 ,,
40–44	6 ,,

Controls were obtained by random sampling of all personnel tested throughout Canada at one particular time. Precautions were taken, and it is felt that the samples of the various "M" test forms were equivalent within the limits of the experimental error. The call-up of men was a matter of local policy within the military district, and the inclusion of all of Canada at the same time tended to control special local factors, such as age and occupation, which might be more weighted in one district than another. The average total "M" test score in Military District No. 2 is higher than that for the whole country, and Major K. A. M. Macintyre, statistician for the Directorate of Personnel selection feels that it is safe to assume that a control group restricted to the Military District would have an average total score at least 5 points higher than the national one. Two thousand five hundred and ninety-six took the English Form A, 2,552 the English Form B, and 1,884 the French Form A.

The revised examination "M" is administered to groups not usually exceeding 50, generally about 30, depending on the volume of men to be examined. It consists of eight subtests in the following order: Picture completion, pictorial absurdities, figure construction, tool recognition, mechanical information, arithmetic, vocabulary and verbal analogies. The maximum total score is 211. Form A was administered until the summer of 1943, after which Form B was used. In Military District No. 2 only one French test, Form A, was used. Because of the small number in the series the results of the French test are not given. In general they corroborated the conclusions obtained from the English tests.

Results.

The average "M" scores of the epileptics and controls were compared both for the totals and for the individual subtests. The total or global "M" score average was:

	Control.		*Epileptic.*	
English Form A	124·3	S.D. 39·5	110'9	S.D. 39·9 (133 cases).
English Form B	126·4	S.D. 40·3	120'1	S.D. 36·2 (237 ,,).

The difference was found to be statistically significant for Form A only, but when "t" values were combined and equated for the differences in numbers, a statistically significant value of 3·92 was obtained. This combined with the special factor of higher total "M" scores in Military District No. 2, would

indicate that the difference was significant. Frequency distribution curves of total " M " scores showed no marked skewing to indicate increased incidence of epilepsy in any particular portion of the population. The epileptic curve was shifted to the left and somewhat flattened, indicating a generalized lowering of intellectual capacity. Table 1 shows the percentage of the epileptic and control population in the quarters of the total " M " score, and it can be seen that the epileptic group shows a slightly increased percentage in the lower three-quarters, and 7·7 and 6·8 per cent. less respectively in the upper quarter of test Forms A and B.

The mean scores for each subject were calculated and compared for statistical significance. The method used was that given by Fisher (2) "A method of comparing two means." It can be seen that the epileptics did significantly worse in Tests 3 and 8 in both Forms A and B, and worse in Test 1 in Form B.

Because of the significantly lower mean total score of epileptics, an attempt was made to see how the factor of lower intelligence contributed to the " profile." One hundred literate recruits graded as " intelligence insufficient to absorb full military training," selected at random in the same district, were studied in the same manner as above. Because of the weight given to illiteracy in downgrading for " intelligence," it was felt that a purer sample of mental defectives would be obtained in the literate groups and would not materially affect the profile. All were tested with English Form B. These results are also given in Table I. Tests 8 and 1 seem much below the general level of attainment, while better results were obtained in Tests 2 and 3 than in Tests 6 and 7. In view of this finding, the poor performance by the epileptics in Test 8 as compared to Test 7, two tests which ordinarily have a high co-efficient of correlation, is regarded as a reflection of poorer intelligence. The poor performance in Test 3 does not seem to be a function of poor intelligence.

Discussion.

This study might be criticized on the grounds that the diagnosis was established quickly, without, in many cases, verification from other sources, and that the man's word played too great a part in the diagnosis. All cases had been thoroughly examined before they reached the psychiatrist, and all cases of epilepsy were tested for abnormalities of reflexes, motor power and co-ordination. If there was any cause for suspicion that the fits were secondary, skull plates were taken, and a more detailed neurological examination was done. Occasionally the diagnosis was deferred until an electro-encephalogram was obtained. It should be borne in mind that 135 of these cases were serving soldiers whose fits were witnessed by others. A factor which tended to operate in favour of accurate diagnosis was the " accept for recheck " system which was in force in the Canadian Army until Feb., 1945. Men who had complaints, and in whom a definite diagnosis could not be made, were accepted for recheck and seen by a psychiatrist after a trial of training. In this way it was found that the standards for epilepsy were not too strict. These standards agree with those laid down by Roseman (3) as the semi-official attitude in the U.S. Army.

TABLE I.—*Statistical Data.*

Test.	Form A.				Form B.				Defective.		
	D.	Z.	t.	P.	D.	Z.	t.	P.	D.	Z.	t.
1	— ·51	—·1399	1·52	Less than ·2	—1·16	—·364	5·24	Less than ·01	— 5·10	—2·403	24·03
2	— .2	—·0505	·55	,, ·6	— ·46	—·1179	1·70	,, ·1	— 3·9	—1·005	10·05
3	— ·87	—·188	2·04	,, ·05	—1·02	—·2162	3·12	,, .01	— 4·77	—1·018	10·18
4	— ·81	—·13501	·46	,, ·2	—1·04	—·1550	2·23	,, ·05	— 9·06	—3·671	36·71
5	— ·8	—·09721	·05	,, ·3	— ·91	—·1112	1·60	,, ·02	—13·67	—1·695	16·95
6	— ·34	—·0892	·97	,, ·4	— ·63	—·1708	2·46	,, ·02	— 5·04	—1·384	13·84
7	— ·61	+·0849	·92	,, ·4	— ·04	+·0058	·08	,, 1·00	— 8·18	—1·203	12·03
8	—1·83	—·21792	·36	,, ·02	—1·47	—·2268	3·27	,, ·01	—14·32	—2·322	23·22

D = Difference between control and epileptic scores.
Z = Standard score (the difference divided by the standard deviation).
t = Fisher's " t " value.
P = Probability that the difference is due to chance (less than ·05 is statistically significant).

Lennox (4) has stated that about ·5 per cent. of the population suffers from fits; ·62 per cent. (5) was found to be the incidence in Nassau County, New York. In the last war the incidence of epilepsy in the U.S.A. among drafted men was ·51 per cent. (6), and in Scotland among Army recruits from 1917 to 1919, ·64 per cent. The incidence of rejections for epilepsy among Selective Service registrants in World War II in the U.S.A. is ·51 per cent. (7). In Military District No. 2 ·39 per cent. of the men examined were rejected for epilepsy, a somewhat lower incidence than in the U.S.A. These figures would indicate that our standards were not too high. The number of institutionalized male epileptics of military age from the District was calculated, and while this number must at the very best be a rough guess, it raised the incidence of epilepsy in the total male population to ·55 per cent., a figure that coincides with that of Lennox (4) for epilepsy in the general population and which has been generally accepted. The incidence of non-institutionalized epileptics will vary according to the facilities and ease of commitment in the area.

Somerfeld-Ziskind and Ziskind (1) tested 100 epileptic out-patients and found a mean I.Q. of 93 and a range of 39 to 153. They stated that an I.Q. of 100 is normal for the whole community. Memory retention and language ability were somewhat defective. Barnes and Fetterman (8) studied 105 out-patients and found a mean I.Q. of 79 and a range of 35 to 130. Collins, Atwell and Moore (9) reported the results of Stanford-Binet tests in 220 epileptic patients at the Boston Psychopathic Hospital and found I.Qs. of 26 to 130 with the median at 78, using the standard for the I.Q. at the 14-year level. Arluck (10) reported on 16 epileptic out-patients at the Mt. Sinai Hospital, New York, N.Y., and found a mean I.Q. of 113·5, with a range of 68 to 144. Results of the picture absurdity test were significantly worse in epileptics than in control groups. Rubisoff (11) reported a group of 66 institutionalized epileptics, in which she found a mean I.Q. of 75, which she stated was not significantly lower than that found for non-institutionalized groups. Lennox and Collins (12) tested a group of 186 twins. Sixty-three twins were without a history of epilepsy or brain injury, and 30 had a history of seizures. The average I.Q. for the 149 non-epileptic persons was 108. For the 29 persons with epilepsy, but without definite evidence of brain injury it was 96, and for the 10 epileptics with brain injury, 77. Either the Wechsler-Bellevue or the Stanford-Binet Form L tests were used. The subjects who were given the Wechsler-Bellevue tests did relatively poorly in the performance tests.

The above figures indicate the variability of the intelligence levels obtained by different investigators. Even out-patient departments vary a great deal, sometimes in the same cities, in the type of patient, particularly with regard to his social, economic and ethnocultural background, and this tends to select the material. Our own material would indicate that the intelligence of the non-institutionalized epileptic in Military District No. 2 in Canada is on the average only slightly inferior to that of the general population. The incidence of recruits graded "intelligence insufficient to absorb full military training" from May, 1943, to December, 1944, was 7·29 per cent. In that same period the incidence of this category among the epileptics was 8·94 per cent. Using Chi Square Test a value of 1·05 was found, indicating that the difference in

incidence was not statistically significant. It would appear then that the difference in intellectual level of the epileptics and the general population is only slight, and is not reflected in an increased number of mental defectives. In a previous study (13) the close relationship between convulsive disorder and mental deficiency in an institutionalized group of patients was indicated. This is also stated in a study by Lennox (14). The explanation of this lack of relationship in the present group is that in Military District No. 2 most of the defective epileptics are institutionalized by the time they reach military age. Our group also seemed to show distinctively poor performance in the figure construction test. In common with Arluck's group, they also did more poorly in the picture completion than in the other tests, but in this study this is also true for the defective group. In general the difference in performance of epileptics and control groups in the various subtests as reported in the literature are not consistent and apply to many different abilities. Wallin (15) has stated that they are not significant—" accordingly, the epileptic is not abnormal in respect to these traits in the sense that he constitutes a distinct type "

Summary and Conclusions.

1. The intelligence of the non-institutionalized epileptics of military age (approx. 18 to 40) was tested by the Canadian Army Revised Examination " M."

2. It was found that their intelligence was only slightly lower than that of the general population, but significantly so. This lower intelligence was not reflected in an increase of mental defectives (defined by the standard, " intelligence insufficient to absorb full military training "). When the factor of lower intelligence level was discounted, it appeared that the epileptics did relatively poorly on the figure configuration test. In view of other findings in the literature this was not considered very significant.

3. The incidence of non-institutionalized male epileptics of military age in Military District No. 2 is ·39 per cent.

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INTENSIVE ELECTRICAL CONVULSION THERAPY IN ACUTE MANIA.

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IT would seem that the overwhelming success of convulsion therapy in depressive syndromes has retarded recognition of the use of this treatment in states of excitement. Little has been written in this country on E.C.T. in mania, and apart from a report that the condition is refractory and frequently relapses, there is scant guidance on the subject. The object of this paper is to draw attention to the real value of E.C.T. in mania, when given in adequate quantity at the beginning, and followed up by frequent spacing of shocks to prevent relapse. For this purpose, "intensive therapy" is regarded as that which commences with several shocks daily until the excited state is suppressed, and by this method the most maniacal patient can be rapidly and dramatically brought under control.

There is nothing more disturbing in a psychiatric ward than the arrival of a patient in a state of wild excitement. Such a case tests the skill and patience of the nursing staff, and unsettles the other patients. Fortunately, these episodes are not common. Nevertheless, one feels the necessity for immediate action, as with an emergency, but all too frequently the result of the administration of narcotics is a few hours of peace between the outbursts of noisy excitement until the patient's frenzy has spent itself over a period of days or weeks.

Text-books are usually brief in dealing with the treatment of mania, and have not added much to the observations of Kraepelin (1906) that 12 to 16 grammes of sodium bromide daily might cut short a mild attack, but that stronger sedation combined with prolonged warm baths are necessary for the more severe cases. Prolonged narcosis combined with insulin has proved effective, but there is a need for rapid positive control in acute cases.

It is, perhaps, not so surprising to find a degree of reluctance to use E.C.T. in mania, for apart from the active resistance of the patient, there is probably a feeling that the apparent stimulative effect of a convulsion in melancholic and schizophrenic stupors must make it inappropriate for the excited patient. And certainly, the first treatment may appear to make the manic patient worse or, at any rate, have little beneficial effect. But it seems that we have in E.C.T. a therapeutic agent which can be used quantitatively with fine discrimination.

In maniacal states it is necessary to push E.C.T. to the stage where mental confusion is produced, and for this purpose treatments should be given at least once daily to begin with. The risk of producing irreversible brain damage or dysrhythmia is questionable, and has not been proved.

One must weigh in the balance the possible harmful sequelae of treatment

with the harmful effects of the disease process if allowed to continue. On both sides there is a possibility of intellectual impairment, but in E.C.T. the memory changes are transitory. Perlson (1945) reports an investigation in a male schizophrenic aged 27, who recovered after receiving 248 shock treatments, with no evidences of intellectual impairment.

Apart from the so-called maintenance treatment of the chronic psychotic described by Moore (1943) and Caplan (1946), in which E.C.T. may be regarded as extensive rather than intensive, " confusional treatment " has been advocated by relatively few psychiatrists. C. H. Neyman (1944) places great stress on mental confusion as the therapeutic agent in states of excitement, and advises daily, or several times daily treatments in severe psychoses, until complete disorientation is produced. He states that no matter how great the excitement, this will, of necessity, cease under E.C.T.

Kalinowsky (1943) has always emphasized the importance of adequate treatment, and in his recent book (1946) he advises E.C.T. 2 to 3 times daily in states of acute excitement. Berger (1946), reporting on Japanese military psychiatry in Korea, found that in general, excited patients were given convulsions 2 to 3 times daily, while " gentle " patients received 2 to 3 shocks weekly. Fernandes and Polonio (1946) found induced convulsions to be life-saving in " delirium acutum " and " acute fatal catatonia," which is often acccompanied by pyrexia, tachycardia, leucocytosis and increased blood urea. They state that advanced cases respond dramatically to 1 or 2 fits daily for 2 or 3 days, and they remark that death is likely to occur more by under-treatment than by an excess. Of passing interest is the use made by Milligan (1946) of intensive E.C.T. in the intractable neurotic states.

We emphasized in a previous paper (Kino and Thorpe, 1946) that the effective use of E.C.T. requires individual adaptation to each case, and in general should be prolonged in schizophrenia, and intensive in mania. We mentioned that good results were achieved in mania by giving daily treatments, or even 6 to 8 treatments over a period of two days. In the present paper we wish to elaborate upon the latter statement.

The aim of E.C.T. in mania is the production of a degree of mental confusion just sufficient to suppress the abnormal level of psycho-motor activity, the intensity of treatment being in direct proportion to the degree of excitement. In milder cases it is sufficient to begin with one convulsion each day, but in the more acute states only multiple shocks for the first few days will calm the patient, leaving him with a transitory retrograde amnesia.

After the first treatment, the acute case quickly reverts to the previous state of excitement. Another convulsion is then given one to two hours after the first, and repeated at increasing intervals until it is judged that the degree of excitement has been definitely reduced. This may necessitate the administration of 3 to 6 treatments during the first day, at the end of which the patient usually complains of headache, but sleeps well during the night with the help of a sedative.

The treatment is continued on the second day with a reduced number of shocks, and on successive days is gradually tapered off to once daily, alternate daily, twice and once weekly, according to patient's condition, and tendency to relapse. There seems to be little danger in giving multiple shocks provided

sufficient time is given for return of normal pulse and respiration, and for the patient to begin to regain consciousness (Sogliani, 1939). This we can confirm from our experience, even in patients on the verge of physical exhaustion from maniacal excitement.

A typical spacing of 24 treatments could be represented by the formula 32111 . . (24), where the figure in brackets indicates the total number of treatments, including those required at longer than daily intervals to maintain the patient in a quiet state. The complete course of treatment can be divided into three phases, the first phase, lasting two to four days, during which period the mental excitement is suppressed by multiple shocks; the second phase, extending over a period of four to 8 weeks, when maintenance of control will depend upon a judicious spacing of treatments; and a third phase of convalescence and rehabilitation, with cessation of shocks, and preparation for discharge home.

Often on the second or third day of treatment the patient will be found quietly eating a meal, or looking at a book, and conversation will be orderly and rational. Questioning will usually elicit the reply, " Where am I? What am I doing here? " and a retrograde amnesia will be found extending for a considerable period before the illness. The quiet co-operation of the patient will be appreciated by the nursing staff.

For the first few days after return to orderly mental functioning the patient is concerned with reorientation to recent events, and will welcome simple explanations and reassurance. The amnesia gradually recedes during the ensuing weeks. If the spacing of treatments is too long during this second phase a mild relapse of excitement may occur, which can usually be quickly brought under control by a temporary intensification of the treatment. A manic-depressive, on the other hand, may pass over to a period of depression. Many patients, however, show progressive improvement, to eventual recovery in two or three months' time. There is no evidence that this treatment has any influence on the tendency to second attacks.

The usual contra-indications to E.C.T. should be carefully considered, and one should be cautious in the early puerperal mania with its danger of pelvic thrombosis; but in our experience over a period of six years, during which some 20 cases have been given intensive treatment, all have tolerated it well. There have been no untoward complications of sequelae, and no evidence of persisting memory defects.

We have limited our observations to female patients, and since only 10 to 12 per cent. of admissions were manic, relatively few of these required intensive treatment. They were too few for statistical analysis, but most of them recovered. Of the recoveries, 12 have been selected as typical examples, and are summarized in the following table. One or two cases returned to hospital at a later date with second attacks, and one of these is included in the table. With regard to the mild relapses during the second phase, it is not unlikely that they could have been avoided with more experience in reaching the optimum spacing of treatments.

We feel that intensive E.C.T. has a definite place in the treatment of acute mania, and is worthy of closer attention.

Intensive E.C.T. in 12 Female Patients with Acute Mania.

Case.	Age.	Admitted.	E.C.T.	Periodicity during 1st phase (total treatments).	Relapses during 2nd phase of treatment.	Discharged.
F. M. N—	66	2.6.41	24.7.41	23311..(18)	One	14.1.42
F. C—	46	13.7.41	14.7.41	2411..(12)	None	14.8.41
F. C—	51 (2nd attack)	27.12.45	29.12.45	2322..(50)	Two	6.6.46
M. P—	23	24.7.41	24.7.41	21111..(8)	None	14.8.41
K. W—	29	23.7.41	24.7.41	23311..(24)	One	11.12.41
V. Y—	32	17.12.41	18.12.41	211..(8)	None	14.1.42
G. L—	46	18.9.42	19.9.42	444..(20)	None	17.10.42
M. J. M—	26	24.1.45	25.1.45	221111..(13)	None	2.3.45
G. R—	31	8.6.45	9.6.45	4311..(20)	One	6.8.45
L. D—	42	2.2.46	4.2.46	3321..(20)	None	8.5.46
F. L—	16	6.7.46	7.7.46	4211..(26)	One	13.11.46
M. W—	47	12.9.46	13.9.46	3111..(15)	None	21.10.46
C. H—	49	19.9.46	19.9.46	211..(15)	None	10.12.46

Conclusions.

Intensive electrical convulsion therapy is a superior method of control in acute mania. The treatment is initiated by multiple shocks daily, and continued with gradual decreasing frequency.

With ordinary care, the treatment is in our experience without danger or undesirable sequelae.

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ON THE CONCEPT OF "PSYCHOPATHY" AND THE TREATMENT OF SO-CALLED "PSYCHOPATHS."

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THE characteristic trait of the doctor's medical activity, compared with the quack's, is that the doctor is guided by two theoretical and practical postulates. The first one is diagnostic, and implies that the doctor must try to state the nature of the disease. If this is not possible, he must at least make an analysis of the symptoms in order to establish their patho-physiological connection, so that he knows which are the most important and most susceptible to treatment.

The second postulate is therapeutic, and implies that the doctor has to direct his treatment against the causes of the morbid condition or, if these are unknown or inaccessible, against the symptoms that are most important patho-physiologically, or most painful to the subject. He also ought to know why he is using a certain treatment and how it acts.

In current treatment of psychopaths these postulates are adopted only to a small extent, indeed, only exceptionally. This depends on the fact that the term psychopath is not the denotation of a morbid entity, not even of a syndrome.

Its immediate predecessor in psychiatric terminology is the *dégénéré*, the *deséquilibré* of French psychiatry, which came into vogue especially through Morel's theory of degeneration. At Morel's time and much later psychiatry had not become aware of the important conceptual distinctions between psychic, i.e., psychoneural *disease*, a constellation of disorders of mental functions in persons formerly mentally sane; psychic *imperfection* or *flaw*, conditioned by one or more pathological genes in the biological make-up of the individual, and depending on a lack of development or misdevelopment of some part of the brain; and psychic *defect*, i.e., a residual disorder of mental functions produced by a psychic disease which has come to a standstill but left behind incurable lesions of brain tissue.

Thus, such an excellent psychiatrist as Griesinger (1876) regards idiocy as a mental disease, and as late as 1911 Ziehen reckons the oligophrenias among the congenital defect psychoses.

I cannot tell when the term psychopath was first used in psychiatry. In 1891, however, Koch wrote a book on "Psychopathic Inferiorities" (*Psychopathische Minderwertigkeiten*). It derives from the French theory of degenera-

tion, but its author has the characteristic Teutonic propensity for abstruse systematization, and adopts a great many strange terms which evidently lack an empirical basis.

In his Manual of Psychiatry (1899) Kraepelin talks of " psychopathic conditions " as synonymous with degenerative psychoses (*Entartungsirresein*). Thus he seems to regard these conditions as mental diseases.

In his manual of 1916 Bleuler makes a distinction between original morbid conditions (*Originäre Krankheitszustände*) and psychopathic personalities.

As late as 1928 one finds in Kahn's paper on " Die psychopathischen Anlagen, Reaktionen und Entwicklungen " in Bumke's *Handbuch der Geisteskrankheiten* a classification of psychopaths, from the view-points of drives, temperament and character. Here, too, one finds the curious Teutonic trend of systematization combined with insufficient conceptual analysis, as appears from his choosing as principles of classification the Hippocratic term temperament, which is scientifically unusable on account of its unclearness, and the term character, which refers above all to " social and moral attitudes," and is not a clinical concept.

The heterogeneous origin of the characteristics of the so-called psychopathy is obvious, as is shown by a survey of the basic components of psychopathic personality given by Curran and Mallinson.*

According to Levine (1940), the psychopaths are " not normal, i.e., not mature, of good health and adjustment (!) ; not psychotic ; not neurotic, although they may develop neurotic or psychotic symptoms ; not necessarily feeble-minded ; they live in a greater degree than is healthy in terms of short-term values of the pleasure principle ; they tend to solve their life conflicts by overt behaviour."

Hall (1941) : " Egocentricity, inability to profit by experience ; emotional instability ; lack of perseverance ; unreliability and irresponsibility ; defective judgment ; suspiciousness."

Sprague (1941) : " Inability to postpone, ineffective consideration of consequences ; insufficient learning from experience ; faulty synthesis ; disproportionate responsiveness ; affective dominance over intellect ; disvaluation of reality ; disregard for truth ; insufficient social valuation."

Cleckley (1941) : " Superficial attractiveness ; cleverness, facility for talking and often apparently good intelligence ; freedom from psychotic and more marked psychoneurotic symptoms ; unreliability and irresponsibility ; disregard for truth and honesty ; unwillingness sincerely to accept any blame ; absence of shame ; cheating ; lying, thieving, often for trivial gains ; poor judgment concerning his own welfare ; inability to learn by experience ; egocentricity ; poverty of affect ; inability to see himself as others see him ; inadequate responsiveness to special consideration or kindness ; shocking or fantastic episodes of behaviour often associated with a drinking bout ; infrequent sincere suicidal attempts ; tendency to create scenes and situations so bizarre and untimely as to seem purposeless ; sexual abnormalities, e.g., promiscuity (!) ; the manifestations of psychopathic behaviour may begin at

* Psychopathic personality, in " Recent Progress in Psychiatry," *Journal of Mental Science*, January, 1944.

any time, not necessarily in childhood; lack of perseverance; repeated failures to make good."

When considering these and other descriptions of psychopaths, one will find that the characteristics used to denote the condition are generally certain obvious symptoms or disorders of functions. Thus the definitions are purely symptomatic. Further, one finds in these descriptions of psychopaths a hotchpotch of psychiatric, individual psychological, social psychological, characterological and moral distinctive traits. Then there are collected under the same psychiatric term a great many symptoms or conditions of quite different origin: homosexuality and obsessions; moral insanity and conditions of sensitive over-conscientiousness; faulty development through pathological genes and lesional diseases (such as schizophrenia, ixophrenia, etc.); morbid changes in the frontal lobes and constitutional hypomanic moods, etc.

Often one hears psychopathy described as abnormal mental conditions appertaining neither to the classical vesanias nor to the oligophrenias. This definition is, however, unsatisfactory even from a logical point of view, as both *differentiae specificae* are negative.

If one tries to tell what kinds of clinical morbid conditions and insufficiencies are confounded under the term psychopathy, one would find approximately the following conditions:

1. Conditions of psychological insufficiency or maladjustment on the basis of minus variants of the constitutional radicals.

To this group belong the very frequent sub-solid variants that play such a great criminological part as swindlers, cheats, mythomanic fantasts, dupeurs, mystifiers, etc. Then the shy, timid, over-scrupulous subvalids with their tendencies to distempers, obsessions, narcomanias.

The substables of depressive or hypomanic types.

Even the plus variants of the constitutional radicals can develop states of insufficiency as some superstables with subcapacity or cerebral lesions of different kinds. These factors can originate rigid inflexible ascetic and unrealistic fantasts.

2. Misdevelopment on dyshormonic ground, especially sexual aberrations, homosexual and others. Here it is irrelevant whether these misdevelopments are caused by hormone factors alone or by such factors in connection with environmental influences.

To this group also belong the various kinds of dysmorphias (eunuchoids, gynecoids, infantiles, etc.).

3. Psychoneurotic conditions originating from early environmental agents, on the bases of constitutional plus or minus variants or lesional variants. The psychopathological result of these factors may be fixed neurotic attitudes or warped characters.

4. Lesional variants, among whom there are not diagnosticated schizophrenic conditions (e.g., so-called schizoids, schizophrenia simplex), hypophrenic conditions or slight encephalitides (Sjöbring encephalitis), traumatic insufficiencies, and the conditions that were formerly called epileptoids, epileptic characters or *epilepsia larvata*, but have now by Strömgren been given the good

and characteristic designation ixophrenes. To the latter group certainly belong a lot of the aggressive, explosive persons with tendencies to assaults of different kinds. It is an important fact that one often finds electroencephalographic dysrhythmias of epileptic type in non-epileptic relatives of epileptics. The great frequency of dysrhythmias in criminals of the assaulting type seems to indicate that many of these are ixophrenes.

5. Allergic conditions, with disposition for local or diffuse cerebral œdemata, giving rise to disorders of mental functions through diaschisis or in other ways.

Donner has of late described a case where a person in combination with an attack of urticaria showed symptoms of increased intracranial pressure, ending with loss of consciousness.

In the older psychiatric literature, cases of acute cerebral œdema were described among others by Rieger, who called these conditions *Akute Hirnschwellung*. As the nature of allergic states was then unknown, these conditions of acute cerebral œdema could not be satisfactorily explained.

6. Narcomanias or euphomanias, where certain symptoms depend on a chronic intoxication of some kind, but an individual flaw must exist, which explains why some people become euphomanes, whereas others do not.

7. Sub- or misdevelopment of the emotional life with consecutive disorders of activity. It has been supposed that such conditions, which are very frequent among maladjusted and criminal persons, originate from hypoplastic or dysplastic states in the diencephalon. Whether there is anatomic evidence for that hypothesis I do not know. The existence of the clinical condition of emotional hypoplasia is, however, indubitable.

The coexistence of lesional hypothalamic states (destruction of hypothalamus or impediment of its function by tumours) and conditions of social and moral maladjustment is shown by the cases reported by Cox (1937), Dott (1938), and Alpers (1940).

These cases revealed a great many traits characteristic of asocial psychopaths: a lack of inhibition, together with the development of coarse traits; carelessness in habits; obvious antisocial tendencies; and a complete lack of insight into these changes. In those who survived operation for removal of the tumour the personality once more became normal. It is of special interest, too, that in those who died there was no evidence of damage to the cortex.

8. Conditions of specific vulnerability in the cortex shown by electroencephalographic dysrhythmias concomitant with small variations in the composition of tissue fluids.

Thus, one finds dysrhythmias in states of slight hypoglycemia, with a decrease of blood sugar to 70–80 per cent. of the normal values, whereas dysrhythmias do not occur in healthy people until the blood-sugar value has fallen to 50 per cent. Further, such dysrhythmias have been found in slight hypo- and hyperoxemic states. These changes in the cortical rhythms were associated with some degree of impairment of judgment and clouding of consciousness (Hill and Sargant, 1943).

These findings prove the connection between mental disorders and a specific cortical supersensitivity to small changes in the tissue fluids.

About 60 per cent. of the maladjusted exhibit abnormalities in the EEG,

some of epileptic type. Further, there is a close correlation between abnormal EEG and aggressive psychopathy (65 per cent.), and a significantly higher proportion of dysrhythmias among behaviour problem children. In Hill's cases the correlation of EEG to the personality age was greater than to the chronological or mental age, which suggests that the essential immaturity of aggressive psychopaths and of the behaviour child with temper tantrums is associated with a real subdevelopment of the cortex.*

From this brief summary one seems entitled to infer that most, if not all, the conditions called psychopathies are states of psychic disease. In this connection I should like to emphasize that from the time of Charcot there has been a general trend in medicine to transfer such conditions as were formerly regarded as abnormalities *sine materia* and provided with the inadequate designation " functional conditions " to the group of tissue lesions. The last step on this way is Sjöbring's discovery of the hypophrenic conditions, slight encephalitides, allergic states, and the findings of cortical dysrhythmias in epileptic and ixophrene persons, and in connection with slight changes in the tissue fluids.

The logical claims on a clinical diagnosis are :

1. If possible it should throw light on the condition and not only on its symptoms.

2. It should have a single sense so that there should be no doubt about the clinical condition or entity which is meant.

3. It should refer to conditions associated with factors that are independently variable, lest different diagnoses signify identical clinical entities considered from different sides or manifesting themselves in different shades.

4. It should be founded on an individual psychological and clinical analysis as thorough as is permitted by the existing development of science.

The diagnosis of psychopath and psychopathy does not satisfy any of these claims. It does not give any knowledge of the nature of the condition or entity. It is ambiguous. It does not refer to conditions associated with factors that vary independently. It is founded on insufficient analysis.

Therefore it gives an incomplete, warped and misleading picture. It bolsters up thought laziness, and is an obstacle to the progress of clinical and scientific thought in psychopathology. Therefore it should be abrogated as theoretically unsatisfactory, practically misleading and destructive to scientific thinking.

It is now about thirty years since I opened a campaign in Sweden against another term that has played a fatal part in medicine, i.e., " imputability " or " penal responsibility." The term is several centuries old; it is an alloy of theology, philosophy and jurisprudence, and has therefore a patina of venerability which has given it a strong viability. In spite of this it is now practically dead in Sweden, at least in scientific language.

The term psychopath is only a medical parvenu. It has no venerable descent of theology or philosophy, but derives from common medical thoughtlessness and thought muddle. How long it will survive I do not know, but I

* W. Grey Walter, " Electroencephalography " in " Recent Progress in Psychiatry," *Journal of Mental Science*, January, 1944.

know that I cannot dedicate the next thirty years of my life to its destruction, but must leave that task to younger colleagues.

From the above it appears that one cannot talk of a general treatment of psychopaths, as this term does not indicate the nature of the varying conditions for which it is used.

To the man in the street the term psychopath generally refers to people with behaviour disorders of a more or less asocial kind. Many psychopaths, however, are not socially maladjusted; for instance, persons suffering from obsessions, allergic conditions or slight encephalitides. Many neurotic people show psychic insufficiency of some kind which hampers them in their social tasks, but these symptoms of insufficiency need not have any asocial significance.

In a large group, however, the social maladjustment is a dominating trait which makes these people a torment, nay, even a danger to their environment. Owing to imperfect social organization, their treatment is an especially intricate and hitherto unsolved social and criminological problem. These emotionally aggressive and morally cool persons on the one hand, and on the other the flaccid inept and socially maladjusted ones, are at present, perhaps, the greatest burden on social welfare work.

The practical therapeutic difficulties with regard to these individuals can be summarized under three heads:

1. Society has no organization and no institutions for the treatment of such adult persons before they are prosecuted for crimes. Every doctor has met the characteristic cases when a worried father or mother seeks advice and help for a son or daughter who is on the way to social frustration or perdition. He or she is pleasure-seeking, unreliable, untruthful, does not keep promises, will not work, is dishonest, cheating and thieving, is attracted by low company, is sexually loose, etc., but he or she is not feeble-minded, not incapable; he could work if he " would." Often the doctor does not find any symptoms of psychosis or neurosis; he cannot prescribe any medical treatment; he advises change of environment, boarding in a decent family in the country and so on. Generally these measures are of no use; the case develops with a seemingly fatal regularity and often ends in a court of justice. In the good old times one exported such cases to the U.S.A., where most of them went to the dogs or were sent back by the consulates.

Sometimes these cases seem unexplainable to the family. The maladjusted son or daughter is a black sheep; all the other members of the family are decent and thrifty persons, and there is no mental taint in the family. In these cases one has probably to do with persons who suffer from some hypophrenic condition (a slight encephalitis, a post-traumatic insufficiency or other brain lesion, an allergic condition which has produced the warping of the social and moral attitudes).

When such persons commit crimes and are prosecuted there are two kinds of treatment, both of which have been tried here in Sweden and both found insufficient.

2. One of these is declaration of impunity with subsequent treatment in a mental hosiptal. But these people are generally lucid and formally ordered,

often underground and intriguing, more or less pronounced asocial individuals. They are disturbing, even dangerous in wards for quiet and sensitive mentally diseased persons. If placed in wards for unruly, vehement or uncleanly patients they are irritated and tormented by the abnormal behaviour of these patients.

They need a special medico-pedagogical treatment, which most alienists are not fit to administer, not having been trained for this task.

The presence of a great number of asocial, often very dangerous, maladjusted psychopaths in mental hospitals is an obstacle to the development of these institutions to a full equivalence with the hospitals for physically sick persons.

In brief, the so-called psychopaths do not suit the mental hospitals and these do not suit the psychopaths.

3. The second tried form of treatment of these lucid asocial persons is the prison. Among prisons I also include the institutions for certain dangerous abnormal criminals ("institutions of security," which are used in Sweden) as long as they are administered by prison staff under the central direction of the Prison Board.

The trend of scientific development shows with increasing evidence that persons supposed to belong to the group regarded as mentally misdeveloped on account of pathological genes are people suffering from mental disease, engendered by cerebral lesions.

To put these people in prisons is in contradiction to the medical claim that every member of human society, even if he has committed a crime, should be treated as humanely as is consistent with the security of society.

Therefore Swedish psychiatrists, with some rare exceptions, are opposed to the principle that mentally diseased persons, whether belonging to the classical vesanias or not, should be treated in prisons under the administration of the prison staff.

Further, the great group of so-called psychopaths is at present the most important theoretical problem of psychiatry, and the greatest practical problem of criminal policy and social welfare on the whole.

Certainly the prison administration declares that they will treat these diseased people in psychiatric wards in prison. But that is only nice talk as long as these wards are not provided with the necessary technical and personal resources, and the discipline and punishment spirit still prevails in the prisons.

The implication of these facts is that the so-called psychopaths must be placed under medical care in order to be scientifically studied and treated according to the diagnostic results achieved. The study of these cases needs all the personal, technical and diagnostic resources of clinical psychiatry. The EEG must become a routine examination in these cases, and be associated with biochemical studies and experiments to reveal latent cortical vulnerabilities. The new biological treatments, shock-therapy, lobotomy or chemotherapy, must be tried. It is unpractical to try for years by medico-pedagogical means to persuade aggressive or slack maladjusted people to behave in a socially acceptable way, when it is possible to make them socially adjustable through a lobotomy in half-an-hour.

Perhaps a medico-pedagogical treatment will for a long time be the only

practicable therapeutic measure, but in such cases it must be given by a medically and otherwise trained personnel that is really up-to-date as to its task.

Summary.

The organization of the treatment of mentally diseased, abnormal or defective people should be carried out on the following lines:

For socially maladjusted people, delinquent or not, there should be established a medico-social treatment under central and local medical guidance. This organization should belong neither to the prison administration nor to the mental hospital organization.

This kind of institution for criminal policy and social welfare should be open also for such cases of social maladjustment as are liable to criminal development, but have not so far committed crimes.

Treatment in the institutions must be combined with out-patient treatment, and with consulting and preventive agencies for behaviour cases of all kinds. In Sweden there is a rudiment of such consulting and preventive agencies in the institution of *Skyddskonsulenter* (protective agents) provided by the new legislation on probation (1939). These, however, lack medical assistance, and are therefore rather primitive.

This organization must have at its disposal the best technical resources of clinical psychiatry for diagnosis and treatment, and be administered by a sufficient number of doctors with the best possible clinical training, and provided with competent psychologists and social workers as their assistants.

One of the most important tasks of such an organization would be to procure a fully competent staff for its very difficult work.

Only when we have tried to realize this project of social welfare are we entitled to say that we have taken the first step towards a rational and effective treatment of the great group of mentally diseased abnormal and defective persons who have been herded together under the inadequate and vacant diagnosis psychopathy and psychopaths.*

* *Cfr. O. Kinberg*, " Särskilt yttrande til K. Socialstyrelsens utlåtande över förslag till lag om samhällets barnavård," *Soc. meddel.*, 1934. O. Kinberg, " Om kriminalpolitikens centrala organisation," *Sv. juristtidn.*, 1937.

METHODS OF OFFICER SELECTION IN THE ARMY.*

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IN June, 1940, the first Area Psychiatrists in the United Kingdom, of whom I was one, were appointed. Although at first we were told that there were not many psychiatric cases, and in spite of the lack of encouragement in some areas, clinics were set up, and very soon the psychiatrists were overwhelmed by the number of patients sent, both officers and men. It became apparent to all of us who were doing the work that many of the men could have been eliminated at the source, for by going into the history of the individual patient, and giving him intelligence tests, one could have foretold fairly accurately his future in the army, i.e. whether he would be able to be trained as a soldier in a particular arm, and his length of service before his breakdown. But the process was that of elimination. The psychiatrist working alone managed to sort out the soldier, but there was at that time no disposal method except to hospital, which was not very useful for the dull and backward, and the chronic anxiety states. At the end of 1940, at the suggestion of a Command Psychiatrist, a Directorate of Officer Selection Personnel was set up, so that men joining the army would have their intelligence tested, and be interviewed by a personnel selection officer, and the dull and backward and the difficult cases interviewed by the psychiatrist, either for rejection from the army or for transfer to the unarmed or armed Pioneer Corps, or to any arm which was considered suitable. This process has continued since then, and has made great strides. At present no man is posted to any particular arm, but he comes into the army to primary training centres, where he is tested and interviewed, and after six weeks' general training is then posted to the arm most suitable for him. This procedure helped the problem of "other ranks," and it was hoped that the incidence of psychological illnesses in the army would be lowered, and the number of men sent to the psychiatrist brought within reasonable limits. Till then, the psychiatrist in the army had been working very fast, seeing as many as thirty to one hundred men a day.

But the problem of officers still remained, for the numbers of officers seen at psychiatric clinics were comparatively high, and they differed in no way from other ranks in that their destiny could have been foretold by an interview by the psychiatrist, plus intelligence tests, but it was not until December, 1941, that anything was done. At that time, production of officers was

* A Paper read at the Spring Meeting of the Northern and Midland Division, held on April 25, 1946, at the Central Hospital, Warwick.

insufficient to meet the army's requirements. Not nearly enough candidates were coming forward, and some 20 to 40 per cent. of cadets were returned to their units from OCTU after varying periods of abortive training. This high rejection rate could not go on, and it showed that the method of selection was faulty. The method consisted of picking men from units and sending them for a short interview by Command Selection Boards, which consisted of a colonel and two lieutenant-colonels brought in from surrounding units. It was quite obviously a "hit or miss" method. One colonel made a list of "officer qualities," and gave marks for intelligence, experience, leadership, captain of cricket, etc., and then added up the result at the end.

A new method was put forward by the Command Psychiatrist of the Scottish Command, who, by means of intelligence tests, psychological tests, and psychiatric interview, had found it was possible to predict accurately which candidates would do well at OCTU, which would be satisfactory, and which would be rejected. This method of selection was submitted to the Adjutant-General, and the first new type Officer Selection Board was set up in Edinburgh experimentally at the end of 1941. An ex-OCTU commander acted as President. In order to validate the procedure, the entire intake of two OCTU courses and a senior officers' course was passed through the Board, and a prediction made. At the end of the courses it was found that the reports of the commandants of the respective courses and those of the experimental board coincided to an astonishing degree. With the addition of practical out-door tests, conducted by military testing officers, the new system was approved and a number of similar boards were set up in each command. At this stage various modifications were introduced, and the position of the Boards was as follows:

President.
Deputy President.
Two Psychiatrists.
Three Military Testing Officers.
Three Personnel Selection Staff (N.C.O.'s, but later commissioned as "psychological officers"), who were educational psychologists.

This establishment was found to be sufficient for a Board coping with 80 candidates in a week. How were we going to set about bringing all the candidates to such a Selection Board? First, the Army acquired a number of large country houses, because it was necessary to test the total personality of each candidate, and as far as possible to get them out of their army environment and assess their ability to become good officers.

The candidates, having been recommended by the Commanding Officers, come to the Selection Board for three days. During this period they live in a mess resembling as closely as possible an officers' mess, and are treated as cadets. They go through a series of tests and interviews designed to throw light upon them from as many angles as possible, and their fate is settled at a Board Conference held on the final day. Each member of the Board contributes his views on the candidate and the President sums up and decides. The President, a colonel, is a regimental officer of good standing, young enough to make easy contact with the potential candidates. He, with the assistance

of a deputy president, a lieutenant-colonel, interviews every candidate and presides over the Board Conference, as well as directing the general policy.

After the candidate had come to the country house and had settled in, he had a talk from the President and was then taken to testing rooms, where he was given the following psychological tests: (1) questionary; (2) intelligence tests; (3) psychological tests, sometimes with projection tests. The factual questionary was given first, and acted as a buffer for the more difficult intelligence tests.

The Questionary.

Part I of the questionary gives the military history (including length of service, promotion, and action), education, employment, and games. From this information it is not difficult to see whether the man has progressed or stagnated, whether he has had any experience of leadership in the Army or in civilian life, whether he has made the most of his opportunities, or accepted life passively without effort on his part. This part may be used by the President as a guide to his interview.

Part II of the questionary, the medical and personal section, is confidential to the medical and psychological staff. The questions in it are arranged to reveal, not only the physical make-up, but also the presence of any psycho-pathology. For example, youngest children, only children, and those brought up by step-parents or strangers may present problems, and it is important to discover whether successful adjustments have been made in such cases.

Part III of the questionary deals with interests and the way leisure has been spent. The sports played tend to indicate the individualist, the solitary man, the good mixer. This may be confirmed by the interests, which distinguish also the energetic from the quiet, the shallow from the profound. Finally, in this part of the questionary the candidate is asked to write a description of himself as a friend, and then as someone who disliked him would do so. This enables the psychologist to see what insight a man has into himself.

Intelligence Test.

Whatever qualities comprise the make-up of a good officer, it is certain that adequate intelligence is of prime importance. It is fortunate, therefore, that this is the one most easily measured objectively, thanks to pioneer work in the educational field. The main difficulty in using one of the conventional tests in the Army is their dependence to a greater or lesser extent on education. To overcome this, Raven's Progressive Matrices is used, where the candidate is asked to complete a pattern from a number of possible answers, only one of which is correct. Two versions are in use. Twenty minutes are first allowed; work is then stopped and a line drawn across to mark the point reached. A further twenty-five minutes are given for completion and correction of what has already been attempted—a corrected answer being circled to distinguish it. In this way a measure of performance under pressure (or speed test) is obtained, as well as the ultimate performance (or power).

In addition to this, the candidate does a verbal test (V.I.T.), consisting of synonyms, opposites, analogies, and similar well-established types of question.

Note is made of any large discrepancies between scores in the two tests, or in the two versions of the Matrix. Such differences are of diagnostic value. A Matrix higher than V.I.T., for example, suggests that the subject's education has not kept pace with his intellectual possibilities. A higher V.I.T., on the other hand, suggests that the subject is rather more academically inclined. In the same way a higher grade at speed on the Matrix indicates the rapid, rather superficial worker, while a higher grade in the longer version picks out the slow, steady, accurate man.

The tests are marked on a percentile scale, which means the determination of the person's position in a hundred unselected people. If he falls in the top 10 per cent. he comes in Selection Group 1 (S.G. 1); if in the next 20 per cent., in S.G. 2; in the middle 40 per cent. (i.e. he is average), in S.G. 3; in the next 20 per cent., S.G. 4; and in the bottom 10 per cent., in S.G. 5. It is considered that an officer should be in the first two groups, or the top 30 per cent. of the general population. This figure was reached only after it had been found in practice that successful serving officers, such as those attending the Company Commanders' School at Edinburgh, are rarely below this standard. This officer intelligence range is then itself divided into similar percentile grades: "A" the top 5 per cent. of officers; "B" the next 20 per cent.; "C" the middle 50 per cent. (i.e. average officer); "D" the next 20 per cent., and D/E the bottom 5 per cent. Below is "E," in which a candidate is regarded as unsuitable, as his intelligence would not then be above the average of other ranks.

Later on a "Reasoning Test" was added to the battery of tests.

Psychological Tests.

These are given by the psychologist or the sergeant tester.

Word Association Test.

The questionary provides information about the life-history and career of the candidate as he himself regards it, but it is necessary to probe a little deeper. For this two tests are used. It has been known for some time that if a person is given a word and told to reply with the first thought that comes into his head it is possible to tap the "unconscious level." This technique, originally devised by Jung, has been modified and adapted for use on a group. A series of cards, each of which has a word on it, is shown in rapid succession, and the candidate has to write down his immediate reaction on seeing the word. The responses are then scrutinized by the psychologist. For example, from the answers to certain key words such as Mother, Afraid, Home, Worry, he can distinguish the anxious, spoiled, homesick youth from the stable, well-balanced man. Again, a number of words can be interpreted either in a war or non-war sense—Butt, Barrel, Desert, Arm, Front. The man with drive who is war-minded tends to seize on the military meaning and reject the other. All these points are valuable clues to personality.

Thematic Apperception (Story) Test.

The second test referred to above is an adaptation of Murray's Thematic Apperception Test, again modified for group work. The candidate is shown a slide projected on a screen, depicting an ambiguous social situation, which he is told to consider as an illustration to a story. He is then invited to write the story, showing what events have led up to the situation, what the characters are thinking, saying, and doing, and what the final outcome will be. The slide is shown for 30 seconds, and then 3½ minutes are allowed for writing. Here the candidate tends to project himself into the picture, identifying himself with the principal character. For example, one slide shows an elderly woman standing with her back turned to a young man who is fingering his hat, both of them looking depressed. The tendency is for the candidate to expose unwittingly his own relations with his home. Care must be taken with the interpretation of these stories, but with experience valuable information can be brought to light, enabling an opinion to be formed in the case just cited, for example, as to whether there is still parental dependence or whether the subject is independent. If all the stories end happily, with the hero overcoming his difficulties, it is likely that the writer is well balanced and energetic. On the other hand, where the hero is helpless, victim of his circumstances, and passive, there is a strong suspicion that the writer himself is an ineffectual person with little drive.

The work of the Psychologist on an Officer Selection Board consists of two parts: the measurement of a candidate's intelligence, and a tentative assessment of his personality. The tentative nature of the second part is stressed, because nothing more is attempted than to find Personality Pointers, which are hints or suspicions derived from paper work for the Psychiatrist to confirm or refute by interview.

This testing took a long time—something like three-and-a-half hours or more. At the end the sergeant tester and psychologist made "personality pointers," and assessed the total personality of the candidate without seeing him. After some experience they got very close to it, and it took a very brave psychiatrist to go against what the psychologist said.

The Psychiatrist on the Officer Selection Board interviews each candidate and makes an assessment of his personality. In England only 50 per cent. of the candidates were sent to him, but in the Middle East all candidates were seen by a Psychiatrist. In his interview he is aided by the "personality pointers" which the Psychologist has prepared for him.

To find out what a man really is, it is necessary to know something about his early life, his upbringing, his family background; to discover what sort of a person he has been at each stage of his development; to know what use he has made of the opportunities presented to him, and how he has dealt with the obstacles which have fallen across his path. The Psychiatrist must also enquire into the man's contact with others, his sociable and solitary tendencies, his day-to-day moods, his attitude to life. When all this is known of any individual, the story of his life becomes a reasonable whole. One has a vivid feature film in place of a disconnected series of flat and uninteresting stills.

Of his knowledge of what the candidate has been in the past and what he is at present, the Psychiatrist is able to prophesy fairly accurately how he may be expected to react in similar situations in the future. A man's basic personality seldom changes much in adult life. Occasionally some remarkable development takes place, but there is usually a special reason for this, and one which the Psychiatrist can detect. Indeed it is not uncommon for the Psychiatrist to say that given greater opportunities this man may well surprise everyone, revealing latent abilities which hitherto have had no chance to develop.

Many of the young officers who have failed to make good in the past have turned out to be men who would never have been commissioned had they come before a Psychiatrist. The Psychiatrist is trained to detect and exclude not only the mentally unstable, but also all those who habitually evade their difficulties, unloading their rightful responsibilities upon others, or seeking refuge at times of crisis in a series of petty ailments which enable them to retire gracefully, surrounded by the misplaced sympathy of all their friends. He can detect the selfish individual so wrapped up in himself and his own affairs as to have no thought to spare for the welfare of his men. He can detect the aloof, solitary, isolated man, who lives in a dream world, out of touch with reality. He recognizes the feeble, ineffective individual who has never learned to stand on his own feet, always asking for support, always leaning upon others, as helplessly dependent as on the day he was born. He sees through the bluster of the showman and the bully who, knowing their own inadequacy, try to cover it with a glib tongue or a show of force.

The Psychiatrist is happy, too, to recognize true metal when he finds it. He seeks the man who comes of sound stock (in any walk of life), brought up by his parents to be responsible and self-reliant, happy in his contact with his fellows, robust in his attitude to adversity; the man who has shown in every phase of his career a strong urge to achieve something positive. Such a man is likely to have a firm sense of purpose in relation to the War effort. With that addition he will make a sound leader and a good officer.

The Work of the Military Testing Officer.

It is probable that a process of selection for any walk of life could be founded on intelligence and personality tests, coupled with psychiatric interviews, for these are tests equally applicable to any profession or calling contemplated by the individual tested. However, in addition it is necessary to apply special aptitude tests, appropriate only to the occupation for which the candidate is destined, and indicating more specifically his ability to adapt himself to its peculiar exigencies.

In the process of officer selection these special aptitude tests are represented by the tests carried out by the Military Testing Officer, which, broadly speaking, seek to provide that officer with opportunities for observing the reactions of a candidate for a commission when confronted with a situation calling for qualities of leadership and personality necessary to an officer.

In the earlier stages of officer selection, it was considered that the role of the M.T.O. was to test the candidate's basic military training, but it was soon

realized that this training could be imparted at OCTU, and that it was more logical to consider first the candidate's suitability to undergo such training at all. In considering this question the tendency at first was to take each candidate in turn and put him through an individual test, e.g. forcing him to assume command of a body of men and order them about the completion of an allotted task, or calling upon him to carry out some physical task on his own. It was seen, however, that conclusions based upon observing such activities were frequently founded upon false premises, and accordingly the basis of the M.T.O.'s tests underwent a complete change.

It was realized that a more reliable indication of a candidate's qualities could be obtained by observing him as a member of a group confronted with a variety of situations, all presenting different problems for solution. The indication was more reliable, firstly, because each candidate was under observation all the time, and secondly, because he was not forced artificially to take a lead, but was allowed to find his own level in the group.

The principle therefore applied by the M.T.O. at present is to put his candidates into a group and, without appointing a leader, to observe this group engaged in as varied a selection of activities as possible. Instances of their activities are as follows:

1. A Group Discussion in which the group is allowed to choose its own subject and discuss it without any interference from Testing Officers.

2. Group tasks which are practical problems, requiring a certain amount of ingenuity and organizing ability for their solution, as, for example, the construction of a bridge over a ditch.

3. Group Games in which the emphasis is on planning, quick thinking, and the ability to look ahead.

4. Team Activity in which the candidates work as members of a team, in competition with another team, and the interesting feature is their ability to sink their individuality and assist others of their side.

The activities outlined are regarded simply as a variety of "situations," in the course of which the qualities of the individuals taking part gradually become apparent, and by the end of which the Testing Officer has built up a cumulative general impression of each man from which he is able to assess one general grading of his "officer quality," and thus a correct picture of the function of the M.T.O. is obtained.

An important point is that while the candidates are under test they should live in a congenial and friendly atmosphere. Accordingly, any attempt at regimentation should be avoided, and they should live under "officers' mess" conditions. This latter arrangement enables Testing Officers to live with them, and produces an easy atmosphere in which even the most diffident candidate has time to settle down, and by the second day at least will show whether he has the necessary qualities in him.

One final point needs emphasis. Any attempt to formalize the Testing Officer's opinion should be avoided. It has been impossible to agree upon a complete list of officer qualities, and therefore to make up such a list and insist upon the Testing Officer making a note on each quality in relation to

each candidate is profitless. The Officer's final opinion should be in the form of a report of his own composition, in which he records his impression in an informal way, and finally assesses a grading on officer quality as a whole.

That, in the main, is how officers were selected in the Army. Each test in itself could be an hour's lecture. And what was the result? There has been a follow-up system at the War Office ever since this "officer selection" has been going on, and up to a point it has been very successful. In February, 1942, 20 to 40 candidates out of every 100 were being sent back to their units through OCTU from the Middle East as of no use as officers. After the Board had been set up and was working, this figure came down to one candidate per hundred.

One of the difficulties of selection was that we had no adequate test of courage, even if you call it "war purposiveness." We were able to assess a quality like "courage" from the adverse reports of officers who had been sent back from the desert to Cairo after having failed to come up to the standard expected by their commanding officers. Amongst those who had been sent back were many who had psychotic breakdowns, and who could have been eliminated by this new technique of officer selection. One officer I saw, six weeks after commission, had acute schizophrenia. We went carefully into his psychological test and previous history and could find no reason for it. He appeared to be a normal individual who had developed schizophrenia. This type of illness happened quite frequently in the Middle East and in India. It seemed to clear up in about six weeks.

The follow-up procedure not only followed the candidate through OCTU and his unit, but also into battle, and it is hoped that it will be continued into civilian life, so that we may see whether these men who were picked by the Officer Selection Board have really come up to standard.

During all this time many doctors in the Army wanted to know why psychiatrists were being used in selection, and why they were not doing clinical work. The answer is that "selection" to a psychiatrist is almost "preventive psychiatry," eliminating the men who would break down under undue stress.

This method has now been accepted by industry, and by the Government in picking higher civil servants, and for A.T.S. officers. It is used in India for selecting senior officers and Indian Army officers. In the Middle East we had to deal with various nationalities—Palestinians, Southern Rhodesians, South Africans, Cypriots, Arabs—and for each nationality various alterations had to be made in the psychological tests. There is now an Officer Selection Board for "regular officers," but unfortunately there is no psychiatrist on this Board.

Selection of officers was the first positive approach to the scientific selection of leaders, and it is hoped that it will continue in other fields and levels as a branch of preventive psychiatry.

Additional Note by Major S. Yeldham, R.A.

The President was the head of the Selection Board; he was the judge, and took all recommendations from other people, weighing up various views, and making the decision.

As regards the "military testing" side, we wanted to look at the man in

action—to see his personality in contact with other people. In the end it was decided that it was better to form ten men into a group and give them a series of situations where they could show themselves as better or worse than the next man. We wanted to see them as individuals, members of a group, and as people in action, dealing with practical things and with people, and with a combination of both.

To begin with we had to get a good officer, of high intelligence, to act as Military Training Officer. He had to appreciate what others were doing and put the right construction on their actions. He had to be a man who had gone through the whole of the psychological tests, well balanced, and interested in other people. He need have no psychological training, for he was told what would emerge from various tests given. He was given a series of talks by the psychiatrist and shown men going through tests. When a Military Training Officer was trained he was given a group of ten men for two days, during which he was always in contact with them, ate with them, and gave them their tests, etc.

With regard to Group Discussion, the initial test was arranged as follows: ten men in a room, comfortably furnished, if possible, to put them at their ease. The M.T.O. tried to bring himself down to their level or raise them up to his. He tried to be one of the party. The group were told to discuss anything they liked, and suggestions were called for. Naturally three or four men in the group would suggest a subject. The M.T.O. would stay outside the circle formed by the group, and would sit and make notes on the interest in the type of subject proposed, how well it was received by the remainder, and how it was handled by the proposer. Once the discussion had started the M.T.O. would see how much each person contributed, how much confidence a man had in himself and other people, how easily he was led astray, how easily he could persuade others to take up his suggestions, no matter how impracticable they were. The M.T.O. watched people who were silent in order to discover why.

From a group discussion like this—emotional and theoretical aspects—the group had to proceed to where things had got to be done, e.g. make a large hole in the ground and carry heavy articles across it—a matter of intelligence and improvising all the time. Then the group would review the result in detail, two or three suggestions would be put forward and recommendations made, the M.T.O. observing the reasons for these—whether a man was aggressive, a man to be reckoned with, whether he could command attention, etc. Or maybe there would be a man who "worked out problems in the sand" and hoped the M.T.O. was watching. Others would start on a job without any consideration, and would be merely passive. The man who started the job was not always the leader. It was thus possible to get a good idea of a man's capabilities in controlling people, picking other people's brains, etc., and to obtain a general impression as to what sort of man he was. The group was given a series of tests like this.

It was found necessary to have one test where the M.T.O. would single each man out and observe him alone; he might often be good in a group but not alone. The M.T.O. would talk to him about anything he liked, whether he was interested in his own job, etc. Giving about 15 tests the M.T.O. collected quite a lot of information about him, meanwhile maintaining his confidence and keeping him feeling that he was a thoroughly good fellow!

At the end of the tests the M.T.O. wrote a report on each man's personality. The team met at the final board meeting, where every candidate was considered, and the President—who had interviewed the man so that he knew his appearance and had a fairly general picture of him—sat in judgment, also calling on the Psychiatrist to give his opinion. The President then welded together the reports of the Psychiatrist and M.T.O. and decided whether the man should pass.

The method could be used in civil life. It would have much the same result, particularly in regard to selection for executive positions. There is no reason why any person should not be made the subject of a selection procedure if he is to be in charge of people who have themselves been picked.

Discussion.

Dr. Van Someren: I would like to ask whether there could be selection for doctors, and more especially for psychiatrists.

Dr. Gillman: I consider there is a place for selection in the medical world.

Psychiatrists should be selected. There should be a type of selection for undergraduates and for children going to secondary schools. Although individuals should keep their ideas of what they wanted to be, they should be guided into suitable professions. Selection would also help doctors who wished to specialize in any branch of medicine—psychiatry, E.N.T., etc.

Dr. GOULD: There is a point which might be used as an argument against selection. Doctors, wherever they are, are usually very competent in their work. I think selection is desirable, but would suggest that there may be quite a definite point beyond which selection cannot go, except by the hard selection of "living it out." When it comes to selecting, the difficulties encountered in selecting doctors would be very much magnified, and only by eliminating the obviously useless would you get anywhere in selecting for high posts.

Dr. GILLMAN: I disagree—there is no proper judging of doctors' competence nowadays. In all selection people are graded, as they were in the army, into (*a*) those who are fitted to be future commanders in charge; (*b*) below that; (*c*) average; (*d*) below average; the poor officer and the bad officer. Doctors could be graded in the same way. Why should we have bad people in any profession? We should, by reasonable selection, following similar lines, be able to find the total personality in an individual—find his interests, and be able to guide him into a suitable profession or industry in which he is going to be happy. We cannot take away the fact that there are unhappy doctors—no one has investigated *why* they are unhappy in their work. If, with good intelligence, you are not happy in your work, you are usually unhappy because you cannot do it. We had to discharge one doctor from the Army—he should never have taken up medicine.

Dr. GOULD: I disagree.

Dr. GARMANY: I admire Dr. Gillman's methods of selection. We ought to sound a note of warning against accepting selection at the moment. It may well be that the excellent results which followed selection of officers were not ascribable to the accuracy of the method but to the closeness and prolongation of the examination. In the Navy we had a rather different set-up: men on the whole were in smaller groups; their attributes and difficulties were usually known fairly intimately by their officers. We found that on the whole not much was gained by personnel selection, and even our psychologists, who pretended to do personnel selection, knew that no one took a lot of notice of what they said. But we did find that the average executive officer, who was sometimes a most markedly stupid man, chose his fighting men with extraordinary accuracy, usually because he knew the men very well. We should not assume that because a man is unhappy in his work his difficulties are going to be remedied by changing it—the job is not always the cause of his unhappiness. I find that men who give trouble in one job usually give trouble in others.

Dr. GILLMAN: The Navy is a much more chummy service because they get the best personnel. The Army usually came last and had the worst material. So the Navy probably did not need selection in the same way. I do not, however, believe that anyone can say that a man would be a good officer because he knew him very well—this was tried in the Army and it failed.

Dr. MURRAY: Intelligence tests do not fluctuate, but emotional ones do—as the years go by there is sometimes a definite deterioration in medical men. Would you go so far as to say that one selection board is sufficient to plan a man's career for life?

Dr. GILLMAN: A doctor's intelligence is above the average intelligence of the population, but does not come up to the average officer. One selection board is not final—there should be a selection board at various stages—possibly three. In wartime the initial test had to be final on account of urgency. I believe that "selection" is going to become part of psychiatry, and that we shall need a lot of well-trained psychiatrists.

Dr. LADELL: I would like to ask whether there is any available literature about acute schizophrenia in wartime, as I have had cases referred to me as acute schizophrenics, and I could detect nothing but an "anxiety neurosis."

Dr. GILLMAN: When reports were made out by Medical Boards at home the typical symptoms were stated on the case sheet—auditory hallucinations, acute confusion, etc.—some of which resembled those of a toxic state. There is no doubt that everyone diagnosed "acute schizophrenia," and also no doubt that the condition cleared up in about six weeks, which would explain the absence of symptoms on arrival in England.

Dr. GOULD: I have known cases as mentioned which have shown signs of unreality, and in one case post-encephalitic disorder. The acute schizophrenic is confused, but it usually clears up. Some Americans have been talking recently about the slight amount of dementia or mental defect following schizophrenic states. Have you any answer to give?

Dr. BAMFORD: This point is somewhat of a "red herring." I was interested in the condition about twenty years ago and contributed one or two articles to the *Journal of Mental Science*. I do not think it is a military condition at all—it does occur in civilian practice. In a large mental hospital, with a fair admission rate, it was found that some cases recovered, others pursued a very rapid downhill course and became emaciated, and died within nine to twelve months. They had a combination of pathological features, i.e., a very small and narrow aorta with a very small heart, and in conjunction with this a fibrosis of the major viscera, mainly the liver, kidneys and spleen, and in addition a very large brain—a brain above the average in weight. The number of cases was not investigated, but nevertheless I did feel that a certain number might be described as acute or malignant schizophrenia.

I think both speakers have given very interesting addresses, and I wish to thank them. It has lifted the veil of secrecy that has surrounded the last few years. I have met a number of army psychiatrists who have been intensely enthusiastic about personnel selection tests, and for their extension to civilian practice. I do feel, from what army psychiatrists have told me, that there is a big future for personnel selection. I would like to congratulate Dr. Gillman on a most stimulating address.

Dr. CUTHBERT (Secretary): I wish to ask whether the process of selection brought to light emotional circumstances which might in the course of time in any case have produced neurotic breakdowns, and also does Dr. Gillman know anything about the application of the Modified Rorschach Test, possibly with a view to discovering these latent emotional situations?

Dr. GILLMAN: Yes, emotional situations *were* found. But we were out to select officers who would give us twelve months' good service, and who might during that time spend only a few minutes in fighting. It was difficult to assess what would happen in a few years' time. Unless a man is showing frank symptoms I do not think that anyone can say that he will break down, unless he knows the stresses and strains and situations that the officer will undergo. A lot of people broke down who, with all our investigations, showed nothing from the psychiatric point of view, i.e., an apparently stable individual with a good personality was sometimes evacuated to the "Exhaustion Centres." These got better and went back to the fight—but we were not able to follow these up properly. The Modified Rorschach Test was tried out at Edinburgh and was a failure—candidates could not be trained and the environment was all wrong.

Dr. DRURY: It was brought up by the G.N.C. whether group tests for nurses was advisable before they joined the service at all; there were different opinions as to this. One speaker said that for the last ten years we have had a diminishing number of candidates for nursing, and that the next five years would be even worse. Opinions differ on this—probably a test would be very different after two or three years' training.

* * * * *

The Chairman in closing the discussion, proposed a vote of thanks to Dr. Gillman and Major Yeldham for their interesting and stimulating papers. This was carried by acclamation.

Dr. Stern was thanked for his hospitality and kindness in arranging a very interesting meeting.

Part II.—Reviews.

Psychoanalysis and Its Derivatives. By H. CRICHTON-MILLER, M.A., M.D., F.R.C.P. Second edition. London: Oxford University Press, 1945. Pp. 272. Price 3*s*. 6*d*.

Crichton-Miller's little book in the Home University Library well deserved a second edition. It gives a clear exposition of Freudian theory, and there are also excellent chapters on Analytical Psychology, Individual Psychology and the work of Prinzhorn. Especially good is the criticism of psychoanalysis and more particularly the section on the uncriticizability of the psychoanalyst himself. Crichton-Miller's main objection to psychoanalysis concerns one of its basic tenets—scientific determinism and the pessimism entailed. For others it is just this point of view that is acceptable, and puts psychoanalysis in a different category to the thaumaturgical theories of other psycho-therapists.

STANLEY M. COLEMAN.

Grundformen und Erkenntnis Menschlichen Daseins (Formative Principles and Knowledge of Human Existence). By L. BINSWANGER. Zurich, 1942.

There have always been some thinkers who maintain that the rational and quantitative method of modern science is only one, and at that a limited method of enquiry. They have especially doubted if it could be applied to the science of man himself, particularly to that of his psychic life, for it is in the study of those subjective phenomena which form the basis of psychology that observation of the world of objects, systematization and correlation of facts, testing of hypothesis by deliberate experiment seem most inadequate as methods of approach. One cannot "count" or "measure" emotions, interests, moral decisions and beliefs—subjects which lose their essential quality as soon as they are submitted to rational analysis and defy experimental verification. This does not mean that such subjects are not to be studied; these states of mind, such thinkers would hold, represent the most important elements in human existence, and are in the long run the foundations even of scientific thinking. It means that a different approach is required—one in which the student relinquishes any attempt at objectivation and quantification.

The nature of this approach has been hotly debated among Continental philosophers for at least two decades. New schools of thought have sprung up under different names, but all forming part of a European movement contesting the application of natural science methods to the study of man. For example, one thinks of "Phaenomenology" (Husserl); "Existential Philosophy" (Jaspers), recently taken up by French writers as "Existentialisme"; "Ontology" (Heidegger) and "Anthropology." (The latter term, generally used for the science of man's physical nature, was revived in its antiquated meaning among romantic thinkers early in the nineteenth century, when it denoted the knowledge of man's existence outside nature.) Except for some theologians, Anglo-Saxon writers and philosophers have taken little notice of this movement.

Psychiatry, a field ever attractive to philosophical disputants by reason of its uncertain foundations, has not been ignored by the new method of inquiry.

Prof. Van Der Horst, of Amsterdam, has recently published in two volumes an *Anthropological Psychiatry* written in Dutch. Dr. Binswanger, one of the leading psychiatrists and philosophers in Switzerland, first published a series of papers in which he analysed the "existence" of the manic patient with flight of ideas, and later of a paranoid schizophrenic. He showed in these articles how the anthropological aspect helps to understand the psychopathology of patients.

In the present volume he deals with a much more general problem of normal psychology. He analyses "love" as one of the basic forms and moving principles of human existence and, at the same time, tries to establish love as an instrument for the understanding of man—that is, as a psychological method. The analytical part deals with the various kinds of love, from love as relationship between the sexes, friendship, kinship, to infantile, paternal, fraternal love, and to such attenuated impulses as are found in loving admonition of a pupil and friendly reprehension for a broken promise. There is no attempt to reduce the wide scale of human love experiences to a theoretical "drive" such as the libido in the work of Freud, whose simplifying abstractions indeed are frequently attacked. The result of Binswanger's descriptive analysis is that one cannot understand man if one considers him as an individual being only; the inter-human relation between the loving and the beloved gives access to a deeper psychological knowledge, and to a better understanding of the individual himself.

The second part of Binswanger's book is an epistemology of his method based on a wide range of philosophical reading. He establishes the place of his approach within the tradition of ideas, defends its right against similar theories, and justifies his view that psychology can never be based on rational thinking alone, but on both reason and love.

Although not dealing with the psychology of the abnormal, the author addresses himself to the psychiatrist. His professed aim is to unfold the complexity and variety of normal human experience. Without a realization of its diversity, he thinks, an understanding of the abnormal is impossible. It follows that he regards as utterly futile certain attempts of psychiatrists to explain human existence from the narrow viewpoint of psychopathology.

Whatever the ultimate value of Binswanger's scholarly work, it appears a most timely reminder to modesty in view of the excessive claims of to-day's psychology and psychiatry. That he should have made love the object of his study in the midst of a murderous war, and proclaimed its value as an instrument of human understanding, entitles him to the attention of those who, unfamiliar with his philosophical foundations, think him prematurely sceptical in respect of a scientific psychology. W. MAYER-GROSS.

Introduction to Present-Day Psychology. By CURT BOENHEIM. Staples Press, Limited, Westminster, S.W. 1.

Even the most competent of authors would find it difficult to cover in an introduction of one hundred pages the whole field of contemporary psychology. This is to be kept in mind in judging Dr. Boenheim's book. He attempted the difficult task in twenty-four lectures to adults of the W. E. A. of which the book is a transcription. It ranges from "the crying baby" to "industrial psychology" and from "Gestalt Theory" to "psychosomatic medicine." Like so many popular writers on the subject Dr. Boenheim tends to under-rate the intelligence and knowledge of his lay readers, who, nowadays, know more about psychology than we think. One can only hope that, as Professor Wolters writes in the Foreword, this "pleasant sketch of the territory" will inspire many to put forth real effort into further exploration. A list of books given at the end is intended for this purpose. A. P. TAIT.

Het Gezinsleven van Schizophrenen. (The Family Life of Schizophrenics.) By J. ZURING. Amsterdam, 1946.

De Betekenis van de Phaenomenologische of Existentiele Anthropologie in de Psychiatrie. (The Significance of the Phaenomenological or Existential Anthropology in Psychiatry.) By J. H. VAN DEN BERG. Utrecht, 1946.

These are two dissertations for the degree of M.D. of Dutch Universities, each being a well-documented monograph on a special aspect of schizophrenia. Zuring studied the family life of 304 married schizophrenics discharged from hospitals between 1933 and 1942 and now under the excellent After Care Service of the Amsterdam Health Department. These patients represent 43 per cent. of all schizophrenics discharged during this period. Three quarters of the series were women; but only in 16 per cent. could the outbreak of the psychosis be connected with childbirth or other generative factors. Marriage age and average number of children in the patients' families showed little difference from the average of the Amsterdam population. Only a few patients married after discharge from hospital and only 16·7 per cent. of a total of 670 children were born after the first schizophrenic attack. This seems to dispose of eugenic objections to early discharge of remitting schizophrenics. The author sums up the general result of his studies as follows: "The majority of discharged schizophrenics appeared to react favourably to their familiar surroundings without causing any disturbance of the family life." Families with social difficulties are discussed in detail. Decline on the social scale was especially conspicuous in cases belonging to higher social classes; under an apparently quiet and unruffled surface of family unity much tension and hostility was found due to the patient's behaviour; bringing-up of children and their proper education was sometimes difficult—in fact 15 per cent. of the families under investigation were found to be known to the Amsterdam Children's Police. These were families in which either the schizophrenic patient had married an eccentric, psychopathic or defective partner; or the patients' premorbid personality was poor, immature or even defective. The After Care Service should prevent the return of such a case to their family, return him to hospital or board him with strangers.

The thesis of Van den Berg is an attempt to place the new "anthropological" approach to psychiatry, initiated by L. Binswanger (see review of his book, p. 112) and others, in a historical perspective and to justify its philosophy. Its application to clinical problems is demonstrated in a schizophrenic patient. He is a semi-stuporose, manneristic, deteriorated case who gives characteristic short "nonsense" answers to all questions when he speaks at all. The author tries to penetrate into the patient's special world and into his form of existence as to its time, space and meaning. Some of his interpretations are strangely reminiscent of the primitive interpreting lightning as God's anger—or the poet perceiving Nature's kindness in the flowers of Spring. All depends on the interpretation of expression (movements, gestures, words) which is—according to the author—the central problem of this method of psychiatry. The critical question of how the author's observations can be confirmed or disproved, how the truth of his interpretations may be gauged against that of others, remains unanswered. W. MAYER-GROSS.

The Biology of Schizophrenia. By R. G. HOSKINS, M.D. London: Chapman & Hall, 1946. Pp. 191. Price 15s.

This is an excellent summary of the schizophrenia problem written primarily for the intelligent layman, but at the same time for psychiatrists—possibly a curiously mixed audience, but he qualifies this by referring to "beginners in research in the field." The book is really an amplified version of the three

Salmon Memorial Lectures delivered at the New York Academy of Medicine in November, 1945. This is the first time the lectures have been delivered by a non-psychiatrist, but Dr. Hoskins is a physiologist and is director of research at the Worcester State Hospital.

The book is divided into four sections dealing with the biology of man in relation to schizophrenia, the pattern of schizophrenia, psychosomatic aspects of schizophrenia and a biological appraisal of schizophrenia.

The writer is a supporter of integrative evolution, and considers that somewhere in the course of integration there has been a failure, and this failure results in schizophrenia. The cause is unknown. From the study of patients at the Worcester State Hospital the author considers that almost to a man they have failed to have the inner hardihood to adjust to their life situation. None had attained to normal adult sex adjustment. Vocational and social maladjustments were very common. There is a lack of robustness of personality, a lack of the ability " to take it," or more properly put by Rosenzweig, a reduced frustration tolerance.

Possibly the most interesting chapter to the psychiatrist (who is *very* familiar with people who are " unable to take it ") is the chapter on the psychosomatic aspects of schizophrenia. The writer deals with the endocrines at length, and satisfaction must be felt in this country that the biopsy work of Hemphill and Reiss on the testicle receives full credit. The fault probably lies with a deficiency of a gonadotropic factor from the anterior lobe of the pituitary, which is, of course, the master gland of the endocrine hierarchy. Oxygen metabolism, the specific dynamic action of food, carbohydrate metabolism, homeostasis and other subjects are dealt with—mostly quite beyond the ken of the intelligent layman.

In conclusion the physiologist shows his wisdom and a scientific acumen (which the psychiatrist does not always show) in appealing for increased prosecution of research along the lines he has indicated, rather than further pursuit of what he aptly describes as " that will-o'-the-wisp, that semi-projective synthetic artefact, ' the patient as a whole '."

G. W. T. H. FLEMING.

On Suicide and Attempted Suicide. By K. G. DAHLGREN, M.D. Lund: Universitets Bokhandel, 1945. Pp. 354.

This comprehensive and thorough study has been carried out by the Associate-Director of the Psychiatric Clinic of Lund University Medical School, Sweden. It was done during his period of service in the neighbouring town of Malmö, and consists of a statistical and psychiatric review of suicide and attempted suicide occurring in that town during the decade 1933-1942.

Malmö is a town comprising most of the characteristics of our modern European cultural environment. It is a town of about 150,000, with a slowly-growing population. It is a sea-port in close contact with the rest of Europe; it has a fair amount of industry and is also the focus of the province of Scania, an intensively cultivated agricultural area. It " enjoys " a climate similar to our own and the population is recognized as being one where the temperamental characteristics are in the direction of restraint and undemonstrativeness. This study is, therefore, specially valuable and interesting.

The work is divided into two sections, statistical and psychiatric. The statistical part has been subjected to analysis by a statistical expert, which has had the effect of making the tables with which the book is richly supplied, especially interesting and sometimes surprising, particularly in regard to probability factors.

Certain generally accepted ideas in regard to the incidence of suicidal attempts have been modified. " Men have died and worms have eaten them,

but not for love," has long been accepted as being true and generally the view in regard to suicide has been that unhappy love and marital troubles are responsible for suicide in females but not in males, where economic troubles are held to be the most important. Dahlgren, however, shows that in his group of about 300 cases this point is not statistically important or significant. On the other hand, it seems true that economic worries do in fact produce more suicidal attempts in men. The commonly held view that marriage status is important is also subjected to some check. While there is a suggestion that divorced persons and individuals who have lost the marriage partner by death are in danger, Dahlgren's statistics do not confirm the belief that marriage has any suicide preventive influence.

In Britain, the incidence of suicide has steadily risen. This has not been the case in Malmö. During the last five years of the survey the incidence in males actually fell, although the incidence in females rose, but the figures have " not shown any definite tendency in either direction." It would be interesting to reflect on the possibility of Sweden's history as a factor in this. The country has not known war for 150 years or so and, apart from the Kreuger crash, which had a very widespread effect although it was effectively recovered from, is in a stable economic position on account of its great natural riches in iron, timber and water power, to mention only three factors.

In regard to war, it is interesting to compare Dahlgren's statement and figures as to the incidence of suicide in war. There is a tendency to believe that war reduces suicide in belligerents and various theories have been put forward to account for this. Dahlgren, however, points out that the fact is that suicide also decreases in non-belligerent countries during war and shows that the suicide rate in males began to show a decline as far back as 1938.

From the psychiatric point of view, the book consists of a scrutiny of the suicidal situation in the great general groups of psychotic disorder and here the work follows along orthodox lines, with, however, many special points of interest. Dahlgren comments on the bizarrerie of suicide in the parergasias (Meyer), the schizophrenic, paranoid group, and the attachment to depressive reactions in the ordinary way. He is especially interesting, however, in regard to the large and rather nebulous group of personality disorders where the relative failure of integration and personality formation leads to suicide consequent on evaluations of life situations biased by relatively poor judgment, leading to despair and so on. This group, generally subsumed under psychopathy in this country, has had a new nosological concept added to it in the form of ixophrenia. This concept corresponds to the epileptoid constitution, and Dahlgren quotes Trousseau, who stated that any sudden murder or suicide carried out by an apparently previously " normal " person, was surely a manifestation of epilepsy. Ixophrenia derives from the Greek Ixodes—viscous, adhesive. The features of the ixothymic or ixophrenic constitution are, in the words of Sjöbring, Emeritus-Professor of Psychiatry at Lund, " Heavily intense, monotonous, inelastic. They are inert and circumstantial, sticky, perseverating . . . their thoughts attach themselves to the object which interests them for the moment . . . they are hypersexual, childishly caressing, religious, hypochondriacal, paranoid. They often show pronounced changes . . . they are happy, cheerful, irritable, dissatisfied, scared, sad . . . they are always more or less a conflict and, if so, in a more or less explosive state." One feels that experience shows that this description corresponds quite accurately with a personality type frequently encountered in psychiatric practice.

To the subject of motive Dr. Dahlgren brings a clearly objective mind. He points out that when a suicide occurs in a psychosis one tends to look no further for the cause but to lay it at the door of the psychosis. He says: " It is rather interesting that we find data concerning the motive even in such cases where there is a so-called endogenous psychosis," and " There is, further,

at least a possibility that in cases characterized as manic-depressive psychosis, these motives may have contributed to the depression which later became the real cause of the suicide."

An interesting section is devoted to the suicide of apparently normal subjects. Dahlgren is inclined to beg this whole question as being, in his own words "a layman's one." We have, he points out, no criterion of the subject's state of mind at the time, and he quotes the all too true finding of Syerberg, that the so-called "Bilanz" suicidal attempt, well prepared, is almost always successful. The whole philosophy of suicide is carefully gone over in this section, and it is interesting to observe the entire absence of psychoanalytic terminology, for the book comes from a country where psychoanalytic theory has been almost completely rejected.

W. M. C. HARROWES.

Criminal Justice and Social Reconstruction. By HERMANN MANNHEIM, Dr. Jur. London: Kegan Paul, Trench, Trubner & Co., 1946. Pp. 290. Price 15*s*.

The author discusses the protection of human life in relation to homicide, suicide, euthanasia, the extermination of socially useless lives, sterilization, castration, birth control and abortion. The protection of sexual and family life is dealt with under the headings of homosexuality, exhibitionism, bigamy. adultery, incest and neglect to support the family. More than a third of the whole book is given up to a consideration of economic crime, and includes such matters as theft, the protection of public and private property, fraud, share-pushing, usury, profiteering, taxation frauds, strikes and absenteeism. The final chapters deal with replanning criminal justice.

The author believes that a new conception of criminal justice is necessary in a world which is passing through a crisis in social, economic and moral values, and considers his material from a legal rather than from a medical point of view. A great deal of detailed information is given with the clarity which we associate with Dr. Mannheim's writings. At the same time his outstanding prejudices will provoke strong opposition from many of his readers. The key to his point of view seems to be apparent in his statement that "Criminal law has not yet become sufficiently aware of the fact that we are living, not in an individualistic but in a mass age, where everything has to be adapted to the use of mass methods." Presumably, the future will decide whether the individual will derive greater or less freedom, happiness and security in consequence.

The medical reader will miss any discussion on the importance of alcoholism and prostitution in association with the protection of sexual and family life, and the significance of gambling in relation to family life and economic crime.

The book is well documented, and a useful bibliography is provided for each section. Like the author's previous works *The Dilemma of Penal Reform* and *Social Aspects of Crime in England between the Wars*, it is stimulating and provocative. It is reasonable to believe that these may have been the author's main incentives for writing his interesting and instructive book. It deserves a place on the shelves of all who are concerned with the social and legal aspects of crime, and whether they approve or disapprove of the author's standpoint.

W. NORWOOD EAST.

Part III.—Bibliography and Epitome.*

AN attempt is being made to provide as far as possible a complete bibliography compiled from journals dealing not 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.*
Acta Neurol., Naples.
3, 4 *Acta Psychiat. et Neurol.*
3 *Acta Psychol., Hague.*
Acta Psychol., Keijo.
Alg. Neder. Tijdschr. Wijsbegeert. Psychol.
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.*
Am. 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. Anthrop. crim.
2 *Arch. Argent. de Neurol.*
Arch. Argent. Psicol. norm. pat.
2 *Arch. Bras. de Neur. e Psiquiat.*

* 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.

Arch. Brasil Hig. Ment.
Arch. Chilenos de Crim.
Arch. Ital. di Studi Neuropsich.
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.
Arch. di Sci. Cereb. Psich., Salerno.
2, 4 *Arch. f. Psychiat.*
2, 3 *Arch. ges. Psychol.*
Arch. Internat. de Neurol.
Arch. Ital. Psicol.
Arch. Krim. Anthrop.
1, 2, 3, 4 *Arch. Neurol. Psychiat.*
Arch. Neur. Psychiat., Mex.
2, 3 *Arch. Psicol. Neurol. Psichiat. 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.*
1, 2, 3, 4 *Brit. J. Med. Psychol.*
2, 3, 4 *Brit. J. Psychol.*
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Z. Parapsychol.
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ACTA CHIR. SCAND.

VOL. XC. 1944.

ACTA PSYCHIAT. ET NEUROL.

VOL. XXI. 1946.

On the Psychopathology of Disseminated Sclerosis.

A brief review is given of the psychopathology of disseminated sclerosis, and the specificity and differential-diagnostic importance of the euphoria is emphasized.

A relatively well-examined, modern collection of cases is analysed.

47·3 per cent. of 330 patients developed mental symptoms. The neurologic symptomatology is stated and appears to have been comparatively equal for the psychonormal and the psychopathological groups, only the severe motor symptoms and the sphincter disturbances being most frequent in the psychopathological group (39·5 per cent. against 21·4 per cent., and 60·5 per cent. against 42·8 per cent. respectively). Psychiatric predisposition and premorbid mental abnormality were likewise a little more frequent in the psychopathological group.

Three patients died. The pathologico-anatomical findings were those usually made in the case of disseminated sclerosis.

The different mental symptoms and syndromes registered are stated and those

occurring most frequently pointed out. Euphoria was found in 33·0 per cent. of the total number of cases and in 69·2 per cent. of the psychopathological cases, dementia was found in 14·0 per cent. and 29·5 per cent. respectively, and euphoria combined with dementia in 8·5 per cent. and 17·9 per cent. respectively.

A parallel is demonstrated between the degree of the euphoria and that of the paralyses, as well as the frequencies of the sphincter disturbances and the spinal fluid changes. Further it is shown that the mental changes are early symptoms (41·6 per cent. at least developed within the first 3 years).

19·2 per cent. of the psychopathological patients were themselves aware of their mental symptoms.

A number of special mental pictures are mentioned. Three patients presented psycho-reactions of the exogenous type during their stay in this Department, two had previously experienced exogenous psycho-reactions, and one a schizophreniform psychosis of several years' duration, which is characteristic of disseminated sclerosis. This psychosis was cured completely.

(Authors' abstr.)

A Family with Alzheimer's Disease.

The author describes a family in which the father, the daughter and one son died from Alzheimer's disease and the remaining son suffers from mental deficiency.

(Author's abstr.)

On Delirium Acutum.

By means of a number of biochemical examinations in 5 patients with delirium acutum the writers have been able both to confirm certain observations previously made (increased urobilinuria, uremia) and to demonstrate characteristic changes of the concentration in the blood of two intermediary carbohydrate metabolites (pyruvic acid and citric acid) parallel with the clinical course of the acute delirium. The importance of the changes demonstrated is discussed; they are interpreted as disturbances of the aerobic carbohydrate metabolism, being especially compared to the knowledge of the intermediary carbohydrate metabolism acquired through enzyme research. It is emphasized that the metabolic disturbances demonstrated are not specific of delirium acutum, but that it is reasonable to suppose that they are of essential importance to the course of the disorder. (Authors' abstr.)

Psychopathic Personality Traits. Terminological Considerations.

A short resumé is given of the patient material at the Asylum for Psychopathic Criminals in Herstedvester, illustrated by a summary of the diagnoses on admission during 1943 and 1944. The definition of the term psychopathy is discussed. The general tendency is thought to be in the direction of considering psychopathy as mainly a hereditary disease, and that Danish psychiatry has definitely decided to accept psychopathy as hereditary as opposed to the environmentally caused disturbances that should be called nervosism. It is emphasized that a boundary line such as this cannot be maintained, since the hereditary and environmental factors both enter, inextricably, into all personality defects. This opinion is illustrated by a review of case-histories. It is furthermore asserted that somatic factors, especially the consequences of organic brain diseases, frequently enter into the picture also, and that in many cases one must be content with deciding that organic disturbances are one of the factors that have caused the demonstrable personality defect.

A warning is given against using the expression psychopathy in the sense that excludes in advance the consideration of any but aetiological hereditary factors. The more nearly neutral expression "personality defect" is proposed instead. This opens a possibility of a fruitful discussion of the aetiology of individual cases and, thereby, also of suitable therapeutic measures. (Author's abstr.)

SUPPLEMENTUM. 1945–46.

Pain in the Distribution-Area of the 4th Lumbar Root. *von Reis, G.* . No. 36

*A Comparison of 1,459 Shock-Treated and 969 Non Shock-Treated Psychoses in Norwegian Hospitals. *Dedichen, H. H.* . . . . . No. 37

A Comparison of 1,459 *Shock-Treated and* 969 *Non Shock-Treated Psychoses in Norwegian Hospitals.*

A study has been undertaken of 1,087 patients given convulsion treatment (cardiazol or pentrozol), of 243 patients given insulin treatment, of 129 patients given summation treatment, and of 969 patients who served as controls. An account is given of the principles governing the selection and composition of this material with reference to the duration of the disease, the age and sex of the patients, and other factors.

The material is classed in three groups, as it was considered of importance to keep the most pure schizophrenic and manic-melancholic forms of disease separate from the more mixed forms.

After it is pointed out that the treated material and the controls are so alike that they can fairly be compared with each other, statistical calculations are undertaken.

As the duration of the disease before the institution of treatment plays so important a part that it is necessary always to class the material in syndrome groups and durational groups, the numbers in each column often become so small that they afford little opportunity for drawing conclusions by direct calculation. Standard calculations have therefore been undertaken, several durational groups being added to each other so as to provide bigger figures.

The investigations show that in Group I with hebephrenic, paranoid or katatonic syndromes without manic-depressive or confusional trends the percentage of remissions is considerably higher among the pentrozol-treated patients than among the controls. When the disease has lasted less than a year, the difference is 6·6 times the standard error, whereas it has fallen to less than once the standard error when the disease has lasted from 1 to 5 years before the institution of treatment.

In Group II (hebephrenic, paranoid or katatonic syndromes with manic-depressive or confusional trends) there is still a marked difference with regard to the percentage of remissions for the convulsion-treated patients and the controls when the duration of the disease was comparatively short. This difference is 5·7 times the standard error when the disease had lasted less than 1 year, and $\pm$ 0·5 times the standard error when the disease had lasted from 1 to 5 years before the institution of treatment.

On the other hand, in Group III (manic-melancholic syndromes) there is no difference in the tendency to remission between the pentrozol-treated patients and the controls.

It would thus appear that, from the statistical point of view, the treatment achieves the best results in forms of the disease in which the prognosis is otherwise worst. For the manic-melancholic syndromes the prospect of a spontaneous remission is so good that the task of convulsion treatment is only to shorten the course of the disease. The observation period for the shock-treated patients was at least 1 year, and for the controls, fully 10 years. Social remissions were accepted as such only when they had lasted at least half a year. Some of the treated patients underwent a follow-up examination after 4 years. In Group I the remissions had been maintained in 76 per cent., 12 per cent. of the patients had relapsed and 12 per cent. could not be traced. In Group II the corresponding percentages were 69, 12 and 19. In all these cases the disease had lasted less than a year before the institution of treatment. When the disease had lasted from 1 to 5 years before the institution of treatment, 61 per cent. of the patients in Group I had maintained their remissions, and 24 per cent. had relapsed. The corresponding percentages for Group II were 78 and 7 respectively.

The follow-up examinations also showed that some of the patients not achieving a remission in response to the treatment did so later on.

This study also showed that in Group I the reaction to the treatment was somewhat better as the patients were older. The sex of the patient does not seem to matter in this respect. It is possible that the treatment is more effective when the outbreak of the disease can be referred to a precipitating factor than when this is not the case. This is so both in Group I and in Group II. In Group I, when the disease has lasted less than a year, it would seem that the prospect of the treatment being successful is better when the onset of the disease has been acute than when it has been insidious. Earlier attacks of the disease do not seem to influence the

effects of the treatment. The present material does not warrant the drawing of conclusions with regard to the significance in this field of body structure, a prepsychotic mentality and a hereditary taint. There follows a detailed account of each group. In Group I it would seem that the prognosis is more or less the same for the paranoid and katatonic syndromes, whereas the fate of hebephrenics seems to be worst both among the patients given convulsion treatment and among those serving as controls. Influence phenomena, whether they occur by themselves or in association with a paranoid syndrome, do not seem to make the prognosis appreciably worse.

Certain syndromes not fitting into any of the three main groups are discussed by themselves. It would seem that diseases of the basal ganglia constitute a special contra-indication to convulsion treatment. The special problems arising in connection with women approaching the menopause, with its proneness to anxiety and an oscillating blood pressure, are discussed in detail, and modifications in the technique of the treatment of such patients are described. The complications of convulsion treatment, notably fractures, pulmonary ailments and amnestic syndromes following the treatment are discussed in detail, and the preventive measures calculated to prove effective are mentioned. The number of the patients given insulin and summation treatment being very small, the account given of them is quite brief. Considerable attention is, however, paid to the complications arising from these treatments. (Author's abstr.)

ACTA NEUROL.

VOL. I. JAN.–FEB., 1946.

MARCH–APRIL.

MAY–JUNE.

JULY-AUGUST.

The Electroencephalogram and Psychophysiological Regulation in the Brain.

The paradoxical association of relatively large amplitude alpha 10 ± per second activity with a relatively low level of waking cerebral function is attributed to the inhibitory effects of subcortical 10 ± per second pacing of activity in the cortex and to associated autonomic effects causing cerebral constriction. On the other hand, the association of fast activity with cortical excitation, metabolite (CO_2) production, and fast activity in cholinergic nerves accounts for associated vasodilatation. Thus, by the opposed effects of fast vs. 10 ± per second slower activity, cortical and subcortical mechanisms may regulate one another. This may provide a homeostatic mechanism by which excitation in the cortex is normally prevented from producing excessive discharge or from self-perpetuation. Underactivity, overactivity, or imbalance of these functions would account for the EEG and autonomic patterns seen in many abnormal mental conditions.

(Author's abstr.)

Effects of Sedative Drugs on the Electroencephalogram.

A study is presented of the electroencephalographic effects of small oral doses of the usual sedative drugs (phenobarbital, sodium amytal, nembutal, seconal, paraldehyde, chloral) in 10 normal subjects with normal EEGs.

Data on 45 psychiatric patients who had received oral sedation within 24 hours of the electroencephalographic recording are compared with a control group of 45 psychiatric patients who had received no sedation. Patients with a diagnosis of epilepsy or of organic central nervous system disease were excluded from this study.

The results of the two methods of study are in essential agreement and lead to the following conclusions:

1. The commonly used barbiturates given orally in small doses may change a normal to an abnormal EEG. Paraldehyde and chloral do not cause prolonged alterations in the normal EEG under the conditions of this study.

2. The change occurs in an estimated 35 per cent. of individuals with normal electroencephalographic tracings. This change is of a nature and degree to require re-evaluation of studies on patients receiving sedatives.

3. The change usually consists of an increase in fast activity, but it may consist of an increase in slow activity. In either case, the direction of the change is more constant for the individual than for the drug employed.

4. The factors which influence the appearance of an abnormal EEG after sedation are individual susceptibility, drug employed, time interval and dosage. The highest percentage of abnormal records occurs in the patients who received 0·3 grm. or more of barbiturate 12 to 14 hours before the EEG.

(Author's abstr.)

JULY.

AM. J. PSYCHOL.

VOL. LIX. 1946.

AM. J. PUB. HLTH.

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VOL. CIV (I). MAY, 1946

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VOL. CVI. 1940.

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ARCH. NEUROL. PSYCHIAT.

VOL. LV. JUNE, 1946.

CHICAGO NEUROLOGICAL SOCIETY.

NEW YORK NEUROLOGICAL SOCIETY, ETC.

Electroencephalographic Studies of Psychopathic Personalities.

Records showing frequencies lower than 8 a second or an abundance of waves slower than 8 a second in the frontal leads, regardless of amplitude, were considered abnormal. This is essentially in accordance with the criterion of Gibbs, Gibbs and Lennox. The record of one patient was considered adnormal during overbreathing only.

All the abnormal records fell under the type of electroencephalograms usually called " pathologic record of undetermined type." 53 per cent. of the patients had abnormal records. It was possible to divide these pathologic records into two types, namely, those of average amplitude, 5 to 7 a second activity, and those of low voltage, slower than 5 to 7 a second activity. A third pattern—low voltage, fast activity—was frequently encountered, but it was not considered definitely abnormal.

The majority of the abnormal records were those containing sufficient 5 to 7 a second activity of low average amplitude in the frontal and parietal leads to be considered beyond the limits of normal. Some 5 to 7 a second activity is commonly found in the frontal records of normal subjects, but it is unusual in the parietal leads. Any considerable amount of it in the frontal and parietal leads must certainly be considered abnormal. (Authors' abstr.)

JULY.

PHILADELPHIA PSYCHIATRIC SOCIETY.

CHICAGO NEUROLOGICAL SOCIETY.

Effects of l (+) Glutamic Acid and Other Agents on Experimental Seizures.

In an attempt to measure in the laboratory the anti-convulsant value of glutamic acid, this substance was tested by a number of technics for investigating the potency of anti-convulsant agents. In a wide range of single large and repeated small doses, and in a variety of species, the amino acid was found ineffective in the prevention or modification of electrically or chemically induced convulsions. Glutamic acid failed to elevate the normal seizure threshold, did not modify the character of the convulsion produced by supramaximal currents, and had no effect on the electric shock threshold lowered by cellular hydration. Glutamic acid was also without effect on metrazol-induced electroencephalographic dysrhythmias of the *petit mal* type. In addition, it did not alter the resting electroencephalogram or the electroencephalographic response to single cortical shocks.

Inasmuch as diphenylhydantoin, phenobarbital, Tridione, dimethyl-N-methyl barbituric acid and benzimidazole give laboratory evidence of anti-convulsant potency with one or more of the technics employed, it is suggested that if further clinical work substantiates the efficacy of glutamic acid in treatment of *petit mal* and psychomotor epilepsy, the mechanism of its action is likely to prove considerably different from that of the known anti-convulsant drugs in clinical use. Indeed, one would not be able to predict from present laboratory screening methods that glutamic acid has anti-convulsant potency or value. (Authors' abstr.)

Sensation of Electric Shock Following Head Injury.

A series of 30 cases of head injury is presented in which the phenomenon of sensation of electric shock was perceived in various parts of the body on flexion of the neck. Multiple etiologic factors may be operative; the hypothesis of concomitant concussion of the cord and of a special cerebral origin are discussed. The pathologic process is unknown, demyelination of spinal tracts and meningeal scars being considered as likely factors; the process, however, is self-limited and reversible so far as the phenomenon is concerned. (Author's abstr.)

AUGUST.

ILLINOIS PSYCHIATRIC SOCIETY.

CHICAGO NEUROLOGICAL SOCIETY.

Electric Shock Therapy of Elderly Patients.

The results of electric shock therapy in a group of 53 patients aged 65 or more are reported. The difficulties in diagnosis, the contra-indications to treatment and the complications and effectiveness of therapy are discussed. Three cardinal problems have emerged from this study:

1. The differentiation of true intellectual decline and other types of psychoses of the senium, especially depression, must be made. Suggestions for making this distinction are offered.

2. The significance of an impared cardiovascular system in the patient with serious mental illness must be evaluated in terms of what the future holds for the patient with and without treatment.

3. When a diagnosis other than senile dementia can be made in a patient over 65, especially that of depressive, manic or paranoid psychosis, electric shock therapy should be considered. The only contraindications should be extreme defects in the physical state, particularly in the cardiovascular system.

(Authors' abstr.)

Pattern of Metabolic Depression Induced with Pentothal Sodium.

In this investigation on the pattern of the action of pentothal sodium on the brain, it was possible to show that the cerebral hemispheres are the areas first involved in the depressant action of this drug, because of the peculiarities of the anatomic venous cerebral return, which in the majority of patients directs most of the blood from the cerebral hemispheres either to the right or to the left internal jugular vein, and a major portion of the blood from the basal ganglia to the opposite vein. A total of 36 observations were made on 12 subjects under pentothal anesthesia. Of 22 observations, made at the lighter levels of anesthesia, the results may be divided into two groups. In 9 of the subjects the arteriovenous difference on one side was more depressed than that on the opposite side, and in the 3 remaining patients the arteriovenous differences were similar on the two sides. Further evidence supporting the differences between the values for the right and the left internal jugular vein is obtained from the data for glucose and lactate, for in the same 3 patients in which the arteriovenous oxygen differences were always within the experimental error the arteriovenous glucose and arteriovenous lactate differences exhibited a similar agreement, while in the other 9 patients the paired results did not show a similar precise concordance. With deeper anesthesia the subcortical parts became more involved, and the paired arteriovenous oxygen differences for the two sides were greatly depressed and within the experimental error in all but 2 of 14 observations. These results indicate that oxidation is not decreased to the same extent in all parts of the brain at the lighter levels of barbiturate anesthesia, but that the cerebral hemispheres are the areas of the brain preponderantly involved in the depressant action of the drug. The other parts of the brain gradually suffer an increasing inhibition of oxidation as the deep levels of pentothal anesthesia are produced. (Authors' abstr.).

Effects of Antibiotic Substances on the Central Nervous System.

Clinical and experimental studies indicate that penicillin may produce convulsive manifestations. During systemic administration for conditions other than primary ones of the central nervous system, the electroencephalogram was found to be abnormal in more than 60 per cent. of a series of 51 patients. Control records taken before and after penicillin therapy usually showed normal tracings. Large doses of penicillin injected intrathecally in man or monkey may give rise to convulsions, followed in some cases by coma and death. The application of as little as 500 international units to the cerebral cortex of the macaque monkey may induce epileptic attacks.

Streptomycin in cats and monkeys applied to the cerebral cortex in doses of 1,250 units induced convulsive manifestations in 30 per cent. of the animals. Electroencephalographic records at such times showed slow waves and spikes, with subsequent decrease of cortical activity lasting for 1½ to 3 hours. Cisternal injection in the monkey of 2,500 units of streptomycin induced signs of severe cerebellar dysfunction.

Streptothricin applied to the parietal cerebral cortex in doses of 5,000 to 10,000 units produced clinical and electroencephalographic convulsive manifestations. Although these phenomena usually disappeared spontaneously in 2 to 3 hours, in two monkeys they persisted for 2 weeks. At necropsy the brains of these animals showed extensive softenings with perivascular petechial hæmorrhages.

Actinomycin injected into the cerebral cortex or the cisterna magna in a dose of 1 mg. after a latent period of 9 hours produced severe prostration, fasciculations and convulsions, with death in 1 to 7 days. At the site of injection into the cerebral cortex a severe necrobiotic reaction with edema and petechial hæmorrhages was found.

Clavacin when injected into the cerebral cortex in doses of 5 to 10 mg. induced clinical and electroencephalographic manifestations of convulsive phenomena with a marked decrease in spontaneous cerebral activity.

There appears to be a wide margin of safety between the antibiotic concentration of penicillin and streptomycin and the convulsive threshold for those drugs. Such does not appear to be the case for streptothricin, clavacin or actinomycin. Although penicillin has few toxic reactions, if it is given in excessive amounts in the cerebrospinal fluid severe neural sequelæ in the form of radiculitis or convulsions may develop. (Authors' abstr.)

Dominant Brain Wave Frequencies as Measures of Physico-chemical Processes in Cerebral Cortex.

Engel and associates note that their method "may give a slightly false impression of the distribution of wavelengths greater and less than the dominant one," since they do not measure wavelength but take as the frequency the total number of waves per second. The authors' main criticism is that the method is misleading in its misuse of the concept of the dominant frequency itself if one considers waves of similar length arranged in sequences as reflecting physico-chemical processes in the cells. Engel and his collaborators are concerned with the effects of physiologic agents on the electroencephalogram, and, while empiric changes are of course brought out by their method, it seems unfortunate to employ a tool which by its very nature, through its definition of "frequency," masks the possibility of a rational interpretation of rates of events going on in the brain.

The dominant frequency as studied with the Brazier method is the frequency which the authors have used in their earlier studies of the effects of physico-chemical agents on the electroencephalogram. It would, for example, be quite impossible on theoretic grounds to calculate meaningful energies of activation of enzyme steps in the carbohydrate cycle with the method of Engel and associates, since their frequencies, including their dominant frequencies, are composed of waves of different lengths and the independent variable, the per cent. time alpha, contributes to the determination of their actual frequencies *per se*.

This may be illustrated by a hypothetic example. Suppose one has a record composed of continuous and uniform sine waves of 10 per second produced by a piece of electrical apparatus. There would thus be only one frequency, the dominant one determined by the properties of the apparatus making the signals. One may now consider an equal length of record consisting of 5-second strips of the same 10 per second waves, alternating with equal intervals with no waves at all. Such a record could be made artificially by turning the apparatus that makes the waves on and off at 5-second intervals. The dominant rhythm in both these records, according to the authors' studies and to the Brazier method, is clearly 10 cycles per second; the dominant rhythm according to the Engel method is 10 per second in the first record and 5 per second in the second record, and from this one would be led to the erroneous conclusion that the apparatus producing the waves with a frequency of 5 per second was operating at half its former rate.

For the reasons the authors have discussed, the measurements of Engel and associates cannot reflect the rates of changes of kinetic processes in the brain, and in effect they mask these processes. The Engel spectrum is a graphic representation of gross qualitative changes observed in the records, and as an analytic instrument it has all the limitations of the delta index, which the authors have described and have used as a purely empiric expression of the numerical representation of the magnitude of slow-wave activity in the electroencephalogram.

Quantitative changes with physiologic variables of bands of waves of equal length (e.g., the alpha waves) have led to significant insight into the chemical kinetics of the brain, and further studies along these lines hold promise. Much of the value of this type of investigation may be lost unless the limitations of the methods used are borne in mind. (Authors' abstr.)

ARCH. PATH.

VOL. XLII. AUGUST, 1946.

Cerebral Concussion: Histochemical Demonstration of Nucleases in the Cerebrospinal Fluid.

Incubation of buffered specimens of cerebrospinal fluid from patients who had undergone cerebral concussion with sections of cats' cords produced tigrolysis in the anterior horn cells, while similar treatment of the sections with buffered specimens of cerebrospinal fluid from normal persons or with buffered Ringer's solution failed to produce such an effect.

The findings point to the importance of enzymatic substances in the genesis of chromatolysis following cerebral concussion.

The nucleoproteins of the nerve cells go into solution at the hydrogen ion concentration prevailing in the normal central nervous system *in vivo*. When sections of spinal cords are incubated with various fluids, these fluids must be acidified for demonstration of Nissl bodies. (Authors' abstr.)

ARCH. PSICOL. NEUROL. PSICHIAT.

VOL. I. 1940.

VOL. II. 1941.

Electroencephalography: Nature and Psychophysiological Significance of the Electric Phenomena of the Brain.

After a discussion of the basic principles underlying electroencephalographic techniques, the author describes the characteristics of the normal EEG in men and animals, individual differences, the effects of sensory stimuli, electric activity of the brain during sleep, the relationship between electric activity and mental activity, the effects of drugs, and relation of the EEG to temperature, circulation, and metabolism. A critical analysis of the results in the literature suggests the following conclusions: the alpha waves are the expression of synchronic "pulsations" of a great number of cortical neurons; the states of excitement (sensorial stimuli, psychical activity) disturb this synchronism and transform the

alpha rhythm into beta rhythm. Delta waves, the origin of which is still obscure, appear with a diminished cerebral activity. The frequency of the rhythms is consequently related to major or minor cerebral activity. The modifications of the electroencephalograms as an effect of psychical activity are due to sensorial or affective components. (Psychol. abstr.)

New Contributions to Electroencephalography.

After a general consideration of the topic, the author describes the apparatus used in the psychology laboratory of the Catholic University of Sacro Cuore in Milan. Mention is made of an electromagnetic oscillograph with ink-writing pen, also constructed in the same laboratory. Sample records are reproduced. There is a discussion of the principal theories of the nature and origin of alpha waves. The factors of frequency, form and amplitude are examined, and this examination is completed by a systematic study on the lack of synchronism of the waves which originate from different parts of the brain. The author offers the hypothesis of a unit centre for the origin of the alpha waves, and gives an interpretation of the function and the nature of this centre. (Psychol. abstr.)

On Postencephalitic Dementia. The Method of Rorschach Applied to the Study of Postencephalitic Parkinsonism.

The author examined with this test 30 adult subjects affected by postencephalitic parkinsonism. The conclusion is that effectivity, some functions of the intellectual process (resistance to mental work, capacity of concentration and attention), perception and the higher logical processes are involved. This is shown by such typical signs as the following: small number of answers, high percentage of badly perceived forms (F per cent. often with negative values), reduction of kinesthesia and chromesthesia, and tendency to stereotypy. These results do not entirely agree with those of Veit, the only author who has applied the Rorschach test to the study of postencephalitic parkinsonism. (Psychol. Abstr.).

VOL. VI. 1945.

Problems of the Frontal Lobe.

The author describes the case of a wounded patient with a frontal lesion whose symptoms became apparent 10 days after the accident and were of short duration. The syndrome was characterized by severe astasia-dysbasia, dysmetric and asynergic symptoms in the trunk and limbs, loss of motor initiative and emotional contact, spatial disorientation, amnesia and enuresis. Various interpretations of frontal lobe function are discussed, opposite trends represented by Goldstein's holistic approach and Kleist's localizations are evaluated, and the neuropsychobiological basis of prefrontal lobotomy is analysed. (Psychol. abstr.)

ARKANSAS MED. SOC. J.

VOL. XLII. 1945.

ARQ. NEURO.-PSIQUIAT., BRASIL.

VOL. III. MARCH, 1945.

JUNE.

SEPTEMBER.

DECEMBER.

Trauma and Neurosyphilis.

The authors report 13 cases in which cranial or spinal injuries probably played a significant role in the development or aggravation of several forms of neurosyphilis; from the total number of cases, 3 refer to mesenchymatous and the rest to parenchymatous forms (5 cases of tabes and 5 of general paresis). From their own observations and from references in medical literature, the authors can state the following conclusions:

1. Trauma can act (*a*) as an aggravating factor of a pre-existing, clinically recognized neurosyphilis; (*b*) as a precipitating factor of a latent, asymptomatic neurosyphilis; (*c*) as a localizing factor of a pre-existing syphilis which had not, till then, affected the central nervous system.

2. Each case must be judged on its own merits. The points which estimate the connection between trauma and neurosyphilis are: clinical conditions before trauma, circumstances involving the trauma, site of the injury, severity of the trauma, chronologic interval between trauma and beginning of the symptoms, bridging symptoms, shortening of the incubation period and fast development of the disease.

3. The aforementioned elements are sufficient to consider the trauma as an aggravating or as a precipitating factor. If the normality of the cerebrospinal fluid could be tested just before or just after the injury and, some months later, the beginning of the clinical symptomatology became apparent and was confirmed by the positiveness, in the spinal fluid, of the reactions for syphilis, the trauma must be considered a localizing factor. The authors' cases fulfil these conditions, and perhaps they are the only ones recorded in medical literature.

4. The mode of action of trauma on the development of parenchymatous neurosyphilis may be explained by localization of the *Treponema pallidum* in inflamed areas; (*b*) connections between trauma and immunity in neurosyphilis; (*c*) traumatic rupture of the hematoencephalic barrier; (*d*) relation between the germ's electric charge and the permeability of the barrier; (*e*) influence of the traumatic shock of the sympathetic nervous system on the development of parenchymatous neurosyphilis.

5. Whatever the mode of action of the trauma, the medico-legal aspect is the same. The effects are imputable to trauma, but syphilis will always be a pre-existing concausal element. In the juridical valuation of the injury, the assessor must fix the compensation for incapacity according to the role the trauma played; it will be greatest if the injury localized the syphilis on the nervous system, and it will be least if the trauma was only an aggravating factor. (Authors' abstr.)

Prefrontal Leucotomy.

The author discussed the different techniques for leucotomy, especially that of Freeman Watts.

He has devised a "lobotome" for a three-fold purpose—to ascertain the reference marks, sever the fibres and leave iodine-oil in the transection tract. The instrument consists of a trocar slightly flattened to take the shape of a regular leucotome and having one of the ends sealed. In one of the cutting edges near the blind end there are 4 small holes, 1 centimetre apart. Through the free end a syringe may easily draw fluid and inject contrast media into the transection surface.

To secure a more accurate placing of the transection, the writer has recently followed the technique of transfixing the falx and both frontal lobes with a stylet inserted through the burr holes. He also recommends having a pneumo-encephalography systematically performed before operation in order that the ventricles be accurately localized. He does not present any worth while results as the interval is too short.

All the patients operated on were chronic cases who had undergone all the accepted treatments, including leucotomy. (Author's abstr.)

BOLL. D. SOC. ITAL. D. MED. E. IG. TROP.

VOL. IV. 1944.

BRAIN.

VOL. LXIX. MARCH, 1946.

The Development of the Substantia Nigra.

1. The substantia nigra is developed by a ventrolateral extension of cells from the characteristic mid-ventral proliferation in the basal lamina of the mesencephalon.

2. It is first seen in the 22 mm. embryo as a peripheral crescentic strip of cells continuous with the ventrolateral angle of the mid-ventral proliferation.

3. At the same time a narrow band of fibres appears on the superficial aspect of the nigral crescent. These are descending fibres from the cerebrum, and with the nigra they form the peduncle of the mid-brain.

4. From the outset there is a close association between the substantia nigra and the descending cerebral pathway.

5. By the 30 mm. embryo stage, the nigral crescent is separated into groups by the descending fibres. Characteristic medial and lateral groups are soon formed at the medial and lateral extremities.

6. By the eleventh week (6·0 cm.) the nigra is disposed into two strata, corpus and cauda, the former lying deep to the latter with cerebral fibres between them. Medial, lateral and intermediate groups are recognizable in the corpus, and fibres extend between corpus and cauda and penetrate from the nigra into the cerebral pathway.

7. In the 9·0 cm. foetus the pyramidal shape of the substantia nigra is evident. The apex lies in the subthalamus and continues into the intermediate part of the corpus. This is soon flanked by the medial and lateral columns. The cauda lies along the ventral part of the nigra. The base is formed by the columns of the corpus and extends into the pons.

8. At mid-term a new nigral stratum appears. It will be referred to as the caput. It lies on the dorsal aspect of the corpus and is separated from it by cerebral fibres. It links the medial and lateral groups of the corpus and projects aberrant groups into the tegmentum. The caput and cauda are present only in the mid-brain portion of the substantia nigra; the corpus extends to the subthalamus and pons.

9. At the eighth foetal month a rich plexus of fine myelinated fibres pervades the nigra, and fibres extend from it into the crus and tegmentum, and into the subthalamic nucleus.

10. After birth the nigra retains its fœtal architecture, but enlarges and attains its maximum size in childhood.

11. Minute black granules are first seen in some of the nigral neurones at mid-term. Thereafter they increase, but not all the neurones contain them. After birth granular cells are numerous.

12. By dissection the pyramidal shape of the substantia nigra is confirmed.

(Author's abstr.)

The Development of the Human Red Nucleus and Corpus Striatum.

1. The human red nucleus develops as a migration of cells from the mid-ventral proliferation of the mesencephalic basal lamina.

2. These cells migrate towards, and become associated with, cerebello-mesencephalic fibres (brachia conjunctiva) which reach the mid-brain in the embryo of 19 mm. length (6½ weeks).

3. A collection of cells, situated among the cerebello-mesencephalic fibres at the base of the cerebellar outgrowth is seen in the 29 mm. embryo (8 weeks). These cells develop into the dentate nucleus, which appears in series with the red nucleus and is linked to it by tiny groups of cells in the dentato-rubral (cerebello-mesencephalic) fibre pathway. The possibility of a tegmental origin of the dentate nucleus is suggested.

4. Grouping of neurones in the red nucleus begins in the 4·0 cm. foetus (9 weeks).

5. Minute brown granules appear in the rubral neurones at mid-term. Later a diffuse brown coloration distinguishes the cells.

6. The corpus striatum arises as a thickening of the lateral wall of the cerebral vesicle in the 10 mm. embryo (5 weeks).

7. In the 22 mm. embryo (7 weeks) descending cerebral fibres separate the corpus striatum into medial (caudate) and lateral (lentiform) parts.

8. In the 7·0 cm. fœtus (12 weeks) the lentiform nucleus is subdivided into putamen and globus pallidus. (Author's abstr.)

BRIT. J. PSYCHOL.

VOL. XXXVII. SEPTEMBER, 1946.

Some Qualitative Observations on Verbal Memory in Cases of Cerebral Lesion.

1. Some qualitative observations on verbal memory in cases of cerebral lesion are described. These have reference to (*a*) the auditory-verbal memory span; (*b*) rote learning, and (*c*) recall of short stories (substance memory). Special attention is given to the results in cases with disorders of language and of memory respectively.

2. An impairment of memory span for verbal material and severe difficulties in rote learning were consistently found in cases with language disabilities associated with focal lesions of the speech areas. It is pointed out that these defects may long outlast the grosser symptoms of an acute aphasic disorder.

3. Cases of pronounced impairment of general memory (amnesic or Korsakow syndrome) were found to have intact verbal memory span but grossly impaired verbal learning. Substance recall was in general very defective in these cases and fabrication was often marked.

4. It is suggested that the defect of verbal learning in dysphasic cases is syntactical in nature and closely associated with the primary disorder of symbolic formulation and expression. In amnesic cases, on the other hand, it is argued that the defect is independent of language, and due to a generalized inability to organize consecutive responses into a unitary habit.

5. It is pointed out that both rote and substance recall are equally affected in the amnesic syndrome, but that the latter is often well preserved in dysphasic conditions. Some implications of this finding for the theory of memory are briefly considered.

6. The available evidence suggests that some impairment of verbal learning is very common in organic cases irrespective of the precise nature and localization of the lesion. A tendency to stereotyped error has been noted especially in cases with lesions of the frontal lobes.

7. The bearing of the results on practical problems of diagnosis, assessment and re-education in cases of brain injury is briefly indicated. Some suggestions for future research are also mentioned. (Author's abstr.)

An Examination of the Varying Effect of Certain Stimuli upon the Alpha Rhythm of a Single Normal Individual.

A single normal subject has been repeatedly examined on the EEG and the effect of certain types of attention and emotional stimuli systematically examined. Inter-correlations of the stimuli are small and the scatter of the data about the respective means is large, with the exception of suppression of the alpha rhythm associated with visual activity. The effect of a mental arithmetic problem upon 27 cases of a small sample of normal individuals has been compared with the results of the present experiment. The following conclusions may be tentatively drawn from the results. It should be emphasized that these conclusions are based on work with this subject only, and cannot be generalized without further individual investigations:

(i) There is a low positive correlation between the degree of suppression associated with mental arithmetic and concentration problems. This appears to indicate the existence of common mental (or neural) activities for these two tasks. The lack of correlation between these two tasks and the immediate memory span test suggests that the attention associated

with immediate memory processes is to be distinguished from that involved in arithmetical problems and indicates specific types of attention.

(ii) Suppression of the alpha rhythm is associated with focusing of the attention, but is an unreliable guide to the degree of focusing. This indicates lack of direct connection between attention and the amplitude of the alpha rhythm.

(iii) The amplitude of the alpha rhythm is an unreliable indicator of activity of the sympathetic branch of the autonomic nervous system.

(iv) Suppression of the alpha rhythm is not reliably connected with the degree of conscious emotion. The results indicate that a large emotional response is associated with a greater degree of rhythm suppression than either an average or small emotional response, but the difference between the means of these three values is not statistically significant. A small negative correlation exists between associative reaction times and degree of suppression.

(v) The neural processes directly responsible for suppression of the alpha rhythm take place below the level of consciousness since the subject is unable to state the degree of suppression associated with a particular stimulus.

(vi) In solving problems in mental arithmetic the variation in rhythm suppression shown by the single individual, who served as the main subject in this experiment, is almost as wide as that found in 27 different subjects. With the latter both the standard deviation and the mean were slightly greater; but the increases were so small as to be statistically non-significant. (Author's abstr.).

BRIT. MED. J.

1945 (i).

1945 (ii).

BULL. MENNINGER CLIN.

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GENET. PSYCHOL. MONOGR.

GEO. MED. ASSOC. J.

Performance of Brain-damaged Cases on a Memory-for-Designs Test.

A memory-for-designs test, requiring less than 10 minutes to administer, and consisting of 15 designs, presented singly, was given to a group of 70 brain-damaged patients and 70 controls. The controls were also a patient population and had the same age distribution and educational and occupational background as the experimental group. An additional group of 60 controls and 10 experimentals, as well as 16 cases above the upper age limit of 60, was used for cross-validation.

1. Experimental and control groups showed significant mean differences in score on the test.

2. Impairment on the test, indicated by a score above a critical value, was rare in the controls and analysis of the individual cases indicated that it occurred only with feeble-mindedness, where concomitant brain damage is likely, or severe psychiatric illness. Psychiatric cases could generally be differentiated by qualitative indicators not included in the scoring system.

3. Impairment occurred in only 50 per cent. of the experimentals. Although additional factors such as tremor, number of reversals, etc., differentiated some of those scoring low, a considerable number still remained whose performance was in every observed respect like that of the controls.

4. Unusually low correlations were obtained between test score and age and test score and intelligence, indirectly measured by school grade completed and vocabulary. This should make the test an especially valuable addition to a battery for detecting brain damage. (Author's abstr.)

J. APP. PSYCHOL.

VOL. XXX. 1946.

Use of the Shipley-Hartford Test in Evaluating Intellectual Functioning of Neuropsychiatric Patients.

The Shipley-Hartford Retreat Test "was given to 977 randomly selected neuropsychiatric patients at a service hospital. Of this group, 134 were also given the Wechsler-Bellevue Intelligence test. The following conclusions seem warranted: (1) The Shipley-Hartford test can be used as a rough estimate of functional intelligence. (2) The distribution curve of 'original' intelligence of neuropsychiatric patients is very similar to that obtained by Wechsler in a sampling of the adult population. (3) A large proportion (62 per cent.) of neuropsychiatric patients tend to show a lowering of efficiency in their intellectual functioning."

(Psychol. Abstr.).

J. AVIATION MED.

VOL. XVI. 1945.

J. CLIN. PSYCHOL.

VOL. II. JULY, 1946.

J. COMP. NEUR.

VOL. LXXXIV. JUNE, 1946.

Connections of the Cerebral Cortex. I. The Albino Rat. B. Structure of the Cortical Areas.

The identification and arrangement of the cortical areas of the albino rat have been determined on the basis of cell- and myelin-stained material sectioned in various planes. The picture presented by each area has been characterized and illustrated by means of sample strips taken perpendicular to the surface. Some 40 cortical areas are distinguished. Individuality and boundaries of the areas were determined on the basis of appearances alone. The identification, expressed here in Arabic numerals as proposed by Brodmann, has been made with regard to accumulated evidence on connections and probable evolutionary patterns of the cerebrum. It is believed that the parietal cortex has been subdivided in a manner that will enable areas to be equated with those of higher forms. Thus, 3, 1 and 2 occupy a prominent place, while 7 and 39 are, as expected, smaller. Motor, premotor and frontal areas have been distinguished and the frontal region has been divided into polar (10) and basal (8, 11) areas. The auditory cortex (41) is identified, changing radically the pattern formerly claimed for the temporal region of lower animals. The primary sensory receptive cortices are seen to dominate the cerebrum. Sensory associative cortices form marginal strips or fill in chinks. The frontal area is poorly developed. On the other hand, the limbic lobe is markedly developed and presents numerous subdivisions.

The study of the myelin pattern of the cortex has been instructive. Attempting to explain significance of the various categories of fibers, instead of regarding them merely as a means of distinguishing areas, has resulted in the establishment of a number of generalities. The fact that in the rat a large bulk of the interareal associational fibers are intracortical is an important one for cortical analysis.

The plan here established has been compared with the studies of others on related forms.

A plan has been devised to explain the differentiation of cortical areas, the large number that appear in the rat and the conservatism of this arrangement.

The place which this survey has in the project of cortical study under way is discussed. (Author's abstr.)

VOL. LXXXV. AUGUST, 1946.

J. COMP. PSYCHOL.

VOL. XXXIV. JUNE, 1946.

AUGUST.

Experimentally Induced Convulsive Reactions of Laboratory Rats. I. A Comparative Study of the Immediate Reactions.

The conclusions derivable from the experimental observations described in the present study are summarized as follows:

1. The essential motor pattern of abnormal behavior evoked in some rats by noise-fright stimulation can also be evoked in the same animals by direct electrical stimulation of the brain.

2. The essential motor features of the noise-induced abnormal behavior pattern can be produced by electrical stimulation in rats which do not easily react to the noise-fright situation with the NF-3 or NF-4 type of response.

3. However, the electrically induced noise-fright pattern is suggestively more frequently produced in rats which do react with the NF response to the noise-fright situation.

4. Vigorous running is not a necessary precursor of the convulsive phase of the electrically induced NF pattern and of the ensuing passive, hypokinetic state of the reaction.

5. Since the electrical stimulus lasts only ·2 second and since the convulsive phase of the ES-NF-4 pattern is immediately precipitated in some cases, the motor aspects of the abnormal behavior pattern may occur in the absence of any psychologically significant state of fear.

6. Inasmuch as the ES-NF response is always evoked by an electrical voltage less than that necessary to produce a maximal generalized convulsion, the ES-NF pattern represents a reaction to an abnormal but not maximal neurophysiological stimulation. In view of the motor similarity of the ES-NF and NF patterns, it is strongly suggested, therefore, that the NF response is also a reaction to an abnormal but not maximal neurophysiological stimulation.

7. The pattern of the motor expression of the NF reaction in the rat is similar to the motor symptoms of experimental catatonia described as occurring in many other animals following doses of bulbocapnine as well as following other physical and chemical alterations of the internal environment of the animals.

8. The symptoms of catatonia observed following the noise-induced acute behavior reaction last for a significantly longer time than the catatonic symptoms demonstrable after an electrically induced acute NF-4 response. This relatively longer duration of the NF catatonic symptoms is not, therefore, produced simply by the neuromuscular expression of the motor pattern of the response, since the catatonia of the ES-NF-4 reaction in which the same motor pattern may be seen is of shorter duration.

9. The catatonic symptoms following a generalized electro-shock convulsion have a significantly shorter duration than the same symptoms manifest after either

ES-NF-4 or NF-4 reactions. Therefore, the longer-lasting catatonia of the noise-induced behavior is not entirely attributable to any convulsive exhaustion of the animal, since the catatonic symptoms following a generalized convulsion with maximal electrophysiologic discharge of the nervous system are of significantly shorter duration.

10. The longer duration of a catatonic symptom in rats following noise-induced abnormal behavior as compared to such behavior electrically induced is not attributable to any significantly variable duration of the pre-convulsive running phase of the reaction.

11. The absence of a gross startle reaction and the immediate presence of reflexes in the post-convulsive period of the ES-NF and NF responses contrasted with the complete loss of reflexes and the appearance of uncontrolled startle reactions in the recovery period following generalized electrically-induced convulsions indicates that the ES-NF and NF reactions do not involve complete central nervous system dissolution or a discontinuity of consciousness.

12. The demonstration of rage reactions, squeaking, biting, running away from the situation, reaction to pin-prick, and a general more excitatory response to stimuli in the ES-NF reactions as compared to the NF response indicate that while the motor expression of the two differently evoked reactions may be the same, the NF reaction is characterized not only by neuromuscular dysfunction attributable to the motor expression of the reaction but by behavior which is probably best described as reflecting a generalized inhibitory state of the animal.

(Author's abstr.)

J. EDUC. PSYCHOL.

VOL. XXXVI. 1945.

J. EXP. PSYCHOL.

VOL. XXXVI. AUGUST, 1946.

Level of Autonomic Activity and Electroencephalogram.

In a study of 120 persons in the resting-waking state a correlation of r = ·28 ± ·06 between parietal-occipital EEG potential and palmar skin conductance and a correlation of ·33 ± ·06 with heart rate were demonstrated. Combination of skin conductance with heart rate gave a correlation of ·48 ± ·05, thereby suggesting synergistic autonomic action on the EEG. That these correlations obtained in the resting-waking state are of opposite sign to those typical of excitatory effects after stimulation, suggests that the low level of cortical activity and metabolite production in the resting state permits dominance of the cortex by the subcortically determined 10 ± per sec. rhythm and by vasoconstrictor regulatory effects from the autonomic system. It is pointed out that in certain conditions of anticipation where cortical activity precedes the stimulus and in certain emotional reactions where there may be a suppression of central ideational activity and an exaggeration of subcortical and autonomic effects, such a relationship may explain instances of "facilitation" of alpha and slower EEG potentials. It is suggested that levels of autonomic activity giving correlations with EEG in the resting state opposite in sign to correlations produced in conditions of cortical excitation provide evidence of opposing cortical *v.* subcortical influences on cerebral function and offer a means for studying phenomena of mutual cortical-subcortical regulation.

(Authors' abstr.)

J. GENET. PSYCHOL.

VOL. LXVIII. JUNE, 1946.

J. INTERNAT. COLL. SURG.

VOL. VIII. 1945.

JOURN. LANCET.

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J. MT. SINAI HOSP.

VOL. XII. 1945.

J. NERV. MENT. DIS.

VOL. CIV. JULY, 1946.

Disseminated, Diffuse and Transitional Demyelination of the Central Nervous System.

The relationship between disseminated and diffuse sclerosis has been under consideration since Schilder's well-known papers on encephalitis periaxialis diffusa. A table is presented in support of the opinion that a very close relationship exists between disseminated and diffuse demyelination as far as heredity traits, sex, age, duration of disease, clinical diagnosis and gross pathologic findings are concerned.

Cases of diffuse or patchy demyelination of sporadic and heredo-familial type have been reported to occur at all ages from the early age of 1 to 2 months up to the age of 70. The duration of the disease has varied from a few days to 18 to 20 and 26 years and the pathology varied from one of patchy, transitional and diffuse demyelination, irrespective of the original clinical diagnosis.

There are no special mental disturbances which are typical of disseminated sclerosis as opposed to diffuse sclerosis. Bouman thinks that they are not very prominent and Guillain considers them of secondary importance. However, in Gans', Redlich's, Rochon-Duvignaud and the authors' cases they were predominant. Generally, the mental symptoms are more severe in diffuse than in disseminated types. The resulting dementia, if observed, in patchy processes of demyelination is in most cases not so marked as in the diffuse type and the mental symptoms develop sooner in the latter.

Changes of the eyeground (choked disc, optic neuritis, bilateral atrophy or bitemporal atrophy) is relatively more common in the diffuse than in the patchy type. Persistent blindness as opposed to transitory amaurosis, with or without changes of the fundus, is seen very seldom in patchy demyelination, but occurs more frequently in the diffuse type in adults as well as in children. On the other hand, many cases of diffuse sclerosis are reported without alterations of the fundi (Gozzano and Vizioli, Rochon-Duvignaud, the authors' cases). Transitory deafness now and then is found in the diffuse type, more persistent in children. Epileptiform manifestations are more frequent in children, though not uncommon in adults (D'Antona, Bouman, Curschmann). With respect to articulatory speech disturbances, pupillary reactions, abdominal reflexes, Babinski and deep reflexes, paresthesia, nystagmus, disturbances of swallowing, tottering gait, cerebrospinal fluid findings and presence of fever, there is no marked difference between their type and occurrence in either patchy or diffuse demyelination. The tremor of hands, head and trunk occurring frequently in disseminated sclerosis is only occasionally found in the diffuse (Shelden *et al.*). The paresis of the abducens is often mentioned in the diffuse type but its typical alternate appearance and disappearance is exceptionally seen (Austregesilo *et al.*). Facial paralysis was found at times in both disseminated and diffuse demyelination but usually of central type (Bouman, Wilson).

Remissions, which are rare and often of a very short duration in diffuse demyelination (Austregesilo *et al.*, Shelden *et al.*), but longer in Ottonello's cases are more frequently observed in disseminated cases.

Taking into consideration the many clinical analogies between diffuse and disseminated types apart from the cases where a so-called combination was present (Gans, Kufs, Benoit, etc.), it is easy to understand why the diagnosis of disseminated sclerosis is often made in cases of diffuse sclerosis. Schilder himself has asked whether diffuse sclerosis is not a form of acute disseminated sclerosis, especially incident in childhood. Marburg, too, accepts the opinion that a great many of the cases of diffuse sclerosis are really instances of disseminated sclerosis. Bouman, however, thinks that from a " practical point of view it is preferable to separate the two forms though they are very similar."

Histopathologically the fundamental and most striking structural changes in multiple and diffuse sclerosis is the demyelination accompanied or not by involvement of the axis cylinders and followed by a more or less marked gliosis.

The histopathologic picture appears variable mostly in relation to the distribution, extension, intensity and duration of the process responsible for myelinolisis.

From a morphologico-topographic point of view the demyelinated areas may be differentiated in (*a*) multiple or patchy demyelinations, variable in form and size. The areas may occasionally be large, scattered here and there in white matter. At times interspersed among the larger ones are isolated smaller patches. At times neighboring small areas coalesce, forming larger ones which gradually may involve very large areas of the white matter, assuming the aspect of so-called " transitional type. " (*b*) Diffuse demyelination which may involve the whole subcortical white matter leaving generally intact the " U " fibers. In this group are included Schilder's encephalitis periaxalis diffusa (sporadic and familial cases), encephaloleukopathia scleroticans progressiva, degenerative subcortical encephalopathy, symmetrical cerebral centro-lobar sclerosis, etc. (*c*) Diffuse demyelination, interspersed by islands of more or less preserved myelin sheaths generally surrounding blood vessels (Pelizaeus-Merzbacher variety). (*d*) Concentric demyelination formed by bands of more or less normal myelin alternating with demyelinated stripes. This type of " concentric demyelination " (Balo) or " map-like demyelination " (Marburg) is a rare incidence found by the authors and by other authors in cases of disseminated or transitional type in both acute and chronic cases.

After Schilder's detailed description of " encephalitis periaxialis diffusa," many authors accepted his original description of the main histopathologic characters of diffuse sclerosis, namely : (1) large extension of demyelination ; (2) limitation of the pathological process only to the white matter of the cerebral hemispheres, with integrity of the cortex and " U " fibers ; (3) relative integrity of the axis cylinders ; (4) presence of large glia cells and increase of the fibrillary type of neuroglia ;

(5) infiltration of the vascular walls with compound granular corpuscles and lymphocytes.

However, in the multiple or patchy and transitional type of demyelination, similar fundamental histologic changes are encountered. Although some authors have attempted to establish differences between disseminated and diffuse sclerosis on the basis of histopathologic features, it seems to us that such a differentiation does not hold true in the light of comparative studies. The review of some of the most important histopathologic features described as typical of diffuse sclerosis will establish their similarities and identities with the histopathologic features of disseminated sclerosis.

1. *Extension and Distribution of the Demyelinated Areas.*—As mentioned above, the histopathologic diagnosis of Schilder's disease is based on the fact that demyelination is intense, diffuse, and is limited to the subcortical white matter. But many cases of diffuse sclerosis have been reported in which, in addition to diffuse demyelination, presence of disseminated isolated patches identical with those of multiple sclerosis were present (Bouman, Gagel, Kufs, Wertham, Schaltenbrand, etc.). The isolated patches were distributed not only in the subcortical white matter but also in the brain stem (Bouman), optic nerves, internal capsule (Gagel), brain stem and spinal cord (Wertham), cortex, brain stem and spinal cord (Gozzano and Vizioli), internal capsule and cerebellum. The presence of these small isolated and disseminated patches of demyelination has been considered by Wertham, Kufs and by the authors as indicative of the mixed or transitional type of demyelination. Such an occurrence has been illustrated by the authors in which the fusion of small isolated patches resulted in large demyelinated areas with a tendency to assume the aspect of a diffuse demyelination. It is presumed that these " transitional forms " complete a passing stage in the development of a diffuse sclerosis.

2. *Involvement of the Ventricular Walls.*—Hallervorden suggested " the integrity of the ventricular walls in diffuse sclerosis " as a differential character between diffuse and multiple sclerosis. However, marked involvement of this region in diffuse sclerosis has been reported by various authors (Stewart *et al.*, Ferraro, Davison and Schick, D'Antona, etc.), and in the authors' case.

3. *Diffusion of the Demyelinating Processes.*—It was felt that generally the areas of demyelination in Schilder's disease have the tendency to diffuse by expansion, whereas large patches in disseminated sclerosis are constituted by coalescence of smaller ones. But in Schilder's disease D'Antona reported the presence of at least three originally isolated foci which fused into a large one involving both cerebral hemispheres. In other cases of diffuse sclerosis, the appearance of large bizarre and irregular patches seems to point to the same mechanism. In Gozzano and Vizioli's case it was noticed that foci of limited dimensions were reunited with the larger central areas through a narrow bridge of demyelination. The authors had also the impression that the peripheral foci were not the expression of a diffusion of the central areas but represented foci in the process of coalescing with the main one.

Another important character in Schilder's disease (Siemerling and Creutzfeld, Walter, Foix and Marie, Scholz, etc.) is the tendency of the demyelinating process to expand along nervous pathways, such as the internal and external capsule. On the other hand, the inferior longitudinal bundle is considered almost constantly preserved. But again this " feature " is really not characteristic because in the case of Gozzano and Vizioli the internal capsule was intact. In case 4 it was only slightly involved, whereas both inferior longitudinal bundles were affected, though in lesser degree than the surrounding areas.

4. *Involvement of the Axis Cylinders.*—Schilder reported in his cases of encephalitis periaxialis diffusa that the axis cylinders were more severely damaged than in cases of multiple sclerosis. Other authors (Gozzano and Vizioli, Cardona, Scholz, Gagel, etc.) have the impression that the involvement of the axis cylinders is in relation to the extension of the process of demyelination, i.e., where the demyelination involves the fibers for a short course the axis cylinders are less involved and better resisting, in contrast with more severe damage when they are deprived of myelin sheaths for a longer course. In the authors' cases the findings were similar to those reported by Weiman, Bielschowsky and Henneberg, Ferraro and Jervis, etc.), namely, partial integrity of the axis cylinders in the initial phase

of the demyelination followed by more or less pronounced destruction in proportion to the myelinolytic process. Sometimes at the periphery of the patch the axis cylinders are much better preserved than the myelin sheaths, while in the center they disclose marked swelling, fragmentation, a granular appearance or " boules terminales " (Weiman). At times they completely disappear. Now and then, however, the axis cylinders appear undoubtedly comparatively better preserved than the myelin sheaths. The authors felt that the severity of the alteration of the axis cylinders is in relation to the intensity and duration of the myelinolytic process.

5. *Demarcation of the Demyelination.*—It is generally considered that in the diffuse type of sclerosis the demarcation of the demyelination is smoother and less distinct than in the patchy type where it appears neat and sharp. Here again many cases of diffuse sclerosis have been reported with neat and sharp demarcation and in the authors' cases of multiple sclerosis the demarcation was hazy and indistinct.

6. *Glia Reaction.*—For some authors the gliosis is considered to be more intense in multiple sclerosis than in diffuse. But it has been noted over and over again that this is not always the case. In the authors' cases they encountered also very intense gliosis in the diffuse type. Although generally there is no appreciable and definite differences between the gliosis of disseminated and diffuse types, distinction must be made between the central parts of the patch and its periphery and the age of the plaques. Generally, the central portion of the diseased areas is occupied mostly by proliferating glia fibrils. The most recent areas or the peripheral zone of the more or less active areas contain numerous astrocytes but not dense fibrils, whereas the older areas are poor in nuclei and contain compact bands of more delicate fibrils.

As far as the presence of " globoid cells " is concerned, the authors mention only that these elements which are considered to be a characteristic of diffuse demyelination (Collier and Greenfield, Coenen and Mir, Barre *et al.*, Cardona, etc.) were noticed also in acute disseminated encephalomyelitis (Ferraro and Jervis, Gill and Richter) and multiple sclerosis (Marburg, Austregesilo *et al.*, etc.). Collier and Greenfield reported that these " globoid " elements were encountered particularly where there was active myelin destruction or where the demyelination appeared to be of more recent date. Austregesilo and co-workers believed that they are identical to the " gemastete Gliazellen " of Nissl and " giant gliocytes." Barre *et al.* insisted upon the straight analogy of these giant glia cells with Alzheimer's cells described in the pseudosclerosis of Westphal-Strumpel and with those encountered in tuberous sclerosis of Bourneville and Brissaud. In the authors' cases of diffuse demyelination as in the cases of Coenen and Mir and of Collier and Greenfield, the authors found astrocytes and " globoid cells " intermingled with compound granular corpuscles and interfascicular oligodendrogliacytes which in certain instances appeared also swollen.

The question of the role of the glia elements in the pathogenesis of the demyelinating processes and whether an abiotrophic deficiency (Collier and Greenfield, Greenfield, Levaditi, Bielschowsky, Jervis) or a metabolic disfunction or insufficiency (Scholz, Coenen and Mir) of the oligodendroglia cells (particularly) is responsible for the development of diffuse demyelination is still open for discussion.

7. *Blood Vessel Changes and Perivascular Infiltrations.*—In one of the authors' cases of multiple and transitional demyelination the blood vessels were apparently increased in number and size as in a case of diffuse demyelination reported by Bouman. In all of the authors' cases of multiple, transitional and diffuse demyelination, the adventitial sheath of the blood vessels was variably infiltrated by lymphocytes, plasma cells, a few " mast " cells and scavenger cells which were scarce in some places and more abundant in others. In addition, in the sheaths of the blood vessels oval nuclei similar to swollen endothelial nuclei were found. Similar findings were reported also by many other authors in both multiple and diffuse demyelination (Dawson, Marburg, Schilder, Jakob, Siemerling and Creuzfeld, Ferraro).

Now and then the character of the perivascular elements varied; at times predominance of compound granular corpuscles or lymphocytes was found, at others these infiltrative cells were mixed with other kinds of cells as mentioned above. This occurred in both patchy and diffuse demyelination.

Without entering into detail the authors will mention only that in some cases of multiple or diffuse demyelination the perivascular infiltrations were considered as expression of inflammation (Schilder, Bouman, Rhodes, Jacob, Stauffenberg, Gozzano-Vizioli, etc.), of degeneration (Haberfeld and Spieler, Krabbe, Scholz, Globus, Bielschowsky and Henneberg, Hassin, etc.) or of symptomatic inflammation (Spielmeyer and Ferraro). In certain cases it was, however, impossible to give a decisive opinion (Weil), and Spielmeyer himself was often in doubt as to whether the exudative infiltration was related to the reaction of " breakdown " products or expression of independent inflammation.

It is very curious that in some instances the opinions of different authors concerning the same cases were completely at variance. For instance, the case of Stauffenberg was regarded by Weimann as of a degenerative nature, whereas Steiner considered it as an inflammatory one. Weimann referred Bouman's first case of diffuse demyelination to the degenerative group, while Bouman himself considered it as belonging to the inflammatory one.

To date there has been no complete agreement among the neuropathologists concerning the concept of inflammation, degeneration or symptomatic inflammation of the nervous tissue. Ferraro has suggested the term of " hyperergic inflammation " of allergic nature to reconcile the two extreme viewpoints. Also, Marburg, by introducing the new term of " Parencephalomyelitis " intended to indicate that in this condition there is an " accompanying but not a genuine inflammation " of the nervous system. He believed that this reaction might be similar to that elicited by Schwartzmann's phenomenon with sterile toxins.

8. *Relationship of the Demyelinating Areas with Vascular Pattern and their Histogenesis.*—The patches of demyelination in multiple or patchy sclerosis have been considered to be vascular in distribution, whereas in the diffuse type the demyelination is supposed to be independent of the vascular pattern.

But this statement is not supported by many histopathologic reports. Kufs in his first case of diffuse sclerosis observed that one small thalamic focus was in relation to a vein. Similarly in one of Bouman's cases, in Stewart *et al.* and in Perdrau's monkey, isolated patches were in relation to blood vessels. On the other hand, while this perivascular distribution, in the diffuse type has been observed mostly in relation to isolated foci, many disseminated patches of multiple sclerosis have been reported as independent of vascular pattern.

This latter problem has been much discussed since the time of Rindfleisch and Ribert who claimed that the demyelinated areas were related to a primary vascular lesion or thrombosis. But Dawson, Symonds and Wilson, although recognizing a frequent relationship between the lesions and small blood vessels, expressed the belief that the changes were secondary to inflammation produced either by the noxious agent or by the breakdown of the damaged tissue.

Recently, Putnam and co-workers found that demyelination, with or without destruction of the axons, followed experimental obstruction of the small vessels and especially venules. Also, in multiple sclerosis and disseminated encephalomyelitis Putnam, Putnam and Alexander and Scheinker emphasized the occurrence of thrombi in the smaller veins and considered them the primary cause of demyelination. In support of this hypothesis, Simon and Solomon and Dattner found in disseminated sclerosis increased coagulation of the blood.

Marburg considered phlebothrombosis as only one of the etiologic factors of the demyelination in disseminated sclerosis. Hassin instead maintained that " blood vessels play no role in the genesis of the changes in multiple sclerosis, in which the nerve fibers are attacked primarily and directly, without the intermediation of the blood vessels."

In 1942, Dow and Berglund studied the vascular pattern of lesions of multiple sclerosis in serial sections. " Although the lesions were not always oriented about the veins, they found that two-thirds of them were." These authors were inclined to attribute the thrombosis to a " local absorption of thromboplastic substances revealed by the breakdown of myelin." Ferraro, in his attempt at considering the pathology of demyelinating diseases (both patchy and diffuse) as expression of allergic reaction, is in agreement with Abel and Schenck's as well as Putnam's views that the thrombi might be one aspect of allergy. In the authors' cases they found that a large number of demyelinated areas were in relation to blood vessels (arteries or veins) but only occasionally did they observe presence of thrombi.

Many authors have also failed to detect thrombi in cases of disseminated sclerosis. This failure Putnam believed to be due to technical difficulty in demonstrating certain thrombi and to their rapid disappearance from the lesions. It seems necessary to mention that while the writers who disagree with Putnam's views speak in general terms of " blood vessels or arteries," the latter insists more specifically on the involvement of the " venous drainage."

More recently, Hurst and Ternnent Cooke studied " capillary fat embolism in the brains of sheep, pigs and monkeys with special reference to demyelination." In their experiments " the lesions ranged from slight demyelination to full necrosis." In addition, they observed that " obstructive plugs (not thrombi) present in the early stage of the reaction, disappeared within a few days from lesions to the formation of which they have obviously contributed."

However, the theory of venous obstruction would still have to explain : (1) why the white matter is almost exclusively involved in many cases ; (2) the mechanism of formation of Balo's concentric type of demyelination or of Marburg's map-like (" Landkartenherde ") formations, and (3) the occasional preserved perivascular myelin islands encountered in the Pelizaeus-Merzbacher type of demyelination.

9. *Cortical, Extracortical and Spinal Cord Lesions.*—In the diffuse type of demyelination many authors reported that the pathologic process was limited only to the white subcortical areas, whereas the involvement of " extracortical " areas or of the spinal cord was considered secondary and of degenerative character. For this reason they called it also progressive degenerative subcortical encephalopathy, encephalopathia subcorticalis diffusa, etc.

In this connection the authors will mention only that involvement of the gray matter in both diffuse and patchy demyelination was observed in the cases of Gagel, Coenen and Mir, Klarfeld, Weimann, Bouman, Neuburger, Walter, Bielschowsky and Maas, Schelden *et al.*, Kraus and Weil, Wertham, etc., and in the authors' cases.

In addition, several cases of diffuse demyelination were reported in which the demyelinating process also involved the spinal cord. The lesions were not exclusively of a secondary degenerative character but were identical with primary patches of demyelination (Stewart *et al.*, Popi, Jacob, Wertham, Gozzano and Vizioli).

The supracortical pia-arachnoid has generally been reported as normal, but quite often various changes were noticed also in both patchy and diffuse demyelination. Such changes consisted generally of simple thickening of the meninges, lymphocytic infiltration or association of both (Austregesilo *et al.*, Neuburger, Kaltenbach, Bouman, Schilder, Braun, Schaltenbrand), presence of fat granular cells or of fat droplets with slight edema of the meninges (Kraus and Weil) and patches of dense infiltration by macrophages as well as by lymphocytes and polyblasts. In the authors' case the pia-arachnoid in many regions was intact, but over the forebrain there were patches of more or less perivascular and free infiltration of lymphocytes, macrophages, a few plasma cells and some polyblasts.

10. *Products of Degenerative or Disintegrative Metamorphosis*, such as different types of fat-staining material, or prelipoids or " Markballen " (Greenfield and King), mucinophile, argentophile and siderophile products, corpora amylacea (" protagonoide Abbaukugeln " Kaltenbach) and metachromatic substances were found by the authors in both disseminated and diffuse demyelination as well as in the transitional type. Their distribution and histochemical character is generally identical in both types of demyelination. In the authors' estimation, they cannot be used as " typical " differential elements for one or another type of demyelination as Cardona does concerning the intensity of the " metachromatic substance " which he considered to be specific for " Schilder's disease."

11. *Cystic Formations.*—They were described in both patchy and diffuse demyelinating processes (Schilder's first case, Rossolimo, Bouman's case 1, Bodechtel and Guttman, Braun, Borst, etc.). Sometimes these were surrounded by several layers of cylindrical cells giving the impression of small gliomas (Barre *et al.*). A cystic formation was found in the authors' cases of diffuse sclerosis (case 3).

12. *Hemorrhages, Necrosis and Edema.*—Hemorrhages were observed by various authors in cases of diffuse, transitional and patchy demyelination. However, more often congestion of blood vessels is found either in the parenchyma or in the meninges. Perivascular hemorrhages were noticed by Putnam, Zimmerman

and Janet, Davison and Friedfeld in cases of encephalomyelitis which Putnam and Ferraro include in the group of the " acute multiple sclerosis."

Necrotic areas may be present, especially in the very acute cases or in the stages of reacutization of multiple sclerosis (Marburg, Ferraro). Similar findings were also described in cases of diffuse demyelination (Schilder, Barre *et al.*, Bodechtel and Guttman, Bielschowsky and Hanneberg, Wohlwill, Gerstman and Straussler).

Edema is also found especially in acute cases either free in the parenchyma or in the perivascular spaces (Ferraro, Roizin, Moriarty and Weil, the authors' case).

From these data it is obvious that not only clinically but also anatomically there is a very close relationship between diffuse and disseminated demyelinating processes. It is to be noticed also that the given clinical differential diagnostic points between the diffuse and disseminated types appear to be not of decisive value because they are found in both conditions. Histopathologically close relationship between diffuse and disseminated types must be admitted because disseminated patches and transitional stages are found in some cases of diffuse demyelination and because of the presence in cases of typical disseminated type of demyelination of transitional and diffuse demyelinated areas.

It is not the authors' aim to discuss here in detail the great complication of nomenclature of diffuse and multiple demyelinations which Ferraro attempted to unify and classify some years ago. However, they wish to state that in the absence of more specific and definite data concerning the etiopathogenesis and histogensis of this insidious disease of the nervous tissue it seems more justifiable, particularly from a histopathologic point of view, to use the term " primary demyelinating diseases " (as Ferraro does) in place of other various arbitrary names, because demyelination is the most striking alteration, and, irrespective of whether it is patchy or diffuse, acute, subacute or chronic in character and sporadic or familial in type, the process is fundamentally the same.

From a descriptive point of view the naming of cases, whether " patchy " or " diffuse," should be based according to the predominance of symptoms or lesions in the case. The term transitional will of necessity have to be used, particularly from the pathologic standpoint, because the clinical symptoms fail at times to furnish precise indication of this occurrence. The term acute, subacute or chronic will be determined mostly by the clinical course. The classification of the familial cases into infantile, juvenile or adult type will be considered as respective varieties of the same clinico-pathologic syndrome and not as individual clinical or pathologic entities. (Authors' abstr.)

AUGUST.

Use of the Bellevue-Wechsler Scale in Clinical Psychiatry.

Experience with the Bellevue-Wechsler test used over a period of 8 years at the Boston Psychopathic Hospital, leads the authors to believe that it is a superior test because it can be administered with relative ease, it has been standardized on adults over a wide age range, it has the flexibility of a point scale with possibility of direct comparison of performance on various test items; and also because it taps a wide range of functions and elicits data of considerable value and interest to the clinician. In the group of cases characterized by the term " brain damage," this test would seem to be of special value for both diagnosis and investigation.

Both quantitative and qualitative signs are found in patients with " brain damage." The quantitative signs consist essentially in marked discrepancy in the weighted scores between various sub-test items. As a rule, performance on non-verbal items (picture arrangement, picture completion and block designs) is most markedly affected, but there is always at least *one* verbal sub-test on which there is also loss in ability to function. The qualitative signs are best displayed on the

non-verbal test items where the patients show rigidity, inability to shift attention or change the mode of responding, inability to ignore superficial or extraneous stimuli and difficulty in organizing material into either a required pattern (block designs) or into a meaningful logical sequence (picture arrangement). The same signs do appear in the verbal material but are more difficult to recognize and may often be missed.

Where both quantitative and qualitative irregularity of performance are found, clinical analysis reveals a very high incidence of brain damage.

Within the broader framework of the " organic " pattern as elicited by the Bellevue-Wechsler test, the authors have noted 7 variant configurations or profiles which are more or less mutually exclusive. The full significance of these profiles is not clear as yet; certainly they are not specific for any given disease entity. As a rule, the greater the loss of function as displayed on the psychological examination, the more serious is the brain damage. There are suggestive relationships between the particular psychological configurations and certain groups of symptoms, but it is felt that the meaning of these trends must await further study.

(Authors' abstr.)

SEPTEMBER.

Paroxysmal Slow Waves in the Electroencephalograms of Patients with Epilepsy and with Subcortical Lesions.

A study has been made of psychomotor waves encountered in 3,000 EEGs over a 2-year period. The characteristics of " psychomotor " activity in 135 epileptics are summarized, and the tendency of psychomotor waves to form shifting foci is stressed. Similar activity has been encountered in addition in 17 proven and 14 probable cases of subcortical pathology. The slower (2–3 per second) psychomotor waves tend to be associated with lesions in the region of the basal ganglia, thalamus and cerebellar hemispheres, whereas 4–6 per second psychomotor waves tend to be associated with lesions in the region of the hypothalamus, pons and (in one case) the cerebellar vermis. It is suggested that psychomotor activity in epileptics probably arises in deep structures. It is emphasized that a focus consisting of or associated with psychomotor activity is usually inconstant and does not indicate focal cortical pathology in the majority of instances.

(Authors' abstr.)

Preliminary Report on the Effect of Glutamic Acid Administration in Mentally Retarded Subjects.

It might be expected that a substance affecting brain metabolism would be more effective in patients whose intellectual potentialities were basically normal, but had been damaged by brain disease or injury, than in patients with a primary mental deficiency. Furthermore, we have found that in functional brain damage, artificially produced by electric shock, glutamic acid administration may exert a favorable influence on confusions, memory and other mental performances. For these reasons we attempted to select for our preliminary study patients with secondary mental deficiency, but in some cases it is very difficult to differentiate between these two types of deficiency and in some of our patients the diagnosis was not certain.

In 7 of the 8 patients studied an unmistakable rise of varying degree in the level of mental function followed the oral administration of glutamic acid in amounts

of 8 to 10 gm. a day. The effect depended on the continuous administration of the amino-acid; when the patients were put on placebos they eventually slumped back to their previous level of performance. This tendency to relapse was not always discernible immediately after discontinuation of the glutamic acid.

On an empirical basis psychometric tests are accepted to-day as giving a good insight into mental capacity even though they do not test the whole performance ability of the patient. To safeguard against errors which are not uncommon in work on mental deficiency, our subjects were repeatedly tested with a battery of different psychometric tests which agreed closely in evaluating the mental capacity. It should be emphasized that most of our patients had been repeatedly tested by different psychologists over a period of years before the present study was undertaken. The IQ was found to be practically static or the gain was very small. The patients received adequate educational attention, and one of them underwent psychotherapy prior to the experiment. With this background the rapid rise in IQ following the administration of glutamic acid can hardly be ascribed to other factors, such as maturation or environmental influences.

It may be argued that the gain in IQ was not valid but resulted from an increased familiarity of the patient with the tests. We believe that this possibility is excluded for the following reasons: (1) The patients were tested several times prior to glutamic acid administration and none of them showed a significant variation in IQ. These pre-treatment tests were spaced at the same time intervals as those carried out later during the glutamic acid periods. (2) Each time the patient was retested, not only the original Binet but other tests with which the patient was not familiar were used. (3) The best proof, however, rests in the fact that the patients dropped in IQ during the placebo period and regained the loss again when glutamic acid was administered.

In analyzing the intellectual gain resulting from the administration of glutamic acid, the question must be asked whether this gain represents an acquisition of new intellectual tools, i.e., an increase of intelligence, or the better utilization of existing intellectual abilities. It was noted that patients who, before administration of glutamic acid, appeared to be dull, inattentive and easily fatigued became more alert, attentive and persistent in trying to accomplish the tasks put before them. It was also observed that in the pre-treatment phase some of these patients appeared at times to be irritable, restless and emotionally labile. During administration of glutamic acid they behaved in a manner which suggested an improved emotional regulation. It seemed to us that the performance of the total personality, rather than of some circumscribed intellectual functions, showed improvement.

In recent investigations on the structure of memory in patients who were exposed to electric shock treatment, similar observations were made by ourselves and Dr. Zubin. Memory impairment and more or less severe confusions after electric shock treatment are known to occur in a large number of patients. 10 to 33 c.c. of a 10 per cent. solution of glutamic acid were administered intravenously to some of these patients at the height of their confusional state, which usually occurs when they have already had 6 to 12 electric shock treatments. The impression was gained that the administration of glutamic acid shortened the period of confusions and memory impairment, and in some patients psychological tests showed an immediate and definite improvement. The memory-defective and confused patients often showed an emotional imbalance such as increased irritability, rapid mood swings, depressed or impulsive behavior, distractibility and inattention. Usually these emotional symptoms improved first and the change in behavior for the better preceded the improvement in the intellectual performance.

It is known to-day that the ability to perform intellectually depends upon many factors, among which the emotional status of the individual plays a significant role. Some patients suffering from organic brain damage show, owing to emotional inhibitory factors, a much more pronounced organic incapacitation than can be explained by the tissue destruction. In hypnosis or under the influence of sodium amytal patients suffering from aphasia, apraxia and many other neurological disturbances may perform much better than otherwise. Memory lapses can also be reduced by these methods. In rehabilitating such patients this factor is now taken into consideration.

From the foregoing considerations it appears possible that glutamic acid does

not so much influence or increase the intellectual ability as such, but only enables the patient to regain his intellectual function which was inhibited by other mechanisms. But inhibitory mechanisms similar to those observed in diaschisis may play a part in addition to the emotional factors. The nervous system often responds to damage with increased inhibitory and excitatory manifestations until a new neural equilibrium is reached. The removal of inhibitory mechanisms in acute cases of brain damage is not surprising, but it is rather impressive that it can occur to some extent in patients with a long-standing brain damage, as in the boy who had an encephalitis 25 years before.

It could be argued that the patients in whom the glutamic acid proved to be beneficial were suffering from traumatic epilepsy. Organic brain damage even without epileptic manifestations sometimes causes intellectual and emotional changes which are similar to those seen in some patients who have epileptic attacks. It could, therefore, be claimed that the improvement with glutamic acid is a result of removing the epileptoid mechanism. There is some evidence that this is not the case. Price, Waelsch and Putnam have pointed out that increase in intellectual efficiency is not always accompanied by a decrease in *petit mal* seizures; and furthermore, our patients did not show a characteristic epileptic pattern in the electroencephalogram.

For practical and for theoretical reasons it is of interest to consider the toxic symptoms observed after the administration of glutamic acid. The oral administration in mentally defective children did not cause any toxic effects. However, in the psychiatric patients, after electric shock treatment, we have occasionally seen gastro-intestinal disturbances, complaints of fullness in the stomach, vomiting and diarrhœa, which, however, subsided rather quickly on reduction of the dose. The intravenous application of glutamic acid caused in some individuals toxic effects of the same type. The individual sensitivity was very variable. Patients with hypersensitivity to the amino-acid complained of flushes, vomiting, feelings of dizziness and of general malaise. These symptoms could be avoided in some cases if the glutamic acid was given in more dilute solution than 10 per cent. and if the injection was given slowly, at a rate of about 1 c.c. per minute. But there remained sporadic cases in whom the toxic reactions occurred even with this technique. These observations on the toxicity of glutamic acid by intravenous injection were made during the last two years, during which time similar observations were reported by others in experiments carried out with animals.

It is impossible at this stage of the investigations to point to any biochemical mechanism as an explanation of the effect in epileptic patients of the administration of glutamic acid, and the same is true for the results obtained with mentally defective subjects. It may well be that other body constituents which may or may not be metabolically related to glutamic acid have the same effect. Up to the present we do not know whether the beneficial results are due to the fact that glutamic acid is administered as free amino-acid and whether they would be also obtained if the amino acid were offered in its linkage in proteins. For these and other reasons it cannot be decided whether we are dealing with a deficiency of glutamic acid which is overcome by its administration. Such a possibility is of major interest from the nutritional point of view since glutamic acid is not only supplied in large amount with the food but is also synthesized in the body.

There are few biochemical studies which may point to a specific role of glutamic acid in brain metabolism. It has been claimed that glutamic acid is the only amino-acid oxidized by brain slices, whereas chopped brain appears to be able to oxidize a variety of amino-acids. A more specific function of glutamic acid in brain metabolism may be deduced from experiments showing that the enzyme system which synthesizes acetylcholine in brain extracts, if inactivated by dialysis, is partially reactivated by the addition of glutamic acid. This finding, if transferable to the intact organism, may offer an explanation of the toxic symptoms, resulting from the intravenous or oral administration of glutamic acid, encountered in psychiatric patients after electroshock.

In this report the authors do not want to raise any extravagant hope that cases of secondary mental deficiency and, by implication, other forms of feeblemindedness, may be cured with glutamic acid; but there is some indication that a limited influence can be demonstrated on some of these patients. Mental defects have been considered unalterable, and research and treatment have been concentrated

on the social and educational aspects, which are of great importance. Nevertheless, the authors felt that attempts should be made to test the possibility of improving brain function by biochemical means. The results obtained with glutamic acid are considered to be a starting point for further investigations. Long and tedious research will be necessary to solve the question of the specificity of glutamic acid and to test other substances which may benefit some patients and may also elucidate basic neural mechanisms in relation to mental activity. (Authors' abstr.)

OCTOBER.

The Influence of Emotion on the Human Electroencephalogram.

1. Hyperemotional states give rise to two characteristic types of electroencephalographic pattern. Type I is characterized by a "spontaneous" low voltage random high frequency pattern. When the attention of the patient is removed from the test and his environment, a normal brain wave pattern ensues. The Type II pattern is characterized by rhythmic, approximately 20 per second activity predominantly in the frontal and parietal regions. This pattern is stable and uninfluenced by afferent stimuli of ordinary intensity.

2. The recognition of these electroencephalographic patterns is important from neuropsychiatric considerations.

3. The rhythmic high frequency potentials observed in hyperaffective disorders is a product primarily of frontal lobe activity.

4. Physiologically increased frontal lobe activity, as evidenced by the superimposition of somatic complaints on a basic emotional disorder, results in an enhanced frontal electric potential output. Hence, the rhythmic high frequency oscillations of the frontal regions may be considered as "true" action potentials. (Author's abstr.)

Porphyria: Neuropsychiatric Aspects in the Case of a Negro.

The diagnosis of porphyria rests on the sum total of signs and symptoms which may be recorded briefly as follows: a hysterical personality with remissions and exacerbations of marked muscular weakness accompanied at times with pronounced but temporary visual impairment and excretion of red-colored urine; an unfavorable response to barbiturates, variability in reflex responses with the recently emphasized absence of knee jerks in the presence of ankle jerks and a summation effect reinstating the normal response of the former; thenar and hypothenar atrophy indicating early anterior horn cell involvement. In addition to these, the other signs and symptoms mentioned in the report add further weight to the diagnosis. Regarding bone changes in porphyria, Nesbitt says: "The bone marrow may appear hyperplastic, and occasional large cells laden with brown pigment may be seen."

An especially interesting fact in this patient is the sequential relationship of the anxiety episodes to the onset of the physical manifestations of the illness. (Author's abstr.)

J. NEUROL. NEUROSURG. PSYCHIAT.

VOL. IX. JANUARY, 1946.

The Relation Between the Electroencephalogram and Muscle Action Potentials in Certain Convulsive States.

1. The EEG's of 2 subjects with severe myoclonic seizures and 1 subject with mild myoclonic jerkings accompanying wave and spike discharge in the EEG are described.

2. Repeated simultaneous recordings of the EEGs and muscle action potentials have been made in these subjects during myoclonic episodes.

3. All subjects show some form of spike discharge, with or without a slow wave, in the inter-seizure periods. In the seizures the patients with the severe myoclonic jerkings show discharges of spikes in their EEGs with a period of 30 to 75 msec. at a rate of 8 to 13 per second.

4. There is an accurate correlation between the occurrence of the spike-like discharges in the EEG and the action potentials of the muscular jerkings in the severe cases and a less accurate correspondence in the mild case.

5. The muscle action potentials show recruitment and facilitation having a different time course of decay for flexor and extensor muscles.

6. In the periods between the spontaneous jerkings changes in spinal reflex excitability may be demonstrated.

7. Important differences in the characters of the muscular jerkings in the severe myoclonic states and the milder state accompanying wave and spike discharge are described.

8. These findings are discussed and their bearing on the origin and mediation of the abnormal discharges in these conditions are considered.

(Author's abstr.)

The Disorganization of Behaviour in Fatigue.

The skilled activity required by an exercise in instrument flying was observed to become disorganized in an experimental situation which was assumed to be fatiguing. The disorganization had two phases, in each of which it was associated with characteristic changes of feeling. The two phases of the disorganization, with the associated effects, were considered to constitute two distinct reactions to the test conditions.

In the first phase, all parts of the work were similarly affected. Although there was little or no increase in their duration, errors became more frequent and were overcorrected. Activity became excessive; movements of the controls tended to be too extensive, and there was a large increase in restless and inappropriate movements. Attention was distributed irregularly over the work and was held by aspects which had acquired a temporary urgency.

Subjects felt under strain, dissatisfied and irritable, and they were preoccupied with the test after it was finished. Signs of emotion, such as agitation and restlessness, were observed, and there were indications that muscular tonus was increased. Flushing of the face was common, and visible sweating also occurred.

In the second phase, some parts of the work were affected more than others, those regarded by the subjects as of greater importance being the better preserved. Errors became less frequent, but their correction was tardy and they were larger. Movements of the controls were often as extensive as in the first phase, but were fewer. Concentration failed and interest flagged. Some subjects were satisfied with a lowered standard of accuracy, whereas others were dissatisfied with their attainment, but made an insufficient response to remedy it, either emotionally or in organized activity, and they were apathetic and discouraged. Postural changes were variable, but flushing, or sweating was rare. (Author's abstr.)

APRIL.

Aetiology and Pathogenesis of Acute Sporadic Disseminated Encephalomyelitis and Multiple Sclerosis.

As a result of our experimental, anatomical and clinical findings we have been able to draw the following conclusions:

1. This work is the first in which experimental investigation of acute encephalomyelitis and multiple sclerosis has been successfully carried out and the infectious origin of these diseases experimentally and clinically confirmed.

2. Virus investigation of patients suffering from acute disseminated encephalomyelitis and multiple sclerosis has enabled us to isolate two strains of filterable virus—from the blood of one case, and from the cerebral tissue of another case of acute disseminated encephalomyelitis. These strains have proved to be identical, and differ from other known human neurotropic viruses.

3. The syndrome of acute disseminated encephalomyelitis has been produced in animals by means of inoculation with this virus. The morphological picture obtained has proved identical, particularly in rabbits and puppies, to that found in man suffering from acute disseminated encephalomyelitis. These experiments are the first in which experimental acute encephalomyelitis has resulted from the inoculation of human material.

4. On the basis of the above data an attempt has been made to neutralize the virus thus isolated with the sera of patients suffering from acute disseminated encephalomyelitis and multiple sclerosis. The virus has been neutralized by sera from 50 per cent. of cases of multiple sclerosis and from 70 per cent. of cases of disseminated encephalomyelitis.

5. These positive neutralization tests suggest that both of these diseases result from the same agent. On the other hand, a negative test does not necessarily indicate a different causative agent. Hence, acute disseminated encephalomyelitis and multiple sclerosis have the same aetiology in some of the cases, while in others the same anatomical and clinical syndromes may be elicited by other agents, or possibly by the same agent but with a different antigenic structure.

6. A small number of cases of acute disseminated encephalomyelitis and multiple sclerosis, subjected to specific vaccine therapy, has yielded so far satisfactory results. Clinical improvement has been registered, together with a considerable increase of antibodies in the blood.

7. It is our belief that this work is far from being complete. The results put forward by us may form a basis for further investigation. (Authors' abstr.)

Re-education in Aphasia.

1. The problem of re-education in aphasia is briefly considered and some practical methods of retraining described.

2. The outcome of re-education in a group of 70 dysphasic cases is reviewed and evaluated. Treatment in 14 of these cases was begun 6 months or more after the onset of the disorder, when relatively little further spontaneous improvement was to be expected.

3. The results are considered in relation to the various aspects of language affected (speech, reading, writing and calculation), and to the type, severity and aetiology of the dysphasic condition. Although the number of cases is too small to permit a determination of the statistical significance of the results, it is suggested that the most favourable outcome is obtained in traumatic cases and in those whose symptoms are relatively mild and predominantly on the executive side.

4. Two-thirds of the patients given re-educational treatment were resettled in economic employment. (Authors' abstr.)

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VOL. V. JULY, 1946.

J. NEUROPHYSIOL.
VOL. IX. JULY, 1946.

Electromyographic Studies of Muscular Co-ordination on Stimulation of the Motor Cortex.

Experiments were performed on the effect of stimulation of the motor cortex of cats and monkeys on muscular co-ordination by means of electromyograms of flexor and extensor muscles. It was found that the effects depend on duration and intensity of stimulation, as follows:

1. Very weak stimulation of the motor cortex causes relaxation of flexor and/or extensor muscles if a pre-stimulatory tonic activity is demonstrable in the electromyograms. Such cortically induced inhibition is frequently followed by a post-stimulatory rebound.

2. With slightly increased intensity which calls forth a movement (flexion or extension), reciprocal innervation of agonist and antagonist may be observed, whereas somewhat stronger stimuli cause simultaneous activity in flexor and extensory muscles, i.e., co-innervation, and consequently co-contraction, during flexion or extension.

3. Variations in the duration of the period of stimulation exert effects similar to those seen in experiments involving different intensities. Whereas reciprocal innervation appears during the early phase of stimulation it is later followed by co-innervation while the stimulation continues.

4. Even the agonist may show a transition from inhibition to excitation during stimulation at constant frequency and intensity.

5. It is shown that an inhibitory period frequently occurs on cessation of stimulation.

6. The phenomena described under 1–5 are interpreted as indicating that with increasing number of discharging neurons the peripheral effect on individual muscles changes from inhibition to excitation, and in the case of an antagonistic pair of muscles, from inhibition to reciprocal innervation, and finally to co-innervation. Under conditions permitting facilitation the predominant type of co-ordination of fore and hindleg muscles in flexor and extensor movements of moderate intensity is that of co-innervation. (Authors' abstr.)

Centrifugal Deterioration of Asphyxiated Peripheral Nerve.

Electrical thresholds of points on a circulated nerve preparation in the cat were determined as the least electrical stimulus required to evoke either a contraction of muscle or the A-wave led from the distal end of the nerve. Then the trachea was clamped and threshold observations were continued.

The most proximal point was always the first to undergo an increase in threshold culminating in complete inexcitability. Successively more distal points underwent similar change with passage of time. Points 6 per cent. and 85 per cent. of the distance between proximal and distal ends of the nerve underwent a five-fold threshold increase in 13 and 96 minutes respectively.

Roots were inexcitable before onset of threshold elevation at the mid-point along the nerve length. In a partly deteriorated nerve, deterioration was further advanced in the central than in the peripheral half of a segment, but of the fibers blocked in the segment, some were blocked only in the peripheral half.

It is thought most likely that in these experiments a given block along a given fiber involved but a very short segment of the fiber, blocking along a greater length resulting from fusion of these short blocked segments. The field of blocking originated at the central end of the nerve and moved peripheralward. Within the field of blocking, blocks appeared most rapidly at the central end, least rapidly at the peripheral end.

This proximo-distal gradient of deterioration must be a manifestation of a gradient along the intact nerve in the living animal. (Authors' abstr.)

The Hypothalamic Regulation of Sleep in Rats: An Experimental Study.

1. In the rat complete bilateral transection of the hypothalamus, irrespective of location, interferes with the normal regulation of sleep.

2. The location of lesions which cause disturbances of the function of waking indicates the existence of a structure in the caudal hypothalamic region and in the adjacent part of the midbrain tegmentum, which is of specific importance for the capacity of maintaining the waking state during the absence of external stimuli (" waking centre ").

3. There is reason to accept a structure in the preoptic region, which is of specific importance for the capacity of sleeping (" sleep centre ").

4. Evidence is offered that sleep is caused by an inhibitory action of the sleep centre on the waking centre.

5. The lateral hypothalamic area seems to be of more importance for the regulation of sleep and waking than the inner areas. It seems probable that the medial forebrain bundle, which occupies this area, is implicated in the transmission of impulses determining the sleep-waking rhythm.

6. The hypothalamic centres involved in the regulation of sleep are topographically identical with those determining the autonomic balance.

(Author's abstr.)

Frequency of Centripetal Stimulation in Inhibition and Facilitation of the Knee-jerk.

An analysis has been made of the relations between the frequency of centripetal stimulation of a nerve-trunk and the resulting reflex effects upon the anterior horn cells innervating the quadriceps muscle in the acute spinal cat. These effects can be classified as (i) ipsilateral extensor activity; (ii) ipsilateral inhibition of the knee-jerk; (iii) contralateral extensor activity; (iv) contralateral facilitation of the knee-jerk; (v) inhibitory after-effects, and (vi) excitatory rebound.

The intensity of the excitatory process increases with frequency from 1 per sec. up to 30 per sec., without further increase up to 120 per sec. The rate of increase is slow at frequencies lower than 8 per sec. The intensity of the inhibitory process increases with frequency from 1 per sec. up to at least 120 per sec., the highest frequency studied. (Author's abstr.)

Mechanism of Pupillary Dilatation Elicited by Cortical Stimulation.

Pupillary dilatation elicited by electrical stimulation of area 8 in the cerebral cortex of the monkey is a localized sympathetic response having all the properties of reciprocal innervation. This response is abolished by section of the cervical sympathetic chain, minimal pupillary dilatation due to inhibition of the oculomotor nucleus being obtainable only under special conditions of anesthesia. The active dilator component travels over pathways involving the hypothalamus. This cortico-hypothalamic pathway is not a direct one. The reciprocal inhibitory pathway from area 8 to the oculomotor nucleus has been shown to be a direct projection. (Authors' abstr.)

Inhibition at the Nerve Muscle Junction in Crustacea.

The effect of inhibitory nerve impulses on the potential changes and on the subsequent contractions of crustacean muscle was investigated.

1. The action potentials of inhibitory axons do not differ from those of other nerve fibres. Inhibitory impulses alone have no detectable electrical effect on the muscle. These findings confirm those of other investigators.

2. There are two separate actions of inhibitory impulses on the motor response:

(*a*) An electrical effect, the α-action, reduces the junctional potential (e.p.p.) to an extent depending upon the relative times of arrival of inhibitory and motor impulses at the junction. Due to the reduction of the e.p.p. (i) the setting up of propagated muscle impulses is prevented, and (ii) local contractions at the junctional region are diminished or abolished. At 17° C. that α-action lasts about 20 to 25 msec. and declines to half in about 5 msec. The time course of the e.p.p. is not appreciably altered by inhibition.

(*b*) The inhibitory impulse has direct action on the contractile process at the junction, the β-action. At low frequencies complete mechanical inhibition can be obtained without reduction of the e.p.p. This confirms observations by Marmont and Wiersma (9). The β-effect can sum at intervals of 0·1 sec.

3. Facilitation responsible for the growth of successive e.p.p.s is not affected by inhibition at 50 per sec. The first or second e.p.p., after cessation of inhibitory impulses, reaches the amplitude to which it would have grown in the absence of inhibition.

4. It is suggested that the α-effect is due to action of the inhibitor on the junctional receptors of the muscle membrane, and that the release of the transmitter is unaffected. (Authors' abstr.)

J. NEUROSURG.

VOL. III. JULY, 1946.

SEPTEMBER.

Observations on Encephalographic Findings in Cerebral Trauma.

1. The encephalographic findings in a series of 261 patients, 206 of whom had had cranial trauma, have been reviewed. Of these, 177 had head injuries with skull defects, while 29 had closed head injuries.

2. Abnormal encephalograms were found in 74 per cent. of the cases of head trauma.

3. Unilateral dilatation of the ventricles was found in 29 per cent. of the cases of head trauma. Symmetrical bilateral dilatation of the ventricles was found in 16 per cent. of these cases; asymmetrical bilateral dilatation in 29 per cent.

4. In a group of 60 cases in which second-day study of the ventricles was made, an increase in the ventricular size on the second day was found in over one-third.

5. Many of the encephalographic abnormalities were found within a short time after injury. (Authors' abstr.)

Cortical Localization by Electroencephalography. The Value of a Quantitative and Statistical Analysis of Homologous Recordings Obtained Simultaneously.

1. A modified electroencephalographic technique based upon the quantitative and statistical analysis of homologous recordings obtained simultaneously has been investigated for its cortical localizing value. The principle involved is identical with that employed in the neurological examination in which focal abnormal findings on one side are checked against the normal side as a control. The technique methods of analysis and principles of evaluation are presented in detail.

2. This technique has been employed in 1,200 examinations on patients who have received an adequate clinical work-up. Definite cortical localizations were obtained in approximately one-third of this abnormal group, which gave a high degree of correlation with the clinical findings. 90 per cent. of the remainder had convulsive states or other conditions in which focal signs and symptoms or neurological findings of localizing value were not obtained.

3. In 248 patients of this group subjected to pneumoencephalography, an overall correlation of 81 per cent. was observed between the roentgenographic findings and those of the electroencephalogram obtained by means of the technique of homologous recordings.

4. In 85 proved cortical lesions an electroencephalographic correlation of 95 per cent. was obtained.

5. It is estimated that electroencephalographic localization of lesions of a less gross character was made in approximately 20 per cent. of the entire group, which correlated well with the clinical and pneumoencephalographic findings and which would not have been detected by other techniques.

6. The extra time and effort required by the technique are not excessive and appear to be well justified when used for purposes of localization.

(Authors' abstr.)

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Psychotic Casualties in New Guinea, with Special Reference to the Use of Convulsive Therapy in Forward Areas.

1. The problems of accommodation and treatment of psychotic casualties at an Australian general hospital in a forward area are presented.

2. The dangers attendant upon air transport and the methods successfully adopted to combat them are discussed.

3. A description and classification of the types of psychoses encountered in service personnel in New Guinea during the period from June, 1944, to May, 1945, inclusive, reveal that the same forms of illness occurred in service personnel as are met with in civil life. An interesting feature was the extreme degree of excitement and agitation manifested immediately prior to admission to hospital.

4. The role of " Atebrin " in the production of psychotic illnesses is discussed, and the type of illness attributed to such intoxication is described.

5. Certain impressions resulting from the observation of 333 cases have been given. A comparison is made of the results obtained before and after the introduction of convulsive therapy, and the value of this form of treatment in the management of psychotic patients who are violent and resistive and in the overcoming of the necessity for physical restraint is shown. (Author's abstr.)

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Motor Chronaxia in Aged Patients with Generalized Arteriosclerosis.

An analysis of the chronaxia and rheobase values obtained in generalized arteriosclerosis patients varying in age from 57 to 96 enables us to note peculiarities in the excitation of the neuro-muscular system in aged persons as compared with the chronaxia values in healthy people of middle age (men and women).

A comparison of the data obtained with the results of chronaxia and rheobase measurements in persons of the same age who had attained normal physiological senescence, shows that no essential differences exist between the values except those for the rheobase. The rheobase figures in aged persons who have attained physiological senescence is somewhat higher than the rheobase value in middle-aged persons; whereas in diseased persons of advanced age it is twice and sometimes three times as high as the normal.

The most pronounced cases of decreased chronaxia are noted in cases of generalized arteriosclerosis and in emphysema of the lungs, while cases of increased chronaxia are encountered in generalized arteriosclerosis attended by manifestations of cardiovascular deficiency. (Authors' abstr.)

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VOL. VIII. 1945.

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Pavlov's Doctrine of the Protective and Therapeutic Role of Inhibition in Instances of Trauma of the Nervous System.

It is generally considered that Pavlov thought of inhibition as playing a secondary, protective role in the regeneration of injured nerve centers, preventing further damage from pathogenic stimuli while other factors brought about the regeneration of the tissue. Asratian believes it is closer to Pavlov's doctrine to say that inhibition not only plays a protective role but is also an active, independent, therapeutic factor. Having thus stated Pavlov's point of view, he recounts a series of his own investigations whereby he developed techniques for accelerating recovery from injuries to the nervous system by the use of narcotics.

(Psychol. Abstr.)

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VOL. VIII. MAY–JUNE, 1946.

A Comparison of the Exercise Response in Anxiety States and Normal Controls.

1. Twenty normal controls, 10 anxiety states (with somatic anxiety symptoms but with no complaint of poor exercise response) and 10 effort syndrome patients are compared regarding their responses to moderate exercise on a bicycle ergometer.

2. O_2 uptake, lactate rise and pulse area were determined after exercise for each group.

3. The anxiety states as well as the effort syndromes had a significantly poor exercise response compared with the normal controls.

4. O_2 consumption after standard work is probably the most satisfactory quantitation of exercise response, but the three tests collectively give the most reliable index. (Authors' abstr.)

The Effect of Exercise on Soldiers with Neurocirculatory Asthenia.

1. A simple classification for different types of effort syndrome is outlined.

2. Twenty-five Group II ("constitutional") effort syndromes showed a mean blood lactate rise of 28·9 mgm. per cent. ± 6·14 s.d. after standard exercise on a bicycle ergometer. The corresponding figure for 35 normal controls was 21·1 mgm. per cent. ± 5·89 s.d., which is significantly different.

3. Ten Group III (psychogenically produced) effort syndromes did not show a significantly different lactate rise compared with the controls.

4. When worked to exhaustion point on a bicycle ergometer 20 normal controls showed a mean blood lactate rise of 78·0 mgm. per cent. ± 8·15 s.d. Twenty E.S. patients gave a mean blood lactate rise of 50·2 mgm. per cent. ± 5·74 s.d.

5. Pulse rise and decrement after standard work is highest in Group II E.S. and lowest in the normal controls, with Group III E.S. occupying an intermediate position. (Authors' abstr.)

A Comparison of the Exercise Response in Various Groups of Neurotic Patients, and a Method of Rapid Determination of Oxygen in Expired Air, Using a Catharometer.

1. The exercise response to standard work on a bicycle ergometer of five different groups of neurotic patients (E.S., Group II; E.S., Group III; somatic anxiety states; anxiety states without demonstrable somatic anxiety, and patients with conversion hysteria) is compared with 20 normal controls, regarding oxygen uptake, lactate rise and pulse area.

2. All five groups are significantly worse than the controls when oxygen uptake is compared, but this differentiation is not so complete with the lactate rise and pulse area. The oxygen uptake figures indicate that poor exercise response is an attribute of neurotic patients in general.

3. A catharometer is a simple, quick and accurate method for oxygen estimation, and compared with Haldane's method of gas analysis on 22 gas samples gave a product moment correlation of 0·996. (Authors' abstr.)

JULY–AUGUST.

Changes in the Electroencephalogram and in the Excretion of 17-Ketosteroids Accompanying Electro-shock Therapy of Agitated Depression.

1. Thirteen women suffering from agitated depression have been studied before, during and after periods of 8 to 15 electro-shock treatments.

2. Daily ratings with the use of a new psychiatric scale are found to correlate well with fast (> 13 per second) frequencies in the electroencephalograms. When the patients improve, the percentage of time these waves are present decreases; when they relapse the fast waves tend to return. However, there is also a tendency for the fast waves to return in some patients showing good remission.

3. The diurnal rhythm of the nightly rate of 17-ketosteroid excretion divided into the morning rate as a measure of adrenal cortical activity was also measured. While this value for normals is 1·60, in the patients studied the mean pre-treatment value was 1·03; during the treatment period it rose to 1·32, and declined in the post-treatment period to 1·25.

4. The possible significance of these findings is discussed in terms of questions they raise for future exploration. (Authors' abstr.)

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1. Biochemistry, Physiology, Pathology, &c.

Particularly Intense Acetylcholine-like Activity of a New Series of Polyalcohol Amino Acetals. Fourneau, E., Bovet, D., Bovet, F., and Montezin, G. (Inst. Pasteur, Paris). [*Bull. soc. chim. biol.*, **26**, 516–27 (1944).]

All of the compounds mentioned below have a parasympathomimetic and muscarinic action in experimental animals. F 2249 and F 2301 also have a nicotinic action (produce hypertension in the atropinized dog); the others do not (2,3-dihydroxypropyl) trimethylammonium iodide formal (F 2249), $\overline{O.CH_2.O.CH_2.CHCH_2NMe_3}I$, is 0·5–2·0 times as active as acetylcholine (1). The acetal, $\overline{O.CHMe.O.CH_2.CHCH_2NMe_3}I$ (F 2268), is 10–50 times as active as (1) and is possibly the most potent poison of this type known. The propionaldehyde derivative (F 2292), $\overline{O.CHEt.O.CH_2.CHCH_2NMe_3}I$, and the acetone derivative (F 2269), $\overline{O.CMe_2O.CH_2CHCH_2NMe_3}I$, are 0·1 as active as (1), and the benzaldehyde derivative (F 2262), $\overline{O.CHPh.O.CH_2CHCH_2NMe_3}I$, is about 0·001 as active as (1). $\overline{O.CHMe.O.CH_2CHCH_2.CH_2CH_2NMe_3}I$ (F 2301), and the corresponding triethylammonium derivative (F 2302), have a very weak action, and so do $\overline{O.CHMe.O.CH_2.CHCH_2NMe_3}I$ (F 2276), and $\overline{O.CH_2.CH_2.O.CHCH_2NMe_3}I$ (F 2291).

L. E. Gilson (Chem. Abstr.).

Biochemistry of Choline and its Derivatives. XII. Determination of Total Choline and Water-insoluble Choline of Tissues. Kahane, Ernest, Levy, Jeanne, and Libert, Odette (Univ. Paris). [*Bull. soc. chim. biol.*, **27**, 65–72 (1945); *cf. C. A.*, **40**, 1548[2].]

A 1 gm. sample of blood, mlk, urine, or fresh animal or plant tissue is mixed with 0·5 c.c. of concentrated H_2SO_4 in a porcelain crucible and left for 24 hours in an oven heated to 100–110°. At this temperature, in contact with air containing a little moisture, the H_2SO_4 becomes concentrated to approximately 65 per cent. by weight and remains at this concentration. Much organic matter is destroyed. Free and combined choline is converted to the salt of the half ester, $(CH_3)_3\overline{NCH_2CH_2SO_4}$. No decomposition of choline occurs under these conditions although conversion to $(CH_3)_3N$ may occur at higher temperatures. The contents of the crucible are washed into a flask with about 25 c.c. of water (the resulting mixture should contain approximately 4 per cent. by weight of H_2SO_4) and refluxed 8 hours to hydrolyze the ester. Then 1 c.c. of 50 per cent. $FeCl_3$ solution and an excess of $CaCO_3$ are added, the mixture is filtered, and choline is determined in the filtrate by known methods. It is sometimes necessary to treat the precipitate on the filter paper with dilute HCl to dissolve the $Fe(OH)_3$ and excess $CaCO_3$ and treat the insoluble residue of organic matter (containing $CaSO_4$) with H_2SO_4, etc., as before, to render soluble some choline not made soluble during the first treatment.

L. E. Gilson (Chem. Abstr.).

Changes in the Contents of Acetylcholine in Nervous Tissue Under the Influence of Constant Current. Babskii, Eug. B. (State Pedagogical Inst., Moscow). [*Nature*, **157**, 730 (1946).]

Non-polarizable electrodes were applied to dog brain and a d.c. of 4–10 ma. was used for 10 minutes, after which pieces of the brain were removed and analyzed. Nerve fibers of dog and cat were similarly treated. In all cases the tissue immediately adjacent to the cathode showed an increase in acetylcholine and that next to the anode a decrease. L. E. Gilson (Chem. Abstr.).

Mechanism of Apnea Provoked by Acetylcholine. Martini, V., and Calcagno, L. (Univ. Geneva). [*Boll. soc. ital. biol. sper.*, **15**, 587–8 (1940).]

The production of apnea in experimental animals by acetylcholine is not due to action through the central nervous system, but appears to be a direct effect on the lungs, probably on the bronchial musculature. L. E. Gilson (Chem. Abstr.).

Action of Acetylcholine and of Vitamin B_1 by the Suboccipital Route on Blood Sugar and Calcium. Gomez, F. Idoipe, and Ortiz, A. Valcarreres. [*Farmacoterap. actual* (*Madrid*), **2**, 169–76 (1945).]

Acetylcolhine, 100 mgm. per kgm., injected into the cisterna magna of dogs produces a large rise of blood sugar. This does not occur after previous adrenalectomy. Blood Ca falls probably owing to the resulting overbreathing. Vitamin B_1 (25 mgm.) has a similar action on the blood sugar but does not alter the Ca level.

B. A. (Chem. Abstr.).

Experiments on the Mechanism of Action of Acetylcholine. Effects of Potency and Concentration, and their Recognition in the Isolated Intestine of the Rabbit. Beccari, E. [*Arch. sci. biol.* (*Italy*), **29**, 191–224 (1943).]

The diastolic tonus of decontraction of the tonus in the isolated surviving intestine of the rabbit indicates a duality in the mode of action of acetylcholine upon that organ. The pharmacological action is related to the quantity of the drug fixed upon the effectors which may be termed the "concentration effect," and on the speed of this fixation, which may be called the "potential effect." Experiments reveal that the "potential" effect does not follow the strictly physicochemical laws which apply to non-living membranes.

D. I. Macht (Chem. Abstr.).

Studies on Choline Acetylase. II. Formation of Acetylcholine in the Nerve Axon. Nachmansohn, David, John, Hedda M., and Berman, M. (*Columbia Univ.*). [*J. Biol. Chem.*, **163**, 475–80 (1946); *cf. C. A.*, **39**, 2519⁶.]

A relatively high concentration of choline-acetylating enzyme system (I) was observed in the peripheral axon (II) of rabbit, which is free of cell bodies and nerve endings. The presence of this (I) in (II) supports the assumption that acetylcholine (III) is not only essential for the transmission of the nerve impulse across the synapse but also for its propagation along the axon. In degenerating nerve fiber the enzyme activity decreases slowly, and 72 hours after section, when the condition disappeared, the enzyme activity decreased two-thirds. Six days after section no enzyme activity remained. These results support the assumption that the formation of (III) is associated with condition. L. Weil (Chem. Abstr.).

Microscopic Lesions in Acetylcholine Shock. Altschul, R., and Laskin, M. M. (*Univ. Saskatchewan, Saskatoon, Saskatchewan, Canada*). [*Arch. Path.*, **41**, 11–16 (1946).]

Sublethal and lethal doses of acetylcholine caused vascular reactions in rats and guinea-pigs comparable to other types of shock. About half the animals showed pulmonary edema. M. L. C. Bernheim (Chem. Abstr.).

Stimulation of Phosphorylation in Muscle by Acetylcholine. Wajzer, J. [*Compt. rend. soc. biol.*, **139**, 375–6 (1945).]

In frog muscle poisoned with iodoacetate, acetylcholine 1 : 10,000, accelerates the transfer of H_3PO_4 from creatine phosphate to hexose with formation of hexose diphosphate. The adenosine triphosphate remains unchanged. In this respect acetylcholine acts like ionic K. L. E. Gilson (Chem. Abstr.).

Chemical and Electrical Origin of Nervous Energy. Barnes, T. Cunliffe. (*Hahnemann Med. Coll., Philadelphia*). [*Hahnemannian Monthly*, **81**, 56–60 (1946).]

A discussion of the acetylcholine theory of the action current in nerve.

Joseph S. Hepburn (Chem. Abstr.).

Vagus Substances. v. Muralt, Alexander (*Bern*). [*Experientia*, **1**, 136–46 (1945) (*in German*).]

A lecture discussing the liberation of acetylcholine and thiamine on nerve stimulation and the physiological interrelationships between the two substances.

J. M. Little (Chem. Abstr.).

Acetylcholine Synthesis. Torda, Clara, and Wolff, Harold G. (Cornell Univ. Med. Coll., Ithaca, N.Y.). [*Science*, **103**, 645–6 (1946); *cf. C. A.*, **39**, 550[8], 983[8], 1208[7], 1927[3], 4101[5]; **40**, 2211[7].]

Chiefly review with 33 references.

It is postulated that normally occurring constituents of cells and extracellular fluid modify the amount of acetylcholine synthesized in the living organism. There is a dynamic equilibrium between potentiator substances and inhibitor substances. During physiological activity the original dynamic equilibrium is disturbed and new dynamic equilibrium is established. Certain metabolites of muscle released during prolonged work decrease the synthesis of acetylcholine. The accumulation of such metabolites is important in the production of fatigue resulting from indirect stimulation and secondary to decreased acetylcholine synthesis.

E. D. WALTER (Chem. Abstr.).

Effect of Acetylcholine and Adenosine Triphosphate on Denervated Muscle. Buchtha, Fritz, and Kahlson, Georg (Univ., Lund, Sweden). [*Acta Physiol. Scand.*, **11**, 284–8 (1946).]

Na adenosine triphosphate initiates contractions in denervated anterior tibial muscles of the cat which last longer than in normal muscles. But whereas normal muscle is not affected by a previous injection of acetylcholine, this abolishes the sensitivity of denervated muscle to the ATP. Denervated muscle is 40–50 times as sensitive as normal muscle to acetylcholine whose curare-like action also is very pronounced in denervated muscle. It is argued that the motor end plate survives even a high degree of muscle atrophy, such as exists after 75–85 days of nerve degeneration because in this condition the muscle still shows increased sensitivity to acetylcholine which can be abolished by curarization.

S. MORGULIS (Chem. Abstr.).

Properties and Distribution of the Enzyme System which Synthesizes Acetylcholine in Nervous Tissue. Feldberg, W., and Mann, T. (Cambridge Univ., Eng.). [*J. Physiol.*, **104**, 411–25 (1946); *cf. C. A.*, **29**, 4667[9]; **40**, 1923[8].]

The enzyme was obtained by extraction of acetone-dried tissue with 0·9 per cent. NaCl. Its activity was greatly increased by adenosine triphosphate (ATP), citric acid, and a third substance referred to as the activator and which was found in the juice prepared by extraction of the brain tissue with boiling saline solution. The activator was dialyzable, was not mineral nor identical with choline, ATP, glutathione, cozymase, or thiamine. It was present in liver in approximately the same concentration as in brain, and small amounts were in muscle and yeast. The activating effect of citric acid was not due to its Ca-binding capacity, and the effect was not abolished by malonic acid. None of dl-glutamic, l(+)-glutamic, aconitic, succinic, fumaric, acetic, oxalic, tartaric, pyro-phosphoric, malonic, pyruvic, or oxaloacetic acids showed an accelerating effect comparable to that with citric acid. If ATP, citrate, and the activator were added together to the saline extract from acetone-dried brain, as much as 1·8 mgm. acetylcholine/gm. powder/hour at 37° was formed, or 6 mgm./gm. dry weight of extract. The dialyzed extract was inactive and was not reactivated by any one of the three activators alone, but was by citrate and activator, and in particular by citrate, activator, and ATP. The concentration of enzyme in the nervous tissue varied widely between species, and between parts of the nervous system of a given species. The activity was greater in cerebrum than cerebellum, greater in efferent cholinergic fibers than in afferent fibers. For a given rate of synthesis the corresponding content of acetylcholine was higher in the peripheral than in the central nervous system.

H. L. WILLIAMS (Chem. Abstr.).

A New Method of Estimation of Acetylcholine with the Isolated Duodenum of the Rat. Bayo Bayo, J., García de Jalón, M., and García de Jalón, P. (Lab. Farmacol. exptl. facolta med., Madrid). [*Farmacoterap. actual* (*Madrid*), **2**, 622–8 (1945).]

The duodenum of the rat gives very regular responses to acetylcholine (I) but the voluntary movements of the muscle are of such amplitude that the interpretation

is difficult. It was found that the addition of 0·15 per cent. $MgSO_4$ to Ringer solution causes the gut to relax but does not prevent a prompt response to (I). In tyrode solution the relaxation and reduction of amplitude are still better, but the Mg in presence of the Ca of the solution also depresses the response to (I). The response can be re-established by simultaneous sensitization with pantocaine and eserine. The most favorable conditions are obtained with a tyrode solution containing 0·01 per cent. $CaCl_2$ and 0·1 per cent. $MgSO_4$. After submerging the strip of duodenum in the bath of 80 c.c. at 37–8° 0·2 mgm. of pantocaine-HCl and 0·01 mgm. of eserine salicylate are added. The test is performed after 5 minutes. Equal doses of (I) between 0·1 and 1γ give identical contractions. After each test the gut is washed with 300 c.c. of the bath fluid. A. E. MEYER (Chem. Abstr.).

Acetylcholine and Choline Esterase Contents of Small Intestine. Cheng, C. P., Hsin, H. Y., and Hsu, F. H. [*Proc. Chinese Physiol. Soc.*, **1**, 27–30 (1942).]

In rabbits and dogs, choline esterase activity is higher in the muscle than in the mucosa, and in the lower parts of the small intestine than in the duodenum. Acetylcholine can be extracted both from muscle and from the mucosa, and in greater quantity from the upper part of the intestine than from the lower segments. In a rabbit, vagotomized, atropinized, and eserinized, 25·4 per cent. of acetylcholine were synthesized in 10 minutes by the jejunum. These findings are probably related to the higher motor sensitivity of the upper gut to acetylcholine in comparison with the lower gut. B. A. (Chem. Abstr.).

Cholinesterase in Cerebrospinal Fluid. Glasson, B., and Mutrux, S. (*Univ. Geneve*). [*Helv. Physiol. Pharmacol. Acta*, **4**, C12–14 (1946) (*in French*).]

The manometric method of Ammon (liberation of CO_2 from $NaHCO_3$ by the freed acid) was used with two substrates, acetylcholine (I) and monobutyrin (II). Human blood serum was quite active on both (I) and (II) and in both cases the action was almost completely inhibited by eserine (III). Red corpuscles and normal cerebrospinal fluid were strongly active on (I) and this action was inhibited by (III). Corpuscles showed a slight, and cerebrospinal fluid a variable activity towards (II) and this action was unaffected by (III). Cerebrospinal fluid from three cases of oligophrenia was strongly active on (I) and only slightly active on (II).
L. E. GILSON (Chem. Abstr.).

Influence of the Anticholinesterase, Diisopropylfluorophosphate, on Cardiovascular and Respiratory Reflexes of Carotid Sinus Origin. Heymans, C., and Pannier, R. (*Univ. of Ghent, Belgium*). [*Proc. Soc. Exptl. Biol. Med.*, **26**, 228 (1946).]

In dogs under chloralose anesthesia, intravenous injections of diisopropylfluorophosphate (0·12–1·0 mgm./kgm.) inhibiting completely the cholinesterase activity of the blood do not stimulate the respiratory center and do not affect either the heart rate or the blood pressure. The cardiovascular and respiratory reflexes induced by increase or decrease of the intracarotid sinus pressure are unaffected. These results do not support the theory of a cholinergic transmission of the respiratory and cardiovascular reflexes induced by a physiological stimulation of the carotid sinus pressoceptors. L. E. GILSON (Chem. Abstr.).

Studies on Cholinesterase. II. Enzyme Activity and Voltage of the Action Potential in Electric Tissue. Nachmansohn, David, Coates, C. W., and Rothenberg Mortimer A. (*Columbia Univ.*). [*J. Biol. Chem.*, **163**, 39–48 (1946); *cf. C. A.*, **39**, 3798[1].]

The activity of cholinesterase and the voltage of the action potential were measured simultaneously in the electric organ of a number of specimens of *Electrophorus electricus* confirming and extending previous findings indicating a close parallelism between the two. The direct connection of acetylcholine with the nerve action potential and nerve condition is highly probable.
DAVID B. SABINE (Chem. Abstr.).

Cholinesterases in Degenerating and Regenerating Peripheral Nerves. Sawyer, Charles H. (Duke Univ., Durham, North Carolina). [*Am. J. Physiol.*, **146**, 246–53 (1946).]

The guinea-pig sciatic nerve contains both true cholinesterase (I) and pseudocholinesterase (II). Extracts of unoperated nerve hydrolyze mecholyl nearly 60 per cent. as readily as (I) and benzoylcholine only 20 per cent. as rapidly as (I). Wallerian degeneration of the tibial and peroneal nerves is attended, within the first few days after section of the sciatic nerve, by a 60 per cent. loss of their true (I) content. Further loss of the enzyme fails to occur even with the complete disintegration of axis cylinders. (II) activity is unaffected by the operation while (I) hydrolyzing capacity, dependent on the two enzymes, drops 30 per cent. Nearly two-thirds of the true (I) is secreted by the axis cylinders, but more than one-third is produced by some other element or elements, perhaps sheath cells. (II) is probably completely resident in the connective tissue.

E. D. WALTER (Chem. Abstr.).

Choline Esterase and its Specificity. Augustinsson, K. B. (Chem. Inst. of Vet. Coll., Stockholm). [*Nature*, **157**, 587–8 (1946); *cf. C. A.*, **39**, 5258[8].]

A specific cholinesterase is an enzyme which hydrolyzes acetylcholine at a higher rate than any other esters. The whole animal of *Patella vulgata* and the ampulla and podia of *Asterias rubens* from the west coast of Sweden split acetyl-β-methylcholine at a higher rate than acetylcholine. Benzoylcholine is very little split. In contrast, *Terebratulina caput serpentis* hydrolyzes acetylcholine but neither acetyl-β-methylcholine nor benzoylcholine. The reactions used to distinguish between a true and a pseudocholinesterase with the help of two choline esters do not tell the complete story about the types of this enzyme.

E. D. WALTER (Chem. Abstr.).

Specificity of Cholinesterase. Cholinesterase Activity and Phosphatase Activity. Cristol, P., Passouant, P., Benezech, C., and Dutarte, Jeanne (Univ. Montpellier). [*Compt. rend. soc. biol.*, **139**, 312–13 (1945).]

No correlation was found between the variations in cholinesterase activity and phosphatase activity in normal and pathological human serums.

L. E. GILSON (Chem. Abstr.).

Inhibition of Cholinesterase and Activation of Phosphatase in Blood Serum. [*Ibid.*, 314–15.]

Eserine sulfate has no effect on serum phosphatase activity but largely inhibits the cholinesterase activity. $MgSO_4$ increases the phosphatase activity but not the cholinesterase activity. L. E. GILSON (Chem. Abstr.).

Absence of Pseudocholinesterase from the Tissues of Ruminants. Gunter, Josephine M. (Univ. of Toronto, Can.). [*Nature*, **157**, 369 (1946).]

Tissues of ox and sheep which, by their inability to hydrolyze benzoylcholine, were shown to contain no pseudocholinesterase are liver, spleen, pancreas, muscle, gastric mucosa, intestinal mucosa, thyroid gland, and lachrymal gland. This is a further indication of the irrelevance of pseudocholinesterase to the process of nerve impulse transmission. E. D. WALTER (Chem. Abstr.).

Determination of Histamine in Cerebrospinal Fluid and Blood in Some Cases of Cerebral Disease. Businco, Lino, and Visalli, Felice (Univ. Rome). [*Boll. soc. ital. biol. sper.*, **16**, 258–9 (1941).]

In 5 patients with brain tumors the blood contained 0·04–0·10γ of histamine per c.c. and the cerebrospinal fluid not more than 0·02γ/c.c.

L. E. GILSON (Chem. Abstr.).

Free Aneurine Content of Cerebrospinal Fluid. Cacioppo, Filippo (Univ., Palermo, Italy). [*Boll. soc. ital. biol. sper.*, **20**, 83–4 (1945).]

In a study of 29 children, the cerebrospinal fluid showed no appreciable variations in aneurine content in cases of diphtheria or poliomyelitis. The aneurine titer was greatly increased in cases of tubercular meningitis.

HELEN LEE GRUEHL (Chem. Abstr.).

Effect of Morphine on Cerebrospinal Fluid Pressure. Chou, C. [*Proc. Chinese Physiol. Soc.*, **1**, 97–101 (1942).]

In dogs under urethan, paraldehyde, or phenobarbital, morphine (0·25–1 mgm. per kgm.) decreased cerebrospinal fluid pressure simultaneously with blood pressure in 9 out of 16 animals. In the remaining 7 animals, cerebrospinal fluid pressure increased, while the blood pressure remained unaltered or decreased. Changes of cerebrospinal fluid pressure are the result of the balance of the action of the drug on local cerebral circulation and on systemic blood pressure.

B. A. (Chem. Abstr.).

The Specific Gravity of Spinal Fluid. A Review of Methods and the Application of a Newer Micromethod in Spinal Anesthesia. Wolman, Irving J., Evans, Barnett, and Lasker, Sigmund (U.S. Public Health Service Hospital, Sheepshead Bay, Brooklyn). [*Am. J. Clin. Path., Tech. Sect.*, **10**, 33–9 (1946).]

The following method was simple and accurate. Fill the lower part of a 2,000 c.c. graduated cylinder with paraffin so that the mouth of a 250 c.c. graduated cylinder centered in it will protrude about 1 inch. Fill the space between the cylinders with water for insulation, adding a few drops of H_2SO_4 and a few crystals of $CuSO_4$ as preservative. Cover with paraffin. Prepare the gradient mixture by blending 31 c.c. of bromobenzene (specific gravity 1·94) with 94 c.c. of tech. kerosene (sp. gr. 0·81) producing a light mixture (sp. gr. 0·97). To produce a heavy mixture (sp. gr. about 1·05), blend 47·5 c.c. bromobenzene with 77·5 c.c. of kerosene. For a gradient between sp. gr. 1·000 and 1·0200 with extremes from 0·97 to about 1·05, pour the heavier mixture into the inner cylinder to the 125 c.c. mark, and overlay it with the lighter mixture to the 250 c.c. mark. To produce the gradient insert a piece of 16 gauge Cu wire coiled to form a disc with a long handle to the level of the interface two or three times with a 1 inch stroke into each phase. Increase the stroke by 1 inch and repeat. Continue this until only 1 inch of the top and bottom is undisturbed. Calibrate with NaCl solutions of known sp. gr., checking each day of use for changes due to diffusion, temperature, etc. Add drops of the spinal fluid to be tested, of the same size used in calibration and read the sp. gr. from the graduations on the cylinder. The sp. gr. of spinal fluid from persons free from disease of the central nervous system was found to be 1·0062–1·0082, with a mean of 1.00697, at 25 degrees. A few specimens from subjects with syphilis of the central nervous system were elevated above this range.

JOHN T. MYERS (Chem. Abstr.).

Action of Aneurine and Riboflavin on Isolated Intestine and their Functional Relationships to Acetylcholine and Adrenaline. Sanz Sanchez, F. [*Farmacoterap. actual* (*Madrid*), **1**, No. 3, 43–51 (1944).]

Aneurine inhibits the isolated intestine of rabbits and increases the action of adrenaline. Acetylcholine is less effective after administration of aneurine. Lactoflavin inhibits the intestine and does not modify the action of adrenaline or acetylcholine.

B. A. (Chem. Abstr.).

Mental Response to Added Thiamine. Harrell, Ruth F. (Columbia Univ.). [*J. Nutrition*, **31**, 283–98 (1946).]

During three periods of time the effect was observed of daily supplementation of the dietary of an orphanage with 2 mgm. of thiamine per child. Thirty-seven to 55 carefully matched pairs of children were used, one member of each pair receiving thiamine and the other a placebo. Measurements of performance included acuity of vision, skills at games, reaction time, reading, arithmetical processes,

memorizing and forgetting, intelligence tests, and other recognized measures in current use by psychologists. In the first period of 6 weeks the vitamin-fed group made superior average gains in performance in every one of the 18 test tasks. The individual variations in gains within each group were within the limits of probable error in the case of 7 of these tasks. In the second period of 1 year, 15 activities were used and the vitamin-fed group again surpassed the control group in gains in performance in every activity. The superior gain for the vitamin-fed group was statistically significant for 8 of the 15 activities. In the third period of 1 year, without knowledge of the participants, 20 pairs of children were continued with the same regime as in the previous year while 20 pairs were reversed, so that those who had received the thiamine now received the placebo and *vice versa*. The unreversed pairs continued to show superiority of average performance for the thiamine-fed group in all 11 tests used; the reversed pairs showed reversals of superior gain in 7 activities but failed to show adverse effects of withdrawal of thiamine in intelligence tests, educational achievement, reaction time, height or weight gains. The children received from 0·9 to 1·0 mg. thiamine daily in their normal diet. W. B. ESSELEN, JUN. (Chem. Abstr.).

Disturbances of Neuromuscular Excitability During Dietary Imbalance and Avitaminoses. VI. Antialkalosic Action of Ascorbic Acid and Vitamin D (Calciferol, Lecoq, Raoul, Chauchard, Paul, and Mazoue, Henriette (La Sorbonne, Paris). [*Bull. soc. chim. biol.*, **27**, 358–63 (1945); *cf. C. A.*, **40**, 1911[9].]

For action of ascorbic acid, *see C. A.*, **40**, 3513[9]. Calciferol acts in a similar fashion. L. E. GILSON (Chem. Abstr.).

VII. Alkalosis in Experimental Rickets. [*Ibid.*, 364–76.]

In rickets the bone lesions and the neuromuscular troubles due to alkalosis develop independently. Administration of ascorbic acid prevents only the latter, vitamin D prevents or cures both. L. E. GILSON (Chem. Abstr.).

Vitamins Antagonizing the Action of Thyroxine on Nerve Chronaxia. Chauchard, Paul, and Mazoue, Henriette (École hautes études, Paris). [*Compt. rend. soc. biol.*, **139**, 594–5 (1945).]

The shortening of nerve chronaxia in pigeons produced by thyroxine is antagonized by ascorbic acid, thiamine, riboflavin, nicotinamide, or pantothenic acid, but not by vitamins A or D, or glutathione, cysteine, or methionine.
L. E. GILSON (Chem. Abstr.).

Biochemical Study of Avitaminoses of the Pellagra Group. IX. Influence of Riboflavin on the Nicotinamide Content of Livers of Rats on Certain Synthetic Diets. Raoul, Y. (Hôpital Foch, Paris). [*Bull. soc. chim. biol.*, **27**, 371–3 (1945); *cf. C. A.*, **40**, 3510[2].]

The distribution of nicotinamide (plus nicotinic acid) in different parts of the rat liver is very irregular; hence an accurate estimate cannot be made from analysis of a small sample from one lobe. The entire liver should be sampled. A deficiency of riboflavin in the diet frequently causes an important decrease in liver nicotinamide. This should be of interest in connection with human pellagra.
L. E. GILSON (Chem. Abstr.).

Biochemical Study of Avitaminoses of the Pellagra Group. X. Is Cutaneous Excretion of Porphyrin by the Rat a Sign of Pantothenic Acid Deficiency? Raoul, Y., and Marnay, C. (Hôpital Foch, Paris). [*Bull. soc. chim. biol.*, **27**, 502–8 (1945); *cf. C. A.*, **40**, 3510[2].]

The absence of either pantothenic acid or pyridoxine, especially the latter, in the diet results in cutaneous excretion of protoporphyrin by the rat. Choline may have a slight protective action. L. E. GILSON (Chem. Abstr.).

XI. Changes in the Porphyrins of Biological Media under the Influence of Dietary Imbalance. [*Ibid.*, 509–13.]

Rats on diets deficient in pantothenic acid or pyridoxine, or both, showed cutaneous excretion of protoporphyrin without other porphyrins and at the same time an increase in urinary excretion of coproporphyrin. Their livers contained free protoporphyrin, while livers from normal rats contained none. Feeding rats a Goldberger maize diet did not cause cutaneous excretion of protoporphyrin and did not increase the urinary excretion of coproporphyrin (normal is 4·8–5·8γ per cent.). L. E. GILSON (Chem. Abstr.).

Structure of the Liver in Pellagra. Gillman, J., and Gillman, T. (*Univ. Witwatersrand, Johannesburg, S.A.*). [*Arch. Path.*, **40**, 239–63 (1945).]

By means of an improved biopsy technique, the changes in the liver in pellagra have been studied. Fatty livers are found in children, and fat and pigment (cytosiderin and cytolipochrome) are found together or separately in the livers of adults. Pigmentary cirrhosis is common in adults, and is indistinguishable from hemochromatosis. These changes represent the reaction of the liver to acute or chronic malnutrition. M. L. C. BERNHEIM (Chem. Abstr.).

Ultraviolet Absorption of Living Nerve Fibers. Lüthy, H. (*Hallerianum, Bern*). [*Helv. Physiol. Pharmacol. Acta*, **4**, C20–2 (1946) (*in German*).]

The apparatus and method are described. The ultraviolet absorption curve of a frog nerve is shown for the range 250–320 mμ. The curve shows a small peak at 290 mμ due to tyrosine, a high peak at 265–70 mμ due to unknown constituents, a dip at 258 mμ, and complete absorption at 250 mμ.
L. E. GILSON (Chem. Abstr.).

Indicanorachia under Physiological and Pathological Conditions. Tinelli, Giuseppe. [*Ibid.*, 172–3.]

Indican was present in normal human cerebrospinal fluid in amounts of 23.7γ/100 gm. Under various pathological conditions (meningitis, luetic nervous conditions, etc.) the indican increased to an average of 67.5γ/100 gm.

The Effect of Removal of the Suprarenal Capsule on the Neuromuscular System and the Effect of the Injection of Desoxycorticosterone Acetate. Chauchard, Paul (*École hautes études, Sorbonne, Paris*). [*Ann. d'endocrinol.*, **4**, 257–8 (1943); *Chem. Zentr.*, **11**, 227 (1944).]

Chronaximetric measurements on young rats from which the suprarenal capsule had been removed showed that the asthenia observed in such animals is of encephalic origin and that the musculature does not experience a depressor but rather an excitor action. The principal effect of desoxycorticosterone acetate on normal animals is always a muscular excitation and, depending on the dose, an excitation or depression of the nervous centers. In the case of animals from which the suprarenal capsule had been removed or in scorbutic animals the above hormone showed a corrective effect on the chronaxia phenomena.
M. G. MOORE (Chem. Abstr.).

The Diencephalic-hypophysial Centers and Uric Acid Exchange. Ferrannini, Alfredo (*Univ. Bari, Italy*). [*Boll. soc. ital. biol. sper.*, **15**, 782–4 (1940).]

Blood uric acid curves after intravenous injection of uric acid (50 c.c. of Koehler's solution) were determined for patients with lesions of the diencephalic-hypophysial region and for normal subjects. The results were irregular and inconclusive.
L. E. GILSON (Chem. Abstr.).

Uric Acid Exchange in Chronic Encephalitis. [*Ibid.*, 785–6.]

Patients with lesions in the diencephalon resulting from encephalitis were given uric acid intravenously (50 c.c. of Koehler's solution) and the rate of disappearance of the uric acid from the blood determined. The rate seemed to be a little slower than in normal subjects. L. E. GILSON (Chem. Abstr.).

Influence of Magnesium on Chronaxia of Nerve and Muscle. Bartorelli, Cesare (Univ., Bologna). [*Boll. soc. ital. biol. sper.*, **15**, 621–2 (1940).]

Frog nerve-muscle preparations were used. Addition of $MgCl_2$ to the bath solution prolonged nerve chronaxia and shortened muscle chronaxia, but increased the rheobase of both nerve and muscle. The effects were reversible.

L. E. GILSON (Chem. Abstr.).

Effect of Anoxia on Nervous Excitability in Man. Beyne, J., Chauchard, B., and Chauchard, P. (Sorbonne). [*Compt. rend. soc. biol.*, **139**, 929–30 (1945).]

Partial anoxia without hypercapnia prolongs the chronaxia of the motor nerves.

L. E. GILSON (Chem. Abstr.).

Effects of Aminothiazole and Thyroxine on Chronaxia. Chauchard, Paul (Sorbonne). [*Compt. rend. soc. biol.*, **139**, 925–6 (1945).]

In pigeons the injection of 50 mgm. of aminothiazole daily for 2 days causes a decrease in basal metabolism and a lengthening of nerve and muscle chronaxia. The oral administration of thyroxine to normal pigeons or pigeons treated with aminothiazole causes an increase in basal metabolism, and a decrease in chronaxia to considerably below normal. L. E. GILSON (Chem. Abstr.).

Oxygen Poisoning. III. The Effect of High Oxygen Pressures upon the Metabolism of Brain. Stadie, William C., Riggs, Benjamin C., and Haugaard, Niels (Univ. of Pennsylvania, Philadelphia). [*J. Biol. Chem.*, **160**, 191–208 (1945); *cf. C. A.*, **38**, 1560².]

The metabolic activity *in vitro* of tissues surviving exposure to high O pressures in comparison with similar tissues under normal O tension was studied in an effort to determine the mechanism of O poisoning. Toxic effects developed rapidly in rats exposed to 8 atmosphere of O culminating in convulsions, and practically all animals exposed for 30 minutes died, either during exposure or within a few hours after decompression. Oxygen poisoning, however, was completely reversible up to a certain point, because if animals were decompressed relatively early, many recovered even though severe convulsions had occurred. Hemorrhagic patches in the lungs and intestines were observed at autopsy. Gross examination of the brain, on the other hand, revealed no changes. Thin slices of tissue from animals killed by high O pressures showed no significant changes in total O intake or respiratory quotient when examined in the Warburg apparatus under normal O tension. Similar preparations from animals exposed during a preliminary period to high O pressures and later observed in the Warburg apparatus under normal O tension manifested a steadily decreasing rate of O intake proportional to the O pressure employed and the time of exposure. Inhibition of brain metabolism by high O pressure was similar with glucose, fructose, pyruvate, or lactate as substrate. Similar findings were obtained when normal tissue was observed at 8 atmosphere of O, a 50 per cent. reduction in the initial O uptake being detected within 1 hour. The fact that the time required for appreciable reduction in the rate of O uptake was far greater than for the production of serious symptoms, convulsions and death when intact animals are subjected to the same O pressures appears significant in connection with the mechanism of O poisoning. Brain slices subjected to relatively high pressures of CO_2 (up to 107 mm. of Hg) in addition to 8 atmosphere of O were no more susceptible to O poisoning than those exposed to 8 atmosphere of O alone. Furthermore, the metabolism of brain tissue *in vitro*, although diminished in rate, was not altered from its predominantly high carbohydrate character by high O pressures. Attempts to reverse the lowered O uptake of tissue poisoned by O with early return to normal O tension failed. The rate of O uptake by tissues *in vitro* in a normal atmosphere was not affected by 7 additional atmospheres of N or H. The data obtained are discussed in relation to the mechanism of acute O poisoning. D. W. MCKINSTRY (Chem. Abstr.).

Suction Type of Electrode for Electroencephalography. Rice, H. V. [*Can. J. Research*, **23E**, 19–21 (1945).]

The electrode is constructed from Pb-coated brass tubing with an upper rubber diaphragm to facilitate application by suction. B. A. (Chem. Abstr.).

Photosensitivity as a Cause of Falsely Positive Cephalincholesterol Flocculation Tests. Moses, C. [*J. Lab. Clin. Med.*, **30**, 267–9 (1945).]

The photosensitivity of the cephalin-cholesterol flocculation reaction is confirmed. Since this reaction occurs in artificial light as well as in sunlight, it is not due to any property peculiar to the latter. It is not due to heat generated in the sample by light. B. A. (Chem. Abstr.).

Consumption of Oxygen and Muscular Work During the Crisis of Electric Shock. Delmas-Marsalet, P., Servantie, L., Faure, J., and Pouyanne, H. (Hôpital Saint-André, Bordeaux). [*Compt. send. roc. biol.*, **139**, 845–6 (1945).]

During the first minute of convulsions produced by electric shock treatment O consumption often increases to 6–8 times the basal rate. At the same time blood lactic acid increases to 2–3 times normal. These effects are due to the intense muscular activity. A 52-year old man was studied.

L. E. GILSON (Chem. Abstr.).

Biochemical and Physiological Differentiation During Morphogenesis. VI. Succinic Dehydrogenase and Succinic Oxidase in the Cerebral Cortex of the Fetal Pig, Flexner, Louis B., and Flexner, Josefa B. (Carnegie Institution of Washington, Baltimore, Md.). [*J. Cellular Comp. Physiol.*, **27**, 35–42 (1946); *cf. C. A.*, **36**, 1075[1].]

In early fetal life succinic dehydrogenase activity of the cerebral cortex is approximately 35 per cent. of the adult value. Between 68 and 75 days the activity begins to increase and reaches the adult level at birth. Succinic oxidase activity is low or absent up to about 66 days. It then increases to birth when it is equal to that of the adult. The low activity in early stages of gestation is ascribed to the low cytochrome c activity. H. L. MASON (Chem. Abstr.).

Contributions to the Study of the General Physiology of Nerve Centers. I. Central Summation. Bremer, F., Bonnet, V., and Moldaver, J. (Lab. Path. Generale of Univ. of Brussels). [*Arch. Intern. Physiol.*, **52**, 1–56 (1942).]

The latent central addition of two impulses of afferent influx has been studied in the frog and toad (spinal animals, decerebrated or intact) for homolateral and contralateral reflexes of the posterior limb. The non-barbiturate narcotics, as well as convulsive agents in doses affecting an isolated stimulus, do not change the shape of the summation curve; they only modify the heights of the ordinate; barbiturates (particularly veronal) depress the second summit of the curve. Physiological aspects of the subject are reported. D. A. MEYER (Chem. Abstr.).

II. Inhibition Reflex. Bremer, F., and Bonnet, V. [*Ibid.*, 153–94.]

The inhibition reflex is provoked in the spinal frog by a single induction shock to a sensitive nerve. While the reflex of the flexion of a posterior member is disturbed by the latent addition of two rupture shocks applied on the afferent sciatic and while the summation curve of this reflex is of a simple type, the precision of an identical or feebler induction shock (stimulus S_1), exciting the same sensitive nerve, has the regular effect of inhibition of response to the stimuli $S_2 + S_3$. This inhibition can proceed to the complete suppression of the reflex. Strychnine and catelectrotonus intensify the excito-motor effect of $S_2 + S_3$ and the inhibiting effect of S_1, depressor agents (central fatigue, narcotics, anelectrotonus) weaken one another. D. A. MEYER (Chem. Abstr.).

III. The After-discharge Reflex and the Neuro-chemical Theory of Central Activation. Bremer, F., Bonnet, V., and Moldaver, J. [*Ibid.*, 215–48.]

Data indicate that the primary discharge reflex and the after-discharge are the central determinants, distinct and relatively independent: (*a*) they have different laws of summation; (*b*) they have different sensitivities to various physical and pharmacological agents, in the sense of a reinforcement or weakening more or less elective of the after-discharge by certain agents, and reciprocally of a much more marked action of other agents on the primary discharge; the after-discharge is

notably strengthened electively by catelectrotonus, K, nicotine, acetylcholine, choline, eserine, and prostigmine, while the action of strychnine applies especially to the primary discharge; it is electively depressed by anelectrotonus and by the barbiturates, especially by veronal. D. A. MEYER (Chem. Abstr.).

Pentosenucleoproteins and Neural Induction. Brachet, J. [*Bull. classe sci., Acad. roy. Belg.*, **29**, 707–18 (1943) (*Pub.*, 1945).]

Nucleoproteins, nucleic acids and certain of their derivatives have induction capacities for the nervous system of amphibians. During invagination of the batrachian embryo, the amount of ribonucleic acid increases in the embryonic nervous system, while it diminishes elsewhere. Zymonucleic acid, in yeast, has its origin in the active derivatives of glucidic metabolism, notably 5-adenylic acid. The hydrocarbon metabolism of the gastrula is most intense in the region where the amount of ribonucleic acid in the cells varies the most; this denotes growth and organization. The synthesis of proteins has been correlated with the presence of large amounts of pentosenucleic acid, although the manner in which it acts is obscure. The splitting of proteins plays a major role in muscular contraction and presumably also in cell division. Recent researches have shown the existence of elongated molecules in the neural plaque of the hen, and the particular form of these cells of the medullary plaque is in harmony with the existence of this type of molecule. D. A. MEYER (Chem. Abstr.).

Changes in the Excitability of the Respiratory Centers of Aviators in a State of Fatigue. Franck, C., Grandpierre, R., Santenoise, D., and Stankoff, E. [*Compt. rend. soc. biol.*, **139**, 835–6 (1945).]

The fatigued state is characterized by an increase in blood CO_2 and a decrease in the sensitivity of the respiratory centers to changes in alveolar CO_2. Normally, the threshold of increase in pulmonary ventilation is 1–2 per cent. of CO_2 in the inspired air, but in the fatigued state this is raised to 3–6 per cent.
L. E. GILSON (Chem. Abstr.).

Urinary Excretion of Estrogenic Substances by Women Before and After Electric-shock Treatment. Bergouignan, M., and Demange, R. [*Compt. rend. soc. biol.*, **139**, 848–50 (1945).]

The results of electric shock treatment as practiced in insane hospitals were inconclusive. Possibly the excretion of estrogens was slightly increased in a few cases. L. E. GILSON (Chem. Abstr.).

Cerebral Lipides in Acute Aniline Poisoning. I. Determination of Cerebral Lipides by the Method of Frankel. Tarsitano, Francisco (*Univ. Naples*). [*Folia med.* (*Naples*), **27**, 830–5 (1941).]

Since the nervous system is particularly involved in aniline (1) poisoning, an examination of the changes which are produced in the brain was undertaken. Rabbits given subcutaneously 1·5 gm. of (1) per kgm. of body weight died within 24 hours. Following the method of Frankel, the brains of rabbits treated with (1), and of controls were subjected to (1) cold extraction by Me_2CO for 24 hours; (2) hot extraction by Me_2CO for 24 hours; (3) extraction by petr. ether for 48 hours; (4) extraction by C_6H_6 for 48 hours; (5) extraction by absolute alcohol for 48 hours, and (6) extraction by Et_2O for 48 hours. In (1) and (2), H_2O, cholesterol, and some unsaturated phosphatides are separated; in (3) unsaturated phosphatides and cerebrosides; in (4), (5) and (6) the saturated phosphatides and remaining cerebrosides. The values found for 5 treated and 5 control animals are, respectively, H_2O, 76·80–77·42 per cent. and 74·90–77·20 per cent.; (1) and (2) (per cent. of dry weight) 22·15–25·00 and 23·90–26·62; (3) 24·97–26·08 and 22·55–26·40; (4) 12·66–15·03 and 11·90–13·58; (5) 4·59–5·55 and 4·44–5·74, and (6) 0·69–1·39 and 0·73–1·45. The total lipides, then, range from 68·35–71·18 in treated animals and from 68·08–71·40 in controls on a dry weight basis. The effects on the brain of treatment with (1) appear to be an increase in H_2O, decrease in (1) and (2), increase in (3) and (4), with little change in (5) and (6) or in the total lipides.
WILLIAM F. BRUCE (Chem. Abstr.).

Mechanism of Action of Sympathomimetic Amines. III. Oxidation of Tyrosine by Rat-liver Homogenates. Govier, Wm. M., Grelis, Mary E., Yanz, Naomi S., and Beyer, Karl H. (Sharp and Dohme, Inc., Glenolden, Pa.). [*J. Pharmacol.*, **87**, 149–58 (1946); *cf. C. A.*, **40**, 1228[8].]

The oxidation of tyrosine by rat liver homogenate is stimulated by cytochrome c, coenzyme (1), α-keto acids, low concentrations of methylene blue, and by Al and Ca ions. p-Hydroxy-phenylacetic acid is strongly inhibitory to both tyrosine oxidation and tissue respiration. A possible mechanism of the reactions is discussed which suggests that " amine oxidase " is a mixture of several enzymes.

L. E. GILSON (Chem. Abstr.).

Action of Some Zoösteroids on the Excitability and Fatigability of Neuromuscular Preparations. Borgatti, G. [*Arch. sci. biol. (Italy)*, **29**, 160–88 (1943).]

Some zoösterols, and more specifically cholesterol, cholic acid, corticosterone, and testosterone were studied by chronaximetric and ergographic methods in regard to the excitability and work done by nerve-muscle preparations. All exhibited a positive neuromyotropic effect on the excitability and contractility of muscle. Corticosterone tended to hasten the return of isochronism between nerve and muscle which is necessary for transmission of an impulse, and the muscle under its influence also did more work. Cholic acid also favored the renewal of nervous excitability after fatigue, but exerted a negative action on work performance. Cholesterol and testosterone did not have a clear-cut effect. The common action of the various compounds on excitability is attributed to the common nucleus of these sterols, while the differences between them in respect to other neuromuscular activities are ascribed to the peculiar properties introduced by the different chemical side chains.

D. I. MACHT (Chem. Abstr.).

The Chemical Excitation of the Cerebral Cortex. Moussatche, H. (Inst. Oswaldo Cruz, Rio de Janeiro). [*Mem. inst. Oswaldo Cruz*, **42**, 365–400 (1945); *cf. C. A.*, **40**, 1935[8].]

Solutions of acetylcholine were applied directly to the motor cortex of dogs, cats, monkeys and rabbits. When 10 per cent. solutions were used, localized muscular twitchings occurred in all animals, and 44·4 per cent. of the animals underwent generalized epileptic convulsions. Convulsions also occurred in some of the animals when 1 per cent. solutions were used and definite responses were generally observed with 0.2 per cent. acetylcholine. Convulsions were easily produced by rapid, light mechanical stimulations of the skin covering the muscles connected to the motor points. Eserine (1 : 10,000) increased the acetylcholine-induced muscular twitchings, and decreased the acetylcholine concentrations normally necessary to produce generalized epilepsy. Prostigmine injections had no effect, but morphine followed by motor cortex stimulation caused epileptiform convulsions. Nicotine in concentrations from 0·002 per cent. to 50 per cent., was a strong convulsant when applied to the motor cortex. Atropine either applied to the motor points in low concentrations (1 : 1,000) or injected in high concentrations (3–5 mgm. atropine sulfate) did not prevent the motor reactions of acetylcholine.

BRUNO VASSELL (Chem. Abstr.).

A Fourth-action Substance of Nerves. Weidmann, S. (*Hallerianum, Bern*). [*Experientia*, **1**, 61–2 (1945) (*in German*).]

A fourth, unknown substance (A_4) has been found polarographically in solutions containing cut nerves. More A_4 is found when the nerve is stimulated. An increase is again noted on stimulation after a period of rest. In degeneration the amount steadily decreases. The polarogram of Ringer solution is changed by A_4 so that the rise occurs 1·9 v. earlier. Some properties of A_4 were determined from nerve extracts which showed appreciable amounts of A_4 polarographically. The substance is dialyzable, remains in solution with sulfosalicylic acid precipitation; hence it is not a protein. It is thermostable, its activity not being changed after 2 hours heating at pH 7 in 0·1 N HCl or 0·1 N NaOH. It is destroyed by ultraviolet light. Its activity is dependent on pH.

A. EDELMANN (Chem. Abstr.).

A Depressor Substance Extracted from Rat Intestine. Kahane, Ernest, and Levy, Jeanne (Univ. Paris). [*Bull. soc. chim. biol.*, **27**, 164–7 (1945).]

When dog intestine or stomach or rat intestine, lung, or brain is ground with Tyrode solution there passes into solution a substance M which, when the extract is heated to 70°, liberates an unidentified substance X. The latter provokes the contraction of leech muscle with or without pretreatment with eserine. The substance X is stable upon boiling in weakly acid or alkaline solution. Its chemical and pharmacological properties show it is not choline or a choline ester, a K salt, histamine, adenosine, the substance P of Euler and Gaddum (*C. A.*, **25**, 5440), the substance R of Chang and Wong (*C. A.*, **27**, 5395), or the depressor substance extracted from blood by alcohol by Fleisch (*Schweiz. Med. Wochen.*, **68**, 81 [1938]). In some respects it resembles the vasodilator substance extracted from fresh blood by Fleisch and Gavin-Franel (*C. A.*, **30**, 4221[8]). L. E. GILSON (Chem. Abstr.).

Chemical Bases of Nerve Impulse Transmission. Rosenbaum, H. [*Compt. rend. ann. et arch. soc. turque sci. phys. nat., Nos.* 8–9, 92–104 (1939–42) (*Pub.*, 1943) (*in German*).]

Review and critic discussion. Conclusion: transmission of nerve impulses is not entirely dependent upon chemical reactions; other non-chemical factors play an important part. BRUNO VASSEL (Chem. Abstr.).

Modification of the Regnier Chronaxia Method for the Measurement of the Excitability of Sensory Nerves under Local Anesthetics. Quevauviller, A. (*Faculté de Pharmacie de Paris, France*). [*Arch. Intern. Pharmacodynamie*, **69**, 361–81 (1944).]

A modification of the method (*C. A.*, **39**, 3356[3]) and a theoretical discussion of chronaxias and a calculation of the electric energy necessary to elicit the crossed extension reflex of the frog under certain conditions are given. Ringer-glucose solutions are necessary for stabilization of the nerve. Novocaine first lowers then raises the chronaxia, but the phase of lowered chronaxia does not correspond to the phase of pre-anesthetic hyperexcitability.

M. L. C. BERNHEIM (Chem. Abstr.).

Toxic Effects of Oxygen and of Hydrogen Peroxide on Brain Metabolism. Mann, P. J. G., and Quastel, J. H. (*City Mental Hosp., Cardiff*). [*Biochem. J.*, **40**, 139–44 (1946); *cf. following abstract.*]

The respiration of minced brain tissue, especially in the presence of glucose, Na lactate or pyruvate, is smaller in O_2 than in air. In the presence of Na succinate the respiration is not quite so sensitive to O_2. Neither the lactic dehydrogenase nor diaphorase is inhibited by exposure of brain tissue to O_2. It appears that the part of the brain respiration system most sensitive to O_2 is the pyruvate oxidizing system. Xanthine oxidase is poisoned by O_2 probably through the intermediate formation of H_2O_2, while d-amino acid oxidase, though it is poisoned by O_2, can be protected by its substrate. The thiol enzyme pyruvic oxidase is thought to be the factor inhibited by high O_2 tensions, but this may be due either to O_2 or to H_2O_2. The toxic effect of the latter is especially noted in the presence of NaN_3.

S. MORGULIS (Chem. Abstr.).

Toxic Effects of Oxygen on Brain Metabolism and on Tissue Enzymes. I. Brain Metabolism. Dickens, F. (*Natl. Inst. Med. Research, London, N.W.*3). [*Biochem. J.*, **40**, 145–71 (1946); *cf. preceding abstract.*]

Respiration of brain tissue is slowly and irreversibly poisoned by exposure to high O_2 pressure (H.O.P.). The injury begins at 1 atmosphere and the rate steadily increases with rising pressure. At pressures of 1 to 5 atmospheres the time of exposure necessary to produce a certain percentage of poisoning is more or less inversely proportional to the O_2 pressure. A plot of the course of poisoning of the respiration of brain tissue against time of exposure gives a sigmoid shape similar to that of a probability curve. The metabolism of the O_2 poisoned brain tissue could not be restored to normal by any methods tried, including return to normal

pressure. This poisoning is probably responsible for the convulsions under H.O.P. The order of sensitivity of the respiration of rat tissues to O_2 is as follows :—Brain cortex (finely ground) > brain cortex (slices) > spinal cord > liver > testis > kidney > lung > muscle. The oxidation of glucose, fructose, lactate, and pyruvate by poisoned brain tissue are all affected, but the ability to oxidize succinate is much less affected. The ability of the brain tissue to oxidize glucose decreases at the same rate as the ability to form lactic acid, and in each case the effect is irreversible. Traces of H_2O_2 poison brain respiration, the succinate oxidation being more sensitive. Poisoning with H_2O_2, unlike that by O_2, is much less severe in a catalase-rich tissue (liver) than in a catalase-poor tissue (brain). But no accumulation of H_2O_2 could be demonstrated in brain tissue under H.O.P. and the poisoning effect could not thus be ascribed to the formation of H_2O_2. Neither was the course of H.O.P. poisoning of the brain appreciably affected by the addition of vitamins B_1, B_2, B_6, and C, pantothenic acid, nicotinamide, adenylic acid, adenine, adenosine, cozymase, flavoprotein, fructose, pyruvate, α-ketoglutarate, NaBr, luminal, chloretone, or EtOH. Glutathione, SH-compounds, NH_4Cl, glutamic acid, or glutamine (0·001 M) increased the susceptibility of brain tissue to poisoning by H.O.P. The respiration of brain-cortex slices was protected against injury by H.O.P. by the following divalent metals : Mn > Co > Mg > Ca. Fe, Ni, or Cu had a slight protective action, but not Zn. In 5×10^{-5} M or higher concentration Co and Mn were very effective or almost completely counteracted the toxic action of H.O.P. but they could not restore an already poisoned respiration. It is suggested that H.O.P. poisons primarily the pyruvate oxidase system, probably by attacking the SH-groups of the enzyme, which are both activated and protected by Mg, Mn, and Co. Inhibition of this enzymic system would interfere with the oxidation of glucose, fructose, and lactate by blocking the regeneration of adenosine triphosphate. It would also inhibit lactic acid formation from glucose. However, it is not denied that other O_2 sensitive enzymes may also be affected by the toxic action of H.O.P.

S. MORGULIS (Chem. Abstr.).

II. Tissue Enzymes. [*Ibid.*, 171–87 (1946).]

At least 5 enzymes (phosphoglucomutase, fructose-6-phosphate phosphorylase, triosephosphate dehydrogenase, succinic dehydrogenase, and pyruvic oxidase) concerned in the carbohydrate metabolism of brain tissue can be inhibited by O_2, and of these, 4 are known to depend upon intact SH-groups for their activity. The connection is clear between their — SH nature and liability to O_2 poisoning, which agrees well with the knowledge of O_2 sensitivity of other — SH enzymes. Succinic oxidase system is inhibited by exposure to H.O.P. Its most sensitive component, the dehydrogenase, is apparently irreversibly poisoned. The accumulation of oxalacetic acid probably accounts only for a very small part of the poisoning effect. Both malonate (10^{-3} M) and Mn ions ($2{\cdot}5 \times 10^{-4}$ M) protect the dehydrogenase against the H.O.P. Cytochrome oxidase may also be somewhat poisoned by prolonged exposure to H.O.P. Lactic and malic acid dehydrogenases from animal tissues are very resistant to inactivation by H.O.P. Triosephosphate dehydrogenase is poisoned only when exposed to H.O.P. in the absence of cozymase. Typical flavoproteins (d-amino acid oxidase, diaphorase) are not affected by H.O.P., even up to 4·4 atmospheres O_2, while the flavine-adeninedinucleotide content of the brain tissue is not affected by exposure to 3·3 atmospheres O_2. Catalase is insensitive to O_2 but choline oxidase which is a — SH enzyme is poisoned. Yeast hexokinase is not affected by O_2 in the presence of glucose. The relationship between the presence of essential — SH groups in the enzymes sensitive to O_2 exposure is stressed.

S. MORGULIS (Chem. Abstr.).

Metabolism of Brain Suspensions. III. Respiration at Low Oxygen Tension. **Elliott, K. A. C., and Henry, Maryon** (*McGill Univ., Montreal.* [*J. Biol. Chem.*, **163**, 351–60 (1946); *cf. C. A.*, **37**, 924⁴.]

The rate of respiration of brain tissue has been studied with Barcroft differential manometers, and suspensions of whole rat brain homogenates in warm Ringer, 0·033 M phosphate, 0·01 M glucose medium. The gas to be used was passed in series through the vessels before warming it in the 38° bath. Small O concentrations were determined in Barcroft manometers with N NaOH in both

vessels. The gas was passed through the manometers in series and after equilibrium in the bath 0·8 c.c. M NaCl in 0·002 N H_2SO_4 + 0·1 M pyrogallol was added from the side arm of one vessel. Formulas are given for determination of O. The results show the rate of respiration is unaffected by reduction of O tension to as low as 4 mm. of Hg provided the rate of diffusion of O into the suspension medium does not limit O uptake. The rate of diffusion can be increased by decreasing the tissue concentration or by increasing the rate of shaking. The full rate of respiration was obtained with a glucose concentration as low as 10^{-4} M.

E. G. SHIPLEY (Chem. Abstr.).

IV. Anaerobic Glycolysis. [*Ibid.*, 361–74.]

Homogenized rat brain was suspended in warm Ringer-bicarbonate-glucose medium, and glycolysis was followed manometrically in the Barcroft apparatus. The results showed that the maximum stimulation to glycolysis by pyruvate was reached with 5×10^{-6} M pyruvate. A preliminary period of aerobiosis briefly stimulated, and a trace of O will continuously stimulate glycolysis. The rate of glycolysis was stimulated by washing the suspension; the effect was due to removal of a system which destroys pyruvate. Washed suspensions were found to contain increased amounts of pyruvate during the period of stimulated glycolysis. By adding the washings to fresh suspensions of brain glycolysis was inhibited. The inhibitory effect was largely abolished by adding pyruvate. An increase in concentration of tissue decreased glycolysis per unit weight of tissue, and was not all due to an increase in pyruvate destruction. Mg was found to be necessary for stimulation of glycolysis after washing the suspension. Added lactate did not inhibit glycolysis in the absence of added pyruvate, but inhibited glycolysis when pyruvate was added. Rat and horse serum inhibited glycolysis although serum did not destroy lactate and in itself contained enough pyruvate to stimulate glycolysis. The nature of the inhibitor in serum was not determined. In Ringer-phosphate-glucose medium the lactic acid production was lower than in Ringer-bicarbonate-glucose, but large amounts of unidentified acid were formed. The anaerobic glycolysis of suspensions of whole brain was found to be less variable than that of slices and duplicates agreed very closely, and were nearly the same as the average rate for slices. The possibility that glycolysis is a normal functional process is discussed.

E. G. SHIPLEY (Chem. Abstr.).

The Neuro-muscular Transmission: Curarization, Decurarization, Reinforcement at the Myo-neural Junction. *Coppée, G.* (*Fredericq Inst., Liege*). [*Arch. intern. physiol.*, **53**, 327–507 (1943); *cf. C. A.*, **38**, 4319².]

Extensive experiments were performed on cat and frog (*Rana esculenta* and *R. temporaria*) muscles, either isolated or *in situ*. The mechanical response of the muscle was registered isometrically upon a smoked cylinder while the electric response was analyzed after amplification by a cathode oscillograph. A functional organelle (designated " motor plate ") was found between the termination of the motor nerve and the muscle fibers. Curarization of muscle, just adequate to abolish the mechanical response, followed by an indirect stimulus, produced in the motor plate a brief electric potential followed by a negative after-potential. During neuro-muscular block by K^+ ions or acetylcholine (1) in the presence of eserine, or after section of the motor nerve, the electric response of the muscle to a motor volley is composed of an action potential of the motor plate on which is superimposed an action potential not originating in the muscle fiber; the negative after-potential will be weak, or replaced by a positive after-potential. The response of the motor plate is not determined by (1) liberated at the end of the nerve fiber; the transmission from nerve to plate is assured by an electric mechanism and is characterized by a measurable synaptic delay. The transmission of the excitation from the plate to the muscle fiber occurs as soon as the slow wave exceeds critical voltage; at that moment a brief potential of muscle fiber becomes superimposed on the slow wave. That brief potential may be diffused and accompanied by contraction or not diffused and not accompanied by contraction. The " critical voltage " is conditioned by the excitability of the muscle fibers. Two factors in transmission from plate to muscle fibers are: (1) the energy of the stimulus measured by the amplitude of the slow wave; (2) the excitability of the muscle fibers for that

stimulus. Most of the decurarizing agents (e.g., phenols, guanidine, veratrine, negative polarization) augment the amplitude. K^+ ions augment and Ca^{++} ions depress the excitability of the muscle fibers, and veratrine appears to produce no change in their excitability. The transmission from plate to muscle fiber occurs normally by an electric mechanism similar to that of the nerve impulse along the axone, and is characterized by a non-measurable latent period. Agents which increase the amplitude of the slow wave decrease the delay. (1) is liberated in the motor plate and acts upon the muscle fibers, but it is too weak or too late to assure transmission, which has been assured by the electric mechanism. In specific cases (as with certain muscles of the cat) and on muscle treated with eserine, the (1) liberated by the plate effects excitation of muscle fibers. All the effects from excitation of muscle fibers, of potentiation or depression of neuromuscular transmission produced by (1), can be explained by the intervention of K^+ liberated by the (1). The (1) unites with a radical (R —) of an organic K complex to displace K^+. Normally the R — (1) is rapidly hydrolyzed in the presence of choline esterase, but the compound is not stable and R — K would become reconstituted. The inhibitors of choline esterase hindered the hydrolysis of (1) and stabilized R — (1) and blocked the radical R — for the final reaction (desensitization of muscle to (1)); in addition, the excess of K^+ alters the functioning of the transmission apparatus (this explains the similarity of electric manifestations in muscles curarized by excess K^+ and by (1) in presence of eserine). When stable non-hydrolyzable excitatory substances (quaternary ammonium, nicotine, cytisine) act upon muscle the excitations are equally due to K^+ displaced at the beginning of the R — K complex, but the depression of the neuro-muscular transmission is not due to an excess of the ions. The curarizing agents act upon the motor plate to depress the response to a motor-nerve impulse. The curarizing agents (except the metallic ions) unite with R — of the organic K complex, and produce a progressive leak of muscle K, responsible for depolarization of the motor plate, for lowering the amplitude of the wave from the motor plate, and for the block of transmission from plate to muscle fiber. Ca^{++} and Mg^{++} act as direct antagonists to muscle K^+ Summation occurs at the interface of nerve and plate and not at plate and muscle fiber. The increased reaction of the plate to the second impulse is due to the negative after-potential produced by the first impulse. When the negative after-potential is absent, there is only a long refractory period. (1) intervenes in summation only at the myo-neural junction. Neuro-muscular transmission can be restored either by increase in amplitude of the slow wave (type: phenol, guanidine, veratrine) or by negative polarization. Decurarization by eserine and the anti-curare action of adrenaline are discussed. Some agents such as guanidine and veratrine are extremely active because they re-establish transmission in myo-neural units and render the muscle fibers repetitive. Reinforcement is concerned either with the repetitive response of muscle fibers (type: eserine, sensitivity to K^+ ions) or with a modification of the muscle contractile apparatus (as by K^+ and an acid pH). Veratrine action is very specific; reinforcement by eserine is due to its anti-esterase activity.

ELVA G. SHIPLEY (Chem. Abstr.).

Modifications of the Phosphorus in Plasma Caused by Anoxia. Cicardo, Vicente H. [*Pubs. centro invest. tisiol. (Buenos Aires)*, **9**, 271–81 (1945).]

In dogs in which muscular contraction is abolished by spinal cord destruction or anesthesia the total acid-soluble plasma P increases during asphyxia. Hepatectomy does not modify this increase but surgical shock produces a further rise. Curarizing drugs which cause a drop in plasma P prevent the liberation of P from the tissues. Anoxia by HCN produces an increase of the total acid-soluble plasma P which occurs by way of depression of the respiratory center as is proved by the fact that the increase does not appear if artificial respiration is applied.

A. E. MEYER (Chem. Abstr.).

Further Studies on the Biochemistry of Epilepsy. Madsen, Jrøgen (St. Hans' Hosp., Roskilde, Denmark). [*Acta Psychiat. Neurol.*, **18**, 257–337 (1943) (*in English*).]

Hyperammoniurics (usually with epilepsy) showed essentially low normal serum Na, K and Ca, with the Na and Cl falling under the influence of theophyllin, particularly in patients in the convulsive phase. The hyperammoniurics showed

lowered water and increased Na excretion during water diuresis and the excretion of water, Na and Cl after salyrgan injection was variable, and after theophyllin injections the excretions varied with the Na and Cl not always parallel. The normal morning urine Cl/Na ratio is 1·26, but in the epileptics it was found to be 1·55 ; this indicates a tendency for retention. The ratio fell after diuretic administration and increased after the injection of pitressin. The hyperammoniuria decreased during liver therapy (exhepa). The mechanism of the hyperammoniuria and its control are discussed. H. L. WILLIAMS (Chem. Abstr.).

Reaction of the Blood in Epilepsy. Faurbye, Arild (Hosp. for Epileptic Dis., Dianalund, Denmark). [*Ibid.*, 419–38 (*in English*).]

The pH is and remains normal. H. L. WILLIAMS (Chem. Abstr.).

New Studies on the Variations in Nervous Excitability under the Influence of Different Sugars. Chauchard, Paul, Mazoué, Henriette, and Lecoq, Raoul. [*Compt. Rend.*, **221**, 643–5 (1945).]

White rats were given daily intraperitoneal injections of 50 mgm. glucose, levulose, galactose, saccharose, maltose, lactose, sorbitol, or mannitol. After the fifth day there was observed a chronaxial effect on the nerves indicative of a depression of the nerve centers. The injection of glucose or levulose into rats produced an immediate chronaxial increase even though the animals were regularly receiving these sugars. The other sugars did not produce this immediate effect.

H. L. G. (Chem. Abstr.).

2. Pharmacology and Treatment.

Experimental Therapy of Acute Barbiturate Poisoning, II. Zancan, Lanfranco (Univ., Padova, Italy). [*Boll. soc. ital. biol. sper.*, **15**, 591–2 (1940).]

L. E. GILSON (Chem. Abstr.).

Modification of Chronaxia of Subordination by Diallylbarbiturate. Bartorelli, Cesare (Univ., Bologna). [*Boll. soc. ital. biol. sper.*, **15**, 624–5 (1940).]

In rabbits Na 5,5-diallylbarbiturate abolished the state of subordination, of chronaxias producing an equalization of the antagonistic muscles of the hind leg.

L. E. GILSON (Chem. Abstr.).

Toxicity and Narcotic Action of Some Derivatives of Barbituric Acid. Donatelli, L., and Abbate, R. (Univ. Firenze, Italy). [*Boll. soc. ital. biol. sper.*, **15**, 838–9 (1940) ; *cf. C. A.*, **33**, 3885[7].]

Effects of some common barbiturates on rats and rabbits are described.

L. E. GILSON (Chem. Abstr.).

Action on the Heart of Some Derivatives of Barbituric Acid Used as Narcotics. Donatelli, L. [*Ibid.*, 839–40 ; *cf. C. A.*, **38**, 2387[1].]

Effects of several commonly used barbiturates on isolated frog, rabbit, and guinea-pig hearts, and on the rabbit heart *in situ* are described.

L. E. GILSON (Chem. Abstr.).

Pyruvic Acid Antagonism to Barbiturate Depression. Westfall, B. A. (Univ. of Missouri, Columbia). [*J. Pharmacol.*, **87**, 33–7 (1946).]

Data on 64 rabbits anesthetized with Na pentobarbital (40 mgm./kgm. intravenously) indicate that adrenaline increases the blood-sugar level and shortens the sleeping time, insulin decreases the blood sugar and also shortens the sleeping time, and intravenous injection of Na pyruvate decreases the depth of depression and shortens the sleeping time but does not materially alter the total depression time. Adrenaline probably exerts the above action by increasing blood pyruvate and insulin by increasing pyruvate metabolism. All these results suggest that utilization of

pyruvic acid may be the step in carbohydrate metabolism depressed by pentobarbital. The experimental data indicate an inverse relationship between the available pyruvic acid in the blood and the degree of depression produced by the drug.

L. E. GILSON (Chem. Abstr.).

The Determination of Barbiturates in Toxicological and Clinical Investigations. Cohen, Eugene L. (Philadelphia Coll. of Pharmacy and Sci., Pa.). [Am. J. Pharm., 118, 40–62 (1946).]

The barbiturate-cobalt reaction can be used for quantitative estimations and the optimum wave length for the measurement of the color compound produced in the barbiturate-Co reaction is 5650 A., with 0·2 ml. of a 1 per cent. cobaltous acetate solution in absolute methanol and 0·6 ml. of 1 per cent. isopropylamine in absolute methanol. Read at this wave length, the color of the reacting agents does not interfere with the color produced in the reaction, and at concentrations of 1 to 10 mgm. of barbiturate per ml. of $CHCl_3$ solution, the colour produced in the reaction was proportional to the barbiturate content. It is not possible to employ one barbiturate as a standard for the determination of all barbiturates. In like manner, a factor based on the ratio of molecular weights, as is practiced in the determination of the sulfonamide drugs, cannot be employed in the quantitative estimation of the barbiturates. A procedure was devised, based on the Stas-Otto method (*cf.* Autenrieth, *Lab. Manual for the Detection of Poisons and Powerful Drugs, C. A.*, **22**, 1829) for the extraction of the barbiturate drugs from animal tissues, whole blood and urine, requiring a minimum of apparatus and technical skill. By this procedure, recoveries of the barbiturate compounds from tissues and fluids of 93 per cent. or more were obtained in 57 estimations. Possible sources of error were noted and recorded. A simple apparatus was also devised for the purification of the barbiturate drugs by sublimation, prior to identification by m.p. and other determinations. W. G. G. (Chem. Abstr.).

Effects of Continued Administration of Phenobarbital and Diphenylhydantoin. Hanzlik, P. J., and Laqueur, G. L. (Stanford Univ., San Francisco, Calif.). [Stanford Med. Bull., 4, 21–32 (1946).]

Phenobarbital (I) and diphenylhydantoin (II) were administered to white rats in concentrations of 0·1 and 0·01 per cent. in the diet over a period of 16 months. The greater injurious effect of (I) as compared with (II) was demonstrated by greater decrease in body weight and growth, greater mortality, more frequent nasal bleeding and encrustation of eyelids, and generally a decreased activity in the group receiving (I). No evidence could be found of antagonism to the effect of feeding (I) by administration of sodium succinate. Animals showing toxic effects of (I) had no anatomically demonstrable changes in the kidneys, liver, brain, heart, lungs, and gonads; however an enlargement of the parenchymatous liver cells was noted in the majority of these cases. D. A. SHIRLEY (Chem. Abstr.).

Site of Action of Narcotics on Brain Metabolism. Greig, Margaret E. (Vanderbilt Univ. School of Med., Nashville, Tenn.). [J. Pharmacol., 87, 185–92 (1946).]

Previous experiments have shown that the dehydrogenase and that part of the cytochrome system involved in the oxidation of succinate are relatively insensitive to narcotics. There are two possible oxidation-reduction reactions on which narcotics might exert their effect in inhibiting the carbohydrate metabolism of the brain. They are (1) the transfer of H from reduced cozymase to flavoproteins, and (2) the oxidation of flavoproteins by the cytochrome system by electron transfer. Experiments showed that reduced cozymase did not accumulate during the carbohydrate metabolism of brain in presence of nembutal, and that the oxidation of reduced cozymase by methylene blue catalyzed by flavoprotein was not affected by nembutal. This indicates that the block is not at the position suggested in (1). The oxidation of lactate by yeast is also inhibited by nembutal. The fact that the yeast lactic enzyme, which like the enzyme in animal tissues does not require cozymase for activity, was inhibited is further evidence that cozymase is not involved and that the block occurs at cytrochrome b. It is possible that the narcotic

acts by binding the reduced flavoprotein with cytochrome b (or another intermediate) and that the affinity of nembutal for this complex is greater than for the succinic dehydrogenase-cytochrome b complex which is not affected by low concentrations of narcotics. L. E. GILSON (Chem. Abstr.).

New Ideas on Mechanism of Narcosis. Valázquez, B. L., and Elio Membrado, F. J. [*Farmacoterap. actual* (*Madrid*), **1**, *No.* 5, 28–33 (1944).]

The action of acetylcholine on *in vitro* muscle preparations of the frog and leech in the presence of chloral hydrate, thiamine, and morphine hydrochloride is described. Cerebrospinal fluid drawn from the cisterna magna of the anesthetized dog has less acetylcholine than normal. It is suggested that the immediate mechanism of narcosis involves the inhibition of acetylcholine synthesis by the direct action of the narcotic on cell metabolism. B. A. (Chem. Abstr.).

Electrocardiographic Studies During Convulsions Produced by Metrazole and Azoman (*3-ethyl-4-cyclohexyl 1,2,4-triazole*). *de Haene, A., Delaunois, A. L., and Pannier, R.* (*Univ. Gand, Belgium*). [*Arch. intern. pharmacodynamie*, **69**, 309–47 (1944).]

Azoman produces changes similar to metrazole on the human electrocardiogram, namely, tachycardia and changes in the T-wave and the S-T interval. Intravenous injection of 1·0 mgm. into frogs causes augmentation of the T-wave which is abolished when the cord is destroyed. 5 to 20 mgm. causes irregularities in the Q-R-S complex and depression of the T-wave. This occurs in normal as well as in sympathectomized frogs and also in those with the cord destroyed. The small doses increase the rate and amplitude of the beat, and the large ones depress. Strychnine behaves like small doses of metrazole. Azoman (1·0 mgm.) causes disappearance of the T-wave in normal frogs and a decrease in amplitude in frogs with the cord destroyed. In both cases, a small increase in the Q-R-S complex occurs. Azoman (5–20 mgm.) produces bradycardia and changes in the Q-R-S complex and T-waves whether the cord is destroyed or not or the frog is sympathectomized. In the dog, azoman causes tachycardia, shortening of the P-R and S-T intervals, and increase in the T-wave followed by a depression. M. L. C. BERNHEIM (Chem. Abstr.).

Localization and Origin of the Convulsions Produced by Metrazole and Coramine. ten Cate, J., and Swijgman, D. W. (*Univ. Amsterdam, Holland*). [*Arch. intern. pharmacodynamie*, **70**, 293–306 (1945).]

Metrazole (27 mgm./kgm.) injected intraperitoneally causes convulsions in cats. Removal of the motor cortex prevents convulsions, and in decapitate cats at least twice the dose is necessary to produce them. 80 mgm./kgm. coramine intravenously produce convulsions in both normal and decorticated cats. In decapitated animals smaller doses are effective, indicating that coramine acts primarily on the spinal cord. M. L. C. BERNHEIM (Chem. Abstr.).

The Alleged Convulsive Action of Pyridoxine. Saviano, Mario (*Univ. Naples*). [*Boll. soc. ital. biol. sper.*, **16**, 763–4 (1941).]

In mice, rats, and rabbits extremely heavy doses of pyridoxine increased neuromuscular excitability and occasionally provoked transient clonic spasms. Blood Ca and phosphate were not affected; blood sugar was slightly increased. L. E. GILSON (Chem. Abstr.).

Morphine Habituation and Abstinence in the Light of Kravkov's Theory of Stages in Toxic Action. Gorovoi-Shaltan, V. A. [*Farmakol. i Toksikol.*, **7**, *No.* 6, 26–30 (1944).]

Clinical evidence supports the following data concerning morphine effects in three stages, where + = stimulation, − = depression, + − = collapse:

	Phase I. Euphoric (incipient).	Phase II. Narcotic (saturation).	Phase III. Abstinence (final).
Cortex	+	−	+ −
Subcortical	−	−	+
Vegetative nervous system :			
Parasympathetic	+	+	+
Sympathetic	−	−	+
Endocrine glands :			
Parathyroid and pancreas, thyroid	+	+	−
Suprarenal, cerebral appendage, reproductive glands	−	−	+

The mode of administering morphine influences both the rate of development and the duration of the first phase. Clinical results in studies of habituation and abstinence proved to be most informative when studied in the light of Kravkov's theory of phases in toxic action. JULIAN F. SMITH (Chem. Abstr.).

The Effect of Glutamic Acid on the Hydrogen Ion Concentration (pH) of the Urine in petit mal Types of Epilepsy. Spangler, Ralph H. (2221 *S. Broad St., Philadelphia, Pa.*). [*Ann. Allergy*, **3**, 241–57 (1945).]

Administration of 1·5–4·5 gm. of dl-glutamic acid-HCl daily resulted in urine with pH 4 on 59 of 114 days. d-Glutamic acid-HCl maintained pH 4 on 89 of 121 days in doses of 4·64–11·6 gm. Natural (+)-glutamic acid was less effective in doses of 10 gm. H. L. MASON (Chem. Abstr.).

Humoral Changes After Insulin Therapy. Delay, Jean, Soulairac, A., and Jouannais, S. (*Univ. Paris*). [*Compt. rend. soc. biol.*, **139**, 460–2 (1945).]

In human subjects given enough insulin to produce cŏma after about 3 hours, blood sugar descended to 36 mgm. per cent., alkali reserve decreased to 54 volumes per cent., blood proteins increased a little (maximum value observed was 8·8 gm./100 c.c.), and serum lipides showed a marked increase. Normal conditions were restored within an hour after administration of glucose.
L. E. GILSON (Chem. Abstr.).

Action of Transcerebral Electrophoresis of Calcium on the Ovaries of the Rat Before and After Hypophysectomy. Bourguignon, Georges (*Coll. France*). [*Compt. rend. soc. biol.*, **139**, 568–70 (1945); *cf. C. A.*, **40**, 1594[8].]

Two positive pad electrodes were placed on the eyes and the negative electrode on the base of the occiput, and 0·5–0·6 ma. d.c. was applied for 10–45 minutes. In intact rats passage of the current for 3–4 minutes produced turgescence first of the graafian follicles then of the entire ovary, and dilation of the blood vessels of the uterine horns. The maximum effect was reached in approximately 10 minutes. If the current was continued for 15 minutes or longer the turgescence and congestion gradually disappeared. In rats hypophysectomized 5–10 days previously no such effects were produced by the current. L. E. GILSON (Chem. Abstr.).

Neutralization of Nerve-exciting Effects of Caffeine by Thiamine and Adrenaline. Chauchard, Paul, and Mazoué, Henriette (*École hautes études, Paris*). [*Compt. rend. soc. biol.*, **139**, 640–1 (1945); *cf. C. A.*, **40**, 1932[1], 1933[5], 3528[6].]

Like the sugars, either adrenaline or thiamine counteracts the effect of caffeine on nerve chronaxia. L. E. GILSON (Chem. Abstr.).

Influence of Acute and Chronic Carbon Monoxide Poisoning on the Activity of Higher Nerves in Animals. Gorsheleva, L. S. [*Farmakol. i Toksikol*, **7**, *No.* 5, 47–51 (1944).]

Chronic poisoning by CO in doses too small to be detected by blood tests can be diagnosed by the method of conditioned reflexes. There is evidence of direct

action on the central nervous system, with sharper reaction than in mild single-dose poisoning. The earliest effects in chronic CO poisoning include cortical changes in the upper parts of the central nervous system. Trophic changes in the skin also occur. JULIAN F. SMITH (Chem. Abstr.).

Idiopathic Hypoparathyroidism with Mental Deterioration: Effect of Treatment on Intellectual Function. Mortell, E. J. (Univ. of Virginia, Charlottesville). [*J. Clin. Endocrinol.*, **6**, 266–74 (1946).]

Serum Ca rose from 4·5 to 10·2, inorganic P fell from 9·6 to 3·1 mgm. per cent., and alkaline phosphatase fell from 5·6 to 3·8 Bodansky units during several months' treatment of a case of idiopathic hypoparathyroidism in a girl 19 years old with $CaCl_2$ and vitamin D given orally. The mental deterioration which had developed as the disease progressed showed no improvement. Intracerebral calcification was shown by X-ray examination. KATHRYN KNOWLTON (Chem. Abstr.).

Adrenal Function and Cholesterol Metabolism in Narcosis. Abelin, I. (Hallerianum Inst., Univ. Bern). [*Helv. Physiol. Pharmacol. Acta*, **4**, 1–9 (1946) (*in German*).]

In rats and guinea-pigs anesthesia by inhalation of Et_2O or $CHCl_3$ or by injection of numal causes a temporary increase of 100 per cent. or more in the cholesterol content of the adrenals. In guinea-pigs, blood cholesterol decreases as the adrenal cholesterol increases. Other known effects of narcosis on blood components are discussed. L. E. GILSON (Chem. Abstr.).

Pharmacology of Some Sympathomimetic Drugs Given by Cisternal Puncture (Dogs). Velázquez, B. Lorenzo, and de Armijo Valenzuela, M. [*Farmacoterap. actual (Madrid)*, **1**, *No.* 2, 29–34 (1944).]

Chloralosed dogs were given injections of 0·125–0·5 mgm. of adrenaline, 10–20 mgm. of ephedrine, or 2·5–5 mgm. of amphetamine, direct into the cisterna magna, blood pressure and respiration changes being recorded. The effect was in the order, ephedrine greater than amphetamine, greater than adrenaline. Repeated injections of the same or of the other drugs were also carried out, and the results are discussed. B. A. (Chem. Abstr.).

Expectorant Action of Parasympathomimetic Drugs. Boyd, Eldon M., and Lapp, M. Shirley (Queen's Univ., Kingston, Canada). [*J. Pharmacol.*, **87**, 24–32 (1946).]

Approximately 400 animals, including albino rats, guinea-pigs, rabbits, cats and dogs were arranged for collection of respiratory tract fluid (RTF). Eleven parasympathomimetic drugs, acetylcholine bromide, acetyl-β-methylcholine chloride (mecholyl), carbaminoylcholine chloride (carbachol), β-methylcholine urethan (urecholine), fur-furyltrimethylammonium iodide (furmethide), physostigmine, prostigmine, pilocarpine, arecoline, and the dimethylurethans of m-isopropyl-p-dimethylaminophenol methiodide and p-dimethylaminothymol methiodide, were given subsutaneously in a range of doses. Practically all of the drugs increased the volume output of RTF, some to over 1,000 per cent. Atropine abolished this effect when produced by pilocarpine, selected as an example of the group. Section of the cervical vagus nerve had no effect on the action of pilocarpine in cats. Pilocarpine was as effective in decerebrate as in urethanized cats. The mean specific gravity of cat RTF was slightly lowered by parasympathomimetic drugs, and the relative viscosity was increased. In general, the chloride content of RTF was increased by the drugs. L. E. GILSON (Chem. Abstr.).

Sympathomimetic Amines: The Relation of the Structure to their Action and Inactivation. Beyer, Karl H. (Sharp and Dohme, Inc., Glenolden, Pa.). [*Physiol. Rev.*, **26**, 169–97 (1946).]

The formation of pressor substances with a basic β-phenylethylamine nucleus is discussed. The nature of the etiologic agents in hypertension is considered as well as the hypothetical relation of dopa to essential hypertension. This naturally led to the use of phenol oxidase (tyrosinase) in the treatment of hypertension but the effects were shown to be non-specific. Much interest centers in quinones as

antipressor agents. It was shown that 2-methyl-1,4-naphthoquinone (having vitamin K activity) reduces blood pressure of acutely hypertensive rats, but the quinones are not effective in human cases of hypertension or in dogs with renal hypertension. The mode of action of sympathomimetic amines is not well understood but more is known about the mechanism of their inactivation. Amine oxidase is widely implicated in this inactivation. The presence of amine oxidase in the body, particularly in the liver, determine whether pharmacologically active derivatives of β-phenylethylamine are effective and are excreted as such when administered by mouth. Derivatives, wherein the NH_2 group is on the terminal C of the side chain, are deaminated and are not active or excreted as such unless a hepatotoxic agent has been administered previously. But those in which the NH_2 group does not have the terminal position on the side chain are not appreciably deaminated and are active orally. There is a certain rough parallelism between rate of deamination and pressor activity. The relation of the ascorbic-dehydroascorbic acid system to the deamination of sympathomimetic agents is discussed, as well as the inactivation by conjugation. The renal excretion of the sympathomimetic amines depends upon the mode of inactivation. Since phenylethylamine derivatives, where the NH_2 is not on a terminal C, are refractory to deamination, they are generally excreted as such. But p-hydroxy derivatives in part, and compounds with a catechol nucleus predominantly, are excreted in conjugated form. As pressor agents, even the best of the aliphatic amines is less active than ephedrine and all demonstrate tachyphylaxis. In the presence of an aromatic nucleus, the NH_2 group on the side chain should be removed at least one C atom; aniline has no pressor activity while β-phenylethylamine has maximum activity. Substitution of alkyls or aryls on the α or β carbon reduces, abolishes, or reverses the sympathomimetic effect of the agent. Substitution of an alkyl group on the NH_2-N practically always decreases the pressor effect. The m-OH is the strongest while the o-OH compound is the weakest, but if 2 OH groups are introduced into the nucleus, the pressor activity depends on their mutual relation as well as on the relation to the side chain. The true sympathomimetic drugs have the o-dihydroxy substitution in the m- and p-positions. Arterenol, β-(3,4-dihydroxyphenyl)-β-hydroxyethylamine is more active than epinephrine and is supposed to be sympathin. S. MORGULIS (Chem. Abstr.).

Toxicity of Sulfanilamide on Higher Nervous Activity. Gantt, W. Horsley, and Marshall, E. K., jun. (*Johns Hopkins Med. School, Baltimore, Md.*). [*Bull. Johns Hopkins Hosp.*, **77**, 104–15 (1945).]

Sulfanilaminde in doses ranging from 0·2 to 1·2 gm./kgm. body weight (in excess of therapeutic dosages) has a depressing action upon all conditioned reflexes in two dogs with well-established salivary conditional reflexes and in two with cerebellar motor reflexes. The maximum effect is reached within 1 hour and disappears within 24 hours. A. EDELMANN (Chem. Abstr.).

Suppression of the Neuromuscular Troubles of Experimental Chronic Alcoholism by Injection or Ingestion of Vitamins B_3 and B_4. Lecoq, Raoul, Chauchard, Paul, and Mazoué, Henriette. [*Compt. rend.*, **222**, 414–6 (1946).]

Repeated amounts 5–10 gm./kgm./day, of alcohol were given to adult rats until they developed symptoms of polyneuritis. The neuromuscular conditions of the disease were not altered by giving thiamine or riboflavin, but they were improved by a combination of 100γ of vitamin B_3 (nicotinamide) and 150γ of B_4 (adenine). J. R. PORTER (Chem. Abstr.).

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Part I.—Original Articles.

PSYCHIATRIC ASPECTS OF THE POST-ENCEPHALITIC SYNDROME.

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THE present description is based on a study of 168 men and 107 women (total 275), who have been admitted to the Rampton State Institution diagnosed as post-encephalitic.

TABLE I.—*Of the Two Sexes the Year of Onset is given as Follows.*

	Males.	Females.
1908	1	—
1910	1	—
1911	—	1
1912	—	1
1915	1	—
1916	—	1
1917	4	—
1918	11	2
1919	7	5
1920	14	6
1921	15	5
1922	7	5
1923	17	16
1924	22	11
1925	16	8
1926	7	4
1927	4	1
1928	2	3
1929	1	1
1930	1	1
1931	—	3
1932	—	1
1933	1	1
	132	76
Years not recorded	36	31
	168	107

Thus of 208 cases in which the year of onset is given, 90 occurred in the years 1923, 1924 and 1925.

It is sometimes stated that encephalitis lethargica is a disease that has now ceased to occur in its acute form, in spite of the fact that odd cases are still being notified under the Infectious Diseases regulations, but whether this is so or not, it remains true that trauma, the infectious fevers and vaccinia are still capable of giving rise to a condition that may resemble the post-encephalitic syndrome very closely.

At the same time, one must admit that none of the present series of cases has given a history of encephalitis subsequent to 1933, though, as will be seen from the table that follows, they were still being admitted to this Institution up to the end of 1944, and I know that their admission continues.

TABLE II.—*Year of Admission to Rampton State Institution.*

	Males.	Females.
1923	1	—
1924	1	—
1925	2	—
1926	8	1
1927	5	2
1928	9	5
1929	15	4
1930	25	18
1931	12	3
1932	12	7
1933	8	8
1934	13	3
1935	10	7
1936	9	10
1937	6	8
1938	9	6
1939	9	7
1940	5	6
1941	7	1
1942	1	3
1943	1	2
1944	—	6
	168	107

The reason for this lag between onset of disease and admission to Rampton is chiefly due to the following facts: (*a*) Personality change is not always quick to show itself; (*b*) many of the cases undergo terms of imprisonment or committal to approved schools, reformatories, industrial schools or Borstal institutions before being certified; (*c*) some of these eventually find their way to mental hospitals and mental deficiency institutions; and (*d*) it is only when they prove unmanageable at other institutions that they are sent to Rampton.

These facts are indicated in the following tables:

TABLE III.—*Showing Interval between Onset of Encephalitis Lethargica and Certification under the M.D. Acts.*

				Males.	Females.
	Less than	1 year		—	1
More than	1 year	"	2 "	5	2
"	2 "	"	3 "	4	5
"	3 "	"	4 "	7	2
"	4 "	"	5 "	15	7
"	5 "	"	6 "	11	7
"	6 "	"	7 "	8	6
"	7 "	"	8 "	15	9
"	8 "	"	9 "	11	9
"	9 "	"	10 "	13	6
"	10 "	"	11 "	8	5
"	11 "	"	12 "	8	3
"	12 "	"	13 "	6	2
"	13 "	"	14 "	7	1
"	14 "	"	15 "	4	6
"	15 "	"	16 "	3	1
"	16 "	"	17 "	2	—
"	17 "	"	18 "	1	—
"	18 "	"	19 "	3	1
"	19 "	"	20 "	—	1
"	20 "	"	21 "	—	1
"	21 "	"	22 "	1	—
"	25 "	"	26 "	—	1
				132	76

Information of a similar kind is provided by tables showing the year of certification for the total group: thus we find the year of certification under the original reception order as follows:

TABLE IV.

	Males.	Females.
1920	2	—
1921	1	1
1922	3	1
1923	1	2
1924	1	3
1925	2	3
1926	8	6
1927	13	3
1928	21	12
1929	18	7
1930	24	11
1931	13	8
1932	17	12
1933	3	2
1934	9	8
1935	14	6
1936	6	7
1937	1	6
1938	5	3
1939	3	4
1940	2	—
1941	1	1
1942	—	—
1943	—	1
	168	107

which shows that whereas the peak years for the onset of encephalitis lethargica were 1923 and 1924, the peak years for certification were the five years 1928–1932 inclusive, during which time 93 of the 168 males and 50 of the 107 female cases were certified.

The wide variety of channels through which these patients eventually find their way to Rampton is indicated by the following table:

TABLE V.—*Showing the Kinds of Previous Institutions (including Domiciliary) from which the Post-encephalitics have been Eventually Transferred (not counting Transfer to Similar Institutions in Individual Cases).*

	Males.	Females.
From Mental hospitals	23	21
,, Certified institutions	87	65
,, Public assistance institutions	32	25
,, Prisons	23	4
,, Police stations	3	—
,, Industrial schools	11	3
,, Reformatories	7	—
,, Borstal institutions	8	—
,, Broadmoor Criminal Lunatic Asylum	1	—
,, Residential schools	2	1
,, Approved schools	3	1
,, ,, homes	1	1
,, Remand homes	2	—
,, Philanthropic social schools	1	—
,, Orphanages: Barnardo's	1	—
National Children's Home	1	—
,, Guardianship	6	3
,, Own homes	6	3
,, Winchmore Hill special hospital for post-encephalitics (L.C.C.)	6	2
,, Places of safety	4	2
,, Occupation centres (under the Central Council for Mental Welfare)	1	1
,, Special schools for M.D. children	1	3

From which it is seen that the main avenues for admission of the present series to Rampton are, in order of importance: (1) Certified institutions for mental defectives, (2) public assistance institutions, (3) mental hospitals, and (4) prisons. The small number of cases direct from home is also evident.

If we compare Table IV with the year of admission to Rampton (Table II), we see that from 1928 to 1932, 73 males and only 37 females were admitted, whereas in the 5-year period 1936–1940 the figures were 38 males and 37 females, which suggests (though no more is claimed for it) that the arrest of mental development is more protracted in females than in males, though it may also indicate that the foibles of the fair sex are tolerated much more readily than those of the male sex. This is borne out by Table V, which indicates that whereas 59 males passed through such "criminal" channels as prisons, Borstal institutions, industrial and approved schools, reformatories, etc., the corresponding number for females is only 10.

The physical effects of encephalitis are much greater in the males than in the females, but it also seems to be true—

(1) That the ratio of psychopathic cases of encephalitis in males and females

is roughly 3 : 2 (as compared with the average admission rate of approximately 9 males to 8 females).

(2) That the social consequences are more serious in the males than in the females.

The relationship to mental deficiency is indicated in Table VI.

TABLE VI.—*To Show the Degree of Mental Defect in Post-encephalitis.*

	Idiot grade. I.Q. 0–25%.	Imbecile grade. 25–50%.	Feeble-minded. 50–75%.	75–100%.	More than 100%.	Total.
Males	2	24	130	11	2	169
Females	0	18	82	5	2	107

Further information may be gained by studying the case material in terms of the relationship of mental deficiency to the age of the onset of encephalitis. Thus Table VII :

TABLE VII.

Males:			
Age of onset before 5	Idiots, 2 Imbeciles, 13 Feeble-minded, 13 I.Q. more than 75, 1	29	132
Age of onset from 5–10	Idiots, 0 Imbeciles, 3 Feeble-minded, 39 I.Q. more than 75, 5	47	
Age of onset from 10–15	Idiots, 0 Imbeciles, 1 Feeble-minded, 34 I.Q. 75–100, 1 ,, more than 100, 1	37	
Age of onset after 15	Idiots, 0 Imbeciles, 2 Feeble-minded, 14 I.Q. 75–100, 2 ,, more than 100, 1	19	
Females :			
Age of onset before 5	Idiots, 0 Imbeciles, 7 Feeble-minded, 12 I.Q. more than 75, 0	19	76
Age of onset from 5–10	Idiots, 0 Imbeciles, 2 Feeble-minded, 31 I.Q. 75–100, 1	34	
Age of onset from 10–15	Feeble-minded, 13 I.Q. 75–100, 2 ,, more than 100, 2	17	
Age of onset after 15	Feebleminded, 6	6	

It will be remembered that the M.D. Acts of 1927 modified the previous Act of 1913, to make possible the certification of post-encephalitics as mental defectives, by defining mental defect as a state of arrested mental development occurring before the age of 18 years. That mental development is retarded there can be little doubt, in spite of the occurrence of exceptional cases showing more than average intelligence. It is also evident that the earlier the disease

makes its appearance, the more likely and profoundly is intellectual impairment to arise. Thus the proportion of the lowest grades is more marked in the "before 5" groups than subsequently, even though the incidence of psychopathic encephalitis is greater in the 5–10 groups than in the others, though it must be remembered that our series does not in general take account of encephalitis occurring after the age of 18. If, however, we review the age of onset for each year, it will be seen that a small group have actually developed encephalitis after the age of 18, though certification under the M.D. Acts was possible by virtue of evidence of mental defect existing prior to the occurrence of encephalitis.

TABLE VIII.—*Showing the Age of Onset of Encephalitis.*

	0–1.	1–2.	2–3	3–4.	4–5.	5–6.	6–7.	7–8.	8–9.	9–10.
Males .	11	4	4	3	3	9	8	14	6	14
Females .	3	0	2	7	7	5	7	6	6	8

	10–11.	11–12.	12–13.	13–14.	14–15.	15–16.	16–17.	17–18.	18	Total.
Males .	5	4	12	9	8	3	8	5	2	132
Females .	5	1	4	2	8	1	3	0	1	76

It is quite evident from our series that mental defectives are no more immune to encephalitis than any other section of the community.

Thus 14 males and 7 females had been notified as showing abnormal tendencies, with or without mental defect, before the onset of encephalitis. These were made up of the following cases:

Males.

(1) Noted as defective from an early age, but having had an attack of encephalitis at 11.

(2) Noted as defective from an early age, but having an attack of encephalitis at 22.

(3) Noted as defective from an early age but with no history of an attack of acute encephalitis, but diagnosed as a post-encephalitic at 23.

(4) Ditto, but diagnosed as a post-encephalitic at 30.

(5) Noted as backward, not walking till 5, but contracting encephalitis at 10.

(6) Noted as defective at 2, but contracting "meningitis" at 7. This man is a very definite post-encephalitic with obvious Parkinsonism.

(7) Noted as "vicious and wandering" at 4, and having encephalitis at 5.

(8) Diagnosed as defective at 10, having a severe head injury at 14, and at 31 noted as being a definite Parkinsonian post-encephalitic.

(9) Had an attack of encephalitis at 13, but noted as defective from an early age.

(10) Had an attack of encephalitis at 17, but noted as defective previously.

(11) Had encephalitis at 13, but was impulsive and destructive previously.

(12) Noted as having criminal tendencies at 7, and encephalitis at 13.

(13) Noted as dull and backward previous to encephalitis at 12.

(14) Noted as having an uncontrollable temper in 1914 and having encephalitis in 1923.

Females.

(1) Had encephalitis at 6, but was noted as defective previously.

(2) Was difficult from birth, but was diagnosed as a post-encephalitic at 19.

(3) Was said to be defective from injury at birth, but on admission at Rampton at 20 was suffering from severe Parkinsonism.

(4) Was noted as defective from an early age, having had convulsions at 3 months, which were attributed to difficult delivery at birth, and being diagnosed as a post-encephalitic at 20, with multiple tics and involuntary movements.

(5) Was at a special school for defectives, and contracted encephalitis at 13.

(6) Was noted as defective from birth, and excluded from school, but on admission at 8 was diagnosed as a post-encephalitic.

(7) Was noted as defective at 7, and had encephalitis at 8.

Examination of the case material shows:

(1) Encephalitis certainly produces severe retardation of intellectual development.

(2) Mental defectiveness in itself may be a precursor of encephalitis, and though it might be hazardous to suggest any causal relationship between the two states, yet the possibility might be borne in mind.

(3) Encephalitis may not only produce arrest of mental development, but also predisposes to marked mental deterioration in certain cases. Cases which illustrate this are the following:

(*a*) One male whose mental age was assessed at 11 years in 1928, but who seven years later was estimated at less than 8.

(*b*) A patient whose I.Q. fell from 82 to 70 in three years.

(*c*) A male patient whose mental age was assessed at 13 in 1940, which had fallen to 11 years 3 months three years later.

(*d*) A male patient whose mental age at 20, three years after an attack of encephalitis, was assessed at 12½, seventeen years later was assessed at 10 years 3 months.

(*e*) A male patient whose mental age by Terman tests was assessed at 16, ten years after an attack of encephalitis, but who twelve years later was assessed at 10 years and 5 months.

(4) In spite of severe mental retardation in certain cases, some recuperation is possible, though this probably applies only to a minority of cases. The following cases exemplify this:

(*a*) The case of a man who was diagnosed as an imbecile in 1937 following encephalitis, but whose mental age in 1943 was assessed at 14, and who was regarded by the other patients as someone rather superior in intelligence as compared with the rest. He was also sufficiently recovered to allow of his transfer to a certified institution.

(*b*) The case of a man who had encephalitis at 11, but who had sufficiently recovered to allow him to graduate with an Arts degree.

(*c*) The case of a man who had encephalitis at 13, was only able to reach standard 4 at school, and by tests was assessed at a mental age of less than 10, but who wrote a play called "The Pride of Rome," which was sufficiently complete to have been capable of production on the stage.

(*d*) The case of a boy of 10 who had encephalitis at 5, and was assessed by tests as having a mental age of 6, though a year later this was assessed at 8 years 11 months, and by the Porteous maze test at 10.

(*e*) The case of a girl who had encephalitis at 5, with a later history of fire-raising

and stealing, whose mental age was assessed by Binet tests as 10½ at 28, and who later recovered so that her mental age at 31 was assessed at 14 years 2 months.

(*f*) The case of a girl who developed encephalitis at 18, whose mental age five years after after a spell of very marked immorality was assessed at 12 years, was found on re-testing at 28 to be 17 years 2 months, with an I.Q. of 114.

(*g*) The case of a girl who had encephalitis at 3, was diagnosed as an imbecile at 10, reported as having a mental age of 9 at 27, and a mental age of 12 years 3 months at 30, with an I.Q. of 82 per cent. by Terman-Merrill tests.

It is advisable to remember the wide variations liable to occur in testing by different workers, though the grading and direction given with the tests is standardized as much as possible. It is only fair to point out, however, that in the present series different workers have assessed the mental ages at different periods, but only figures have been quoted which confirmed the clinical impression of improvement or deterioration, and for the most part at any rate they represent substantial alterations in either an adverse or favourable direction.

In view of what has just been said, it will be realized that the scope of assessment depends upon five important factors:

(1) The level of intelligence attained before the onset of encephalitis.

(2) Related closely to this is the age at which the encephalitis occurred.

(3) The element of psychopathy considerably alters the form of score, with marked scattering in some cases; thus in one case with complete success up to 9, complete failure did not occur till the tests for Superior Adult 1, though the final mental age was only 11 years 7 months; in another case failure began at the tests for 9 with partial successes up to Superior Adult 1, giving a mental age of 12 years 3 months. Failures in performance tests and memory defects, especially for recollecting details of facts and repetition of numbers, are also found.

(4) In addition to this more or less specific effect of psychopathy there is also the deeper underlying factor of retardation from depression with its accompanying slowing of all intellectual processes. The law of reversed effort also operates, for the post-encephalitic does not like feeling beaten, and tries hard, but usually in vain, to come out well in the tests. In the more manic phases, there may be a certain facility in the tests which is offset by distractibility and irrelevant interruptions. Others will argue with great vigour that the form of the tests is wrong, and spend considerable time, if allowed, to indicate how they should be presented. In the Otis group tests the most constant item of failure is in the similarities test, though the other tests show fairly wide variation in failures. In general the post-encephalitic rather enjoys mental tests, and his keenness is probably better brought out in group tests than in the individual ones. He feels that he is competing with his equals and the possibility of success fascinates. This, I think, is a partial explanation of his great interest in conundrums, which appear to provide him with considerable interest and amusement.

(5) The degree of restoration obtained when the active process of deterioration has abated.

The Goodenough test, which is based on the ability to draw the figure of a man, is frequently recommended for assessing the mental age of defectiveness. As a test it has a very restricted sphere of usefulness, if for no other reason than

that it depends upon drawing ability, which is quite a special manifestation of intelligence. In comparison with more representative tests it also tends to give a much lower assessment in general. Thus in 100 post-encephalitics the results were as follows:

Mental age			Cancellation points:				Cancellation points:
less than	3	..	6	less than	3	..	6
3 and	,, 4	..	3	3 and	,, 5	..	2
4 ,,	,, 5	..	3	5 ,,	,, 7	..	3
5 ,,	,, 6	..	17	7 ,,	,, 9	..	7
6 ,,	,, 7	..	26	9 ,,	,, 11	..	9
7 ,,	,, 8	..	21	11 ,,	,, 13	..	12
8 ,,	,, 9	..	17	13 ,,	,, 15	..	14
9 ,,	,, 10	..	3	15 ,,	,, 17	..	12
10 ,,	,, 11	..	4	17 ,,	,, 19	..	10
			—	19 ,,	,, 21	..	10
Total	..	..	100	21 ,,	,, 23	..	8
				23 ,,	,, 25	..	—
				25 ,,	,, 27	..	2
				27 ,,	,, 29	..	4
				29	.. ..	..	1
				Total	..	..	100

Head measurements for 100 male encephalitics, as compared with general male hospital population, give the following figures:

(a) *Longitudinal* (head length).		Average population.	
Post-encephalitic:			
17·8–18 cm. . .	6	1 . .	17–17·5 c.m.
18·1–18·5 cm. .	15	4 . .	17·6–18 cm.
18·6–19 cm. . .	41	22 . .	18·1–18·5 cm.
19·1–19·5 cm. .	23	25 . .	18·6–19 cm.
19·6–20 cm. . .	11	32 . .	19·1–19·5 cm.
20.1–20·5 cm. .	3	12 . .	19·6–20 cm.
20·6–21 cm. . .	0	3 . .	20·1–20·5 cm.
21·1–21·5 cm. .	0	1 . .	20·6–21 cm.
21·6–22 cm. . .	1	0 . .	21·1–21·5 cm.
	—		21·6–22 cm.
	100	100	

An average of 19·03 cm. as compared with 19·004 cm. for the general population:

(b) *Transverse* (head breadth).			
Post encephalitic:		Average population:	
13·5–13·6 cm. .	0	4 . .	13·5–13·6 cm.
13·7–13·8 cm. .	1	4 . .	13·7–13·8 cm.
13·9–14 cm. . .	2	7 . .	13·9–14 cm.
14·1–14·2 cm. .	5	14 . .	14·1–14·2 cm.
14·3–14·4 cm. .	4	15 . .	14·3–14·4 cm.
14·5–14·6 cm. .	16	14 . .	14·5–14·6 cm.
14·7–14·8 cm. .	9	12 . .	14·7–14·8 cm.
14·9–15 cm. . .	17	14 . .	14·9–15 cm.
15·1–15·2 cm. .	5	6 . .	15·1–15·2 cm.
15·3–15·4 cm. .	10	5 . .	15·3–15·4 cm.
15·5–15·6 cm. .	21	3 . .	15·5–15·6 cm.
15·7–15·8 cm. .	2	1 . .	15·7–15·8 cm.
15·9–16 cm. . .	4	1 . .	15·9–16 cm.
16·1–16·2 cm. .	2	0 . .	16·1–16·2 cm.
16·3–16·4 cm. .	1	0 . .	16·3–16·4 cm.
16·5–16·6 cm. .	0	0 . .	16·5–16·6 cm.
16·7–16·8 cm. .	1	0 . .	16·7–16·8 cm.
	100	100	

An average of 15·07 for the post-encephalitic group as against an average of 14·66 for the general hospital male population:

(c) *Cephalic index.* This is obtained by dividing the head breadth by head length and multiplying by 100. The figures for this are:

Post-encephalitics:		General hospital male population:
69·1–70	1	1 69·1–70
70·1–71	1	2 70·1–71
71·1–72	0	3 71·1–72
72·1–73	2	5 72·1–73
73·1–74	0	10 73·1–74
74·1–75	7	12 74·1–75
75·1–76	9	13 75·1–76
76·1–77	6	10 76·1–77
77·1–78	9	13 77·1–78
78·1–79	15	8 78·1–79
79·1–80	18	10 79·1–80
80·1–81	6	5 80·1–81
81·1–82	10	6 81·1–82
82·1–83	3	2 82·1–83
83·1–84	4	0 83·1–84
84·1–85	1	0 84·1–85
85·1–86	3	0 85·1–86
86·1–87	2	0 86·1–87
87.1–88	1	0 87·1–88
88·1–89	2	0 88·1–89
	100	100

An average of 79·23 per cent. for the post-encephalitic group as compared with 76·1 per cent. for the general hospital male population group:

(d) *Cephalic circumference.*—The comparative figures for these are:

Post-encephalitics:		General hospital population:
51·1–52 cm.	0	4
52·1–53 cm.	3	5
53·1–54 cm.	14	19
54·1–55 cm.	19	23
55·1–56 cm.	33	29
56·1–57 cm.	21	13
57·1–58 cm.	3	6
58·1–59 cm.	4	1
59·1–60 cm.	2	0
60·1–61 cm.	0	0
61·1–62 cm.	1	0
	100	100

An average of 55·4 cm. (21·88 in.) for the post-encephalitic group as compared with 54·04 cm. for the general hospital male population group.

In general it appears that head length tends to be shorter, as judged by the main concentration of the group in the ranges less than 19 cm., as compared with that for the controls in the 19·1–19·5 cm. range.

There was one post-encephalitic with hydrocephalus in the 21·6–22 cm. range, which brought up the average considerably.

Along with this relative diminution of head length, there was in the post-encephalitic group a much more uneven distribution curve for head breadth with a definite tendency to concentration in the higher ranges, with the maxi-

mum number of 21 in the 15·5–15·6 cm. range, and for the general hospital population to be concentrated in the less than 15 cm. range.

This difference is confirmed by the figures for the cephalic index, which shows a greater concentration in the higher ranges than for the lower, in contrast to the figures for the general population. The figures for the cephalic circumference show a slightly greater concentration in the higher ranges with a higher average in the post-encephalitic group. The only suggestions I have to offer for this comparatively greater breadth of head, cephalic index and circumference is that some slight degree of hydrocephalus may be more common than we recognize, and also that at post-mortem some of the cases have hypertrophy of the skull, especially of the parietal bones. It is, of course, possible that the decrease in head length could be explained as a consequence of arrested cerebral development. The fact that the distribution curve shows some irregularity for cephalic breadth and index certainly points either to a lack of uniformity in cause, or to multiple factors.

Insanity and the Post-encephalitic State.

Doctors who have worked in both mental hospitals and mental deficiency institutions have said that the post-encephalitics of both institutions present little difference in their characteristics, but there is no doubt that there are individual differences between different cases, so that some present more psychotic symptoms than others. The Rampton series represents an intermediate group in which there are indications of mental defectiveness along with violent and dangerous propensities which may or may not have a markedly psychotic colouring, though in them all there are indications that they have passed from a state of mere backwardness to a state of psychopathy. The psychopathic effects can be dealt with separately, but our immediate purpose is to review their symptoms from the more strictly psychotic aspect.

The data of insanity may be reduced to the following main categories:

(1) Confusion.

(2) Emotional imbalance, either by hypofunction (schizoid) or by hyperfunction (hyperaesthesia), which may be fitful, too pessimistic (depression) or too optimistic (mania).

(3) Hallucination.

(4) Delusion.

(5) Dementia.

If we apply these to the data of the present cases we see that their relative distribution is as follows:

	Males.	Females.
(1) Confusion	60 (35·71%)	42 (39·25%)
(2) Emotional imbalance:		
(*a*) Schizoid	75 (44·64%)	24 (22·42%)
(*b*) Cycloid	89 (52·98%)	38 (35·51%)
(*c*) Epileptoid	32 (19·05%)	10 (9·35%)
(*d*) Manic	60 (35·71%)	31 (28·97%)
(*e*) Depressive	67 (39·88%)	31 (28·97%)
(3) Hallucination	8 (4·76%)	8 (7·48%)
(4) Delusion	42 (25·00%)	13 (12·15%)
(5) Dementia	34 (20·24%)	13 (12·15%)

The phases of confusion appear to be related to insecurity feelings connected with some breakdown in the parent-child relationship. This is exemplified by the following correlations of 57 males and 33 females showing confusional episodes in the suggested connotation. Lack of information explains the brevity of the notes offered here, and also why I am unable to say anything about the remaining 3 males and 9 females.

1. No mother	Wandered away frequently.
2. Brought up by grandparents, both over 70. Father often out of work	Used to hide himself away. Made 16 efforts at absconding.
3. Mother very unstable, health very poor. Father unemployed. Parents unable to control the child. Mother died in 1942	Went away from home for long periods. Memory poor. Threatened suicide on hearing of mother's death.
4. Brought up in poor cottage. Father earned 36s. a week; one of 4 children	Confusion. Indecent exposure to females. Silent and stuporose.
5. Youngest of 12	Wanders. Hid in a ship. Absconded 4 times in one year. Arrested for travelling with no ticket. Stole a cycle on 3 different occasions.
6. Parents of poor mentality. 14 people shared 3 bedrooms in a dirty house. Grandparents lived with them. Mother married one week before patient born	Wanders. Enters and damages property.
7. Parents had no control of the patient	Stayed out all night. Absconded many times. Got out of a window 30 ft. high. Attacks of confusion. Had 15 situations in 2 years.
8. Mother defective. Father alcoholic and immoral	Attacks of confusion. Two attempts at absconding. Used to hide behind the bushes for purposes of masturbation. Sleeps excessively.
9. Mother a hopeless nervous invalid. Father a rag and bone labourer. Patient one of 6 children alive. Lived in a slum with 2 bedrooms	Periodic attacks about once a month with violence, followed by exhaustion. Often ran away from home. Absconded.
10. Father was an M.D. brought up at a C.I.	Wanders at night. No concentration. Dull and vacant.
11. Father on compensation. Mother not strong. Poor home. 2 bedrooms for parents and 5 children	Poor concentration. Truant from school. Wanders on buses.
12. Father neurasthenic. Father and mother and 5 children share 2 bedrooms	Wanders. Tries to escape from home and school.
13. Spoilt by mother, who was mentally dull and nervous. Jealous of twin sisters. Overcrowded house	Boards trains. Absconds. Roof climber. Truant. Noctambulist.
14. Brought up by stepmother . .	No concentration. Lies about anywhere. Dull and apathetic.
15. Says he has no home and no relatives	Stole 2 cycles. Tramped the country. Confused.
16. Father was alcoholic and syphilitic. Mother in bad health	Absconded 15 times. Roof climber and hid in the roof.
17. Parents separated and alcoholic. Father neglectful. Mother's whereabouts unknown	Convictions for wandering. Truant.
18. Father on the dole. Lived in poor locality. One of 5 children	Can't concentrate. Memory defective. Absconded frequently. Convicted for being in a house for unlawful purpose and stealing.

19. Brought up in London slum . .	Convictions for begging, vagrancy and stealing. Had many different employments. Convulsive seizures.
20. Father out of work for 2 years. Brought up in a poor home	Convicted for vagrancy and sexual assault. Stole a cycle. Had many different employments. Wanders.
21. Mother died in fatal accident.. .	Frequently absconded.
22. Father dead. Brought up in London slum	Wanders. Dull and disoriented.
23. Mother an invalid and nearly blind .	Vicious and wandering from the age of 4. Developed encephalitis at 5.
24. Father away at sea in the Navy. Mother very anxious	Restless, inattentive, wanders. Gets out of windows at night. Absconds.
25. Both parents dead. Brought up by sister	Absconded. Runs away. Tramps and sleeps out.
26. Illegitimate. Mother later deserted her husband and went to Canada. Brought up by grandmother and an aunt. Later went to Canada but was sent back home	Absconded 25 times, vagrant. "Neglected and without visible means of support." Ran off with ponies, pigs, chickens, scooters and cycles. Fugue-like states. No recollection of what he has done when he absconds. Falls asleep standing up. Very sleepy periods.
27. Father killed in last war. Brought up by stepfather. Illegitimate	Wanders into houses. Holds cars up. Poor concentration. Stuporose attacks.
28. Born in Canada. An only child. Brought up by stepfather. Mother very nervous	Dull. Lethargic. Absconder. Very sleepy in daytime. Kisses older men. Before the court for being "beyond control."
29. Father in a mental hospital . .	Wanders. Stole a cycle. Beggar. Absconder.
30. Father a casual labourer . .	Absconder. Hid in coal bunker and slept there. Somnolence in daytime. Awake at night.
31. Illegitimate. Stepfather man of queer, violent temper. Mother subnormal. Brought up by grandmother	Sleeps in the daytime. Awake at night. Can't concentrate. Tries to climb fences.
32. Father on night-work . . .	Wandered on enclosed premises. Used to have fainting attacks.
33. Father a man of violent temper; epileptic history	Charged with wandering with no visible means of support. Cataplectic attacks. Says he lives a cotton-wool existence and that he sees life as through a thick veil.
34. Mother died when he was 2. Brought up in a poor home . . .	Can't concentrate. Epileptoid attacks. Restless in the night. Sleepy in the daytime. Confusional attacks.
35. Brought up by stepfather, who was often out of work	Left home for a few weeks without saying where he was going. Tried to abscond. Vaso-vagal attacks.
36. Mother dead	Absconder. Restless. Wanderer. Hides himself. Fainting attacks.
37. Father a widower. Brought up in a poor home	Wanderer. Tried to sleep in bed with clothes on. Absconded 3 times. Stole a motor cycle.
38. Father reduced in circumstances. Was a twin—but the other one died	Stole cycles. Truant. Wandered from home. Sullen and liable to fits of drowsiness and temper. Dull and heavy. 14 situations in 6 months.
39. Brought up in a poor locality. Sister at a C.I. Father dead. Mother's whereabouts unknown	Wanders. Truant. Absconds.

40. Father often out of work. Brought up by grandmother	Absconded 8 times. Ran away from home—wandered on the railway line, and into rivers. Stole a cycle. Climber.
41. Comes from a poor home; lacking in control	Charged with "being beyond control." Wanders. Absconded in his shirt. Epileptic.
42. Mother very difficult woman, who made trouble with neighbours. Working-class family	Acute confusional attack with delirium. Disordered sleep with excitement at night. Beggar. Absconder.
43. Mother deserted father, who lived with another woman, and was out of work. Home conditions poor. Two other children out of control and at special schools	Convicted for wandering. Restless. Absconder.
44. Mother dead	Disorientation for time and place. Drops off to sleep when interviewed.
45. Brought up in a poor locality, and in a very overcrowded house	Wanders aimlessly. Cataplectic. Confusional attacks.
46. Father died of cancer; had been prosecuted for poaching and shop-lifting. Mother was feeble-minded	Stole a cycle. Truant. Absconded. Wandered. Rode through the Severn tunnel on the buffer of a petrol truck. Vacant expression. Slept at school.
47. Brought up by grandmother . .	Wandered into houses, etc. Restless. Tried to abscond.
48. Parents of low mentality. Mother a terror to the village	Slept out at night. Absconds.
49. Mother dead	Vacant expression. Falls asleep in the daytime. Wanders. Absconded 6 times. Beggar. Hides in the bushes.
50. Father a casual labourer. Brought up in a London slum	Wandered. Tried to abscond.
51. Father died of tubercle . . .	Attacks of confusion. Epileptic and fainting attacks. Absconded 5 times. Stole a cycle.
52. Mother alcoholic and separated from father	Attacks of fainting; unconsciousness lasts 5 minutes. Very heavy sleeper, Stole a cycle 5 times. Truant from school. Absconder. Sullen and moody.
53. 8th of 9 children. Father on pension, suffering from shell-shock and malaria	Attacks of vacancy, wandering and absconding. Stole 2 cars. Was found starving in a hut that he had built from stolen property. Broke into a shop at night.
54. Has a mother, whom he has twice tried to strangle, and also a step-father	Always truanting. Absconder. History of epilepsy.
55. Mother died when he was 10. Brought up by grandparents and an uncle and an aunt in an overcrowded house in a slum area	Is inattentive, restless. Stayed out late at night. Aimless.
56. Mother dead; was one of 9 children. Father died when he was 22	Wanders. Moves about at night. Restless.
57. Mother died in a mental hospital .	Wanderer. Frequent absconder. Hides himself.

Other factors which appear to be important, though not specifically mentioned above, are the number of occasions in which the stealing of vehicles is an important episode in the wandering state, and also the number of occasions where sexual assaults, rape, indecent exposure and homosexual adventures appear to be the *dénouement* of the wandering phase. In many cases there is a history

of exposure to mother or sisters, or of other instances of a show of affection which has been misplaced.

Females.

1. Mother a widow. Father killed in the war. One of 7 children. Youngest 2 illegitimate by different fathers. Two bedrooms for whole family	Attacks of confusion. Tried to run away.
2. Father in Bermuda; a soldier in India in 1925. Was in India from 4–11. Mother tubercular	"Found neglected." Absconded from service while on licence. Tried to run away from institutions. Said to be epileptic as a child. Had an illegitimate child.
3. Brought up in a poor home. One of 8 children; only 2 bedrooms. Father out of work. Both parents show stigmata	Ran away whenever possible.
4. Mother dead	Wanders aimlessly.
5. Parents divorced. Was born in Canada; father very cruel. Has an illegitimate sister	Sudden attacks of violence, then goes vacant. Ran in front of traffic to stop it. Walks in her sleep.
6. Mother a widow, with a large family. Brother in a home	Confusional attacks. Cannot concentrate. Somnolent in the daytime. Attacks of *petit mal*.
7. Ill-treatment to mother in pregnancy by father	Absconder. Excessive somnolence.
8. Mother ill in pregnancy. Brought up by stepmother	Ran away with no shoes on.
9. Illegitimate. Brought up by stepfather	Wandered on the railway line. Lay down in the road. Entered cars and tried to start them. Shut herself up in a bread van and rode for 8 miles. Somnolent in the daytime.
10. Father cruel and alcoholic . .	Absconder. Restless.
11. An orphan. No home . . .	Wanderer. Absconder. Attacks of fainting.
12. Parents unknown: No home. Brought up at a foundling school	Attacks of stupor. Restless. Roof climber. Cannot concentrate.
13. Mother of low mentality . .	Dull at intervals. Mind wanders.
14. Mother a widow and alcoholic. Youngest of 9 children	Ran away to London from Newcastle. Attacks in which she falls to the ground limp and helpless. Attacks of drowsiness.
15. Both parents dead. Youngest of 5 .	Convicted for wandering abroad. Came from Glasgow, but found in London. Had an illegitimate child at 17. Attacks of drowsiness.
16. Lived with 3 grandparents. Brought up by stepfather	Restless. Easily distracted. Enters other people's houses and cars and refuses to leave. Kissed and scratched her brother. Wandered for miles.
17. Father out of work. Mother suffering from pre-senile dementia. House badly kept	Lacks concentration. Wanders, following street organs or music. Attacks of fainting and stupor.
18. Father nervous after the last war .	No memory for recent events. Restless at night. Wanders. Sleeps all day.
19. Father suffered from shell-shock. Alcoholic. Parents divorced	Restless. Absconder. Beggar. Immoral from 15.
20. Father charged with drunkenness. Youngest of 5 alive	Restless. Cannot concentrate. Ran away from school.

21. Father dead. Brought up in Liverpool slum	Goes from home without clothes. Accosts men. Confusional attacks.
22. Father deserted mother . . .	Runs away from home. Romances and detached from reality.
23. Illegitimate. Stepfather out of work. Brought up by grandmother	Wanders. Behaves indecently to boys.
24. Mother immoral. Has an illegitimate sister	Screams at night. Wanders irresponsibly. Runs after men and asks for money. Climbed fire escape.
25. Father suffering from shell-shock and neurasthenia. Grandmother lives with family. Poor home	Restless. Runs aimlessly on the road.
26. Father very nervous. Brought up in poor home	Attacks of confusion and dissociation with amnesia. Walks around the room and undresses herself. Inversions of sleep rhythm. Caresses and bites. Tried to abscond. Stole a cycle.
27. Brought up in a one-roomed house. Mother separated from father	Inattentive, restless, confused.
28. Father alcoholic and out of work. Mother had 10 children and one miscarriage	Wanders off and sleeps out with sailors. Truant.
29. Mother epileptic. Had many convictions against her. Abusive and bad example	Unable to concentrate. Absconded many times. Dissociation. Had one illegitimate pregnancy. Father unknown.
30. Illegitimate	Forgetful.
31. Mother died when 2. Father dead. Brought up by stepmother	Attention wanders. One illegitimate child. Attacks of somnolence in daytime. Absconder.
32. Brought up in a slum. Illegitimate. Has a stepfather	Wandered away from home. Absconder. Frequent employments. Out late at night with men. Had an illegitimate child.
33. Mother mentally unbalanced. A widow	Slow, lethargic. Somnolent in daytime. Absconder. Opens windows to get out. Confusional attacks. Hides herself.

In the other cases there is no information available, but it appears very evident that the patient's own sense of insecurity is related to the insecurity of his own family life. In this connection the ambivalent reactions of love and hate make their appearance, showing themselves where caressing and tenderness suddenly give place to biting and other forms of violence.

The association of confusional attacks with phases of wandering is also worth noting.

"*Whoever introverts libido—that is to say, whoever takes it away from a real object without putting into its place a real compensation, is overtaken by the inevitable results of introversion.* The libido, which is turned inward into the subject, awakens again from among the sleeping remembrances one which contains the path upon which the libido once had come to the real object. At the very first and in foremost position it was father and mother who were the objects of the childish love" (Jung, *Psychology of the Unconscious*, p. 53).

This statement from Jung appears to me to be the inverse of what obtains in many of the post-encephalitics, and in its present form has little or no

application to them, but if objectively there is a breakdown in the parent-child relationship from the parent's side, libido becomes misdirected, and eventually extraverted to an abnormal degree, so that the lack of security may find some sort of compensation in the external world, which takes the form of a number of possible alternatives. These are initially confusion, wandering of mind, loss of the power of concentration, abstraction, memory failure, but passing over into fugue-like states, wandering, vagrancy, truancy, running away from home, absconding, inversion of the sleep-walking rhythm, noctambulism or somnambulism and emotional imbalance which may either be schizoid in form or cycloid with epileptoid, manic (or hypomanic) and depressive forms.

The post-encephalitic suffers from an inability to relate his libidinous trends to a suitable external object, and as a result he suffers from a lack of emotional balance which may be schizoid, or cycloid in form, with the resulting possibilities of epileptoid, manic or depressive phases.

The use of these terms calls for a little further description by way of definition, for the usual Kretschmerian classification is hardly applicable to the type of case that we are here considering. The majority of them can, however, be safely described as "affectively lame," and numbers of them exhibit psychaesthetic disproportion which, according to Kretschmer, is typical of the schizoid temperament.

The underlying paradox of psychiatric classification is abundantly illustrated by the cyclothymic phases of the catatonic (Gjessing syndrome) and the intense introversion (schizoid) of the depressed person. Nor are we any better served by such simple divisions as introvert and extravert. The reactions are more complicated than these simple divisions suggest, and it is rather as though we observe a certain patient pass through a number of emotional evolutions, and say that this reaction is schizoid and that one cycloid. For our present purpose we have studied the series of cases with the following definitions in mind:

(1) By "schizoid" we include such traits as autism, negativism, aloofness, detachment, manneristic conduct, solitariness, resistiveness (usually with impulsive phases), apathy and inanity; we also include such phases as those in which there is a breakdown of the thought processes resulting in word-salad, echolalia and verbigeration.

In a few there are states analogous to those found in catatonia, but many of these are included for the present purpose in the epileptoid group, while hallucinatory and delusional forms are dealt with subsequently and separately. Confusional states have already been discussed.

(2) By "cycloid" we refer typically to states in which periodicity is a marked feature. These are sometimes marked predominantly by manic phases or by depressive ones, while in others fitfulness is a well-marked characteristic in which epileptoid reactions are common.

These include such different forms of periodic behaviour as caressing and biting, moodiness, fits of violence and rage, alternation of laughing with crying, elation and depression, alternation of stealing with homosexuality, outbursts of insane rage followed by exhaustion and prostration,

attacks of violence followed by laughter, periodic attacks of ocular crises alternating with epileptoid attacks, spurts of energy followed by listlessness, sulky periods alternating with aggressiveness, striking bouts followed by depression, sleepiness giving place to impulsiveness, drowsiness followed by fits of temper, or depression alternating with fits of laughing.

Sometimes the attacks recur two or three times a week and last for an hour; in other cases the manic phase lasts a comparatively short time, but is followed by a depressive or exhausted phase, which may last for several hours. In another case periodic attacks recurred in which the patient would be homicidal for twelve hours, while in another bouts of weeping recurred two or three times a day.

Frank hallucinatory phases were found in 11 males and 8 females, one of the males having hallucinations of taste and of smell, and a female having hallucinations of sight and hearing.

	Males.	Females.
Auditory	7	4
Visual	1	5
Touch	2	0
Taste	1	0
Smell	1	0

Delusional systems were not completely formed, but represented underlying tendencies rather than frank manifestations. They can be summarized as follows:

	Males.	Females.
False accusations of ill-treatment	18	5
Persecution	11	4
Hypochondria	7	1
Poisoning	5	0
Reference	3	0
Grandeur	3	0
Death (nihilistic)	2	1
Fantasy	1	3
Love	0	1

The criteria for assessing the degree of dementia present some difficulty, for the legal requirements of certification lay down that the arrest of development following encephalitis should have been initiated before the age of 18 years. We are, therefore, spared the necessity of differentiating between mental defectiveness due to encephalitis and that from other causes, though in passing we may say that, as in all psychiatric causation, etiology is usually multiple rather than simple.

For our present purpose, however, we have tried to assess the incidence of dementia, and for this consideration the following factors have been selected as the more important:

(*a*) Such complete physical deterioration as precludes the patient from any healthy form of occupation. This is probably the most important single factor making for dementia in the present group of cases.

(*b*) Such complete mental deterioration as is manifested by prolonged

loss of control of rectum or bladder, complete withdrawal from reality, and reduction to animal levels. Such cases may be characterized by great ferocity and require seclusion for very long periods.

The Psychopathic Effects of the Post-encephalitic State.

These include a wide variety of different forms of behaviour disorders along with other changes of an abnormal kind.

In the idiot grade (2 males) there is inability to wash, dress and feed themselves, and speech is reduced to inarticulate animal noises, though the patients are frequently noisy, destructive, and faulty in habits.

Sometimes they scream continuously, and they have impulsive outbursts when they attack other people by biting, kicking, scratching and striking. Sometimes they spit, and in their excitement may suddenly jump out of the window, or run madly around the compound ; then they throw stones and dirt, and get hold of objects, such as sticks, in order to express their aggressive outbursts. One of the patients was addicted to masturbation, using his legs for the purpose.

The imbecile grade consists of 24 males and 18 females. Although the post-encephalitic may have been of more than average intelligence before the onset of encephalitis, in course of time he may deteriorate to the imbecile level, but in general this grade differs from the picture in higher grades in that he does not usually perpetrate acts of violence or other anti-social conduct which might lead him to the police court, although there are two in the series who were convicted, one of breaking into a canteen and stealing, the other of stealing a cycle. Petty pilfering without conviction is frequently noted.

It has to be remembered, however, that anti-social conduct is more easily overlooked if it is recognized that the patient is so low grade as to be obviously irresponsible for his acts; thus one boy proved a nuisance by begging for coppers, and one girl boarded trams without having the money for her fare.

The chief characteristics of the group are illiteracy, with some impairment of speech, either in the sphere of very much reduced vocabulary or lisping, stuttering, stammering, palilalia, copralalia, echolalia and verbigeration. In other cases speech is reduced to a mutter, with greater or lesser degrees of coherence. Although their habits are slightly more organized than those of the idiot grade, this does not always conduce to cleanliness, for there are a number of cases of which it is reported that they voluntarily and deliberately empty rectum and bladder in the recreation hall, or in their rooms, especially if they are thwarted. It appears as though they use their additional mental equipment for purposes of revenge or self-gratification in ways that are not possible for those of the idiot grade. Thus one patient developed a prolapse of the rectum by putting his fist down his throat to induce vomiting ; in the straining which this produced he partially inhibited the vomiting reflex, increasing the intra-abdominal pressure, and must have derived some sexual gratification for this, as he obtained a promise from an unsuspecting medical officer to replace the prolapse with his finger.

This is analogous to cases which carry out rectal masturbation, of which

there are three examples in the series. There are two cases among the females in which regurgitation of food was a feature; one of these would consume the vomitus so induced, and another actually used to practise this disgusting habit with another patient, who would take in the contents of the stomach from lips to lips. Induction of vomiting is a further degree of the same process also found in some of these patients. One patient sucked his gums and spat blood; others exhibit mildly hypochondriacal states of mind. Other patients would soil themselves deliberately, smear themselves, or throw their faeces out through the window. Urine drinking is also recorded. Masturbation, mutual masturbation, indecent exposure, and various forms of homo-sexuality, such as sodomy and fellatio, are also found. In one case it is recorded that he bit the penis of another patient, and on another occasion allowed a higher grade patient to tie a piece of string around his penis.

Swallowing foreign bodies, eating garbage and berries is a feature of some of these cases. Other perversions of appetite include voracious eating, though the subjects are very thin in spite of the large amounts of food they consume.

Various degrees of self-mutilation occur from rubbing the skin with a blanket, picking sores and sustaining cuts through smashing windows, to actual suicidal attempts associated with depression. In the present series these are comprised chiefly of self-strangulation, either manually or with ties or pieces of cloth, and attempts at drowning. One male patient attempted suicide by putting his head down the lavatory. One female patient, however, went to the extreme of attempting suicide by putting the bed foot on her neck.

Other indications of disregard of the instincts of self-preservation are to be found in the ways in which these patients will run madly out into the road without regard to oncoming traffic. Some throw themselves out of windows or on to the ground, while others exhibit an extreme degree of masochism, so that they will ask others to inflict injury on them. In a few cases there is a history of setting fire to objects, burning books recklessly, while one patient fired himself from a lamp. Another patient caused his relatives concern because he turned on the gas and water taps, and ran out into the street, where he stripped himself. Other reckless acts include the case of a boy who rode through the Severn Tunnel on the buffer of a petrol waggon. Climbing windows, roof-climbing (one girl made seven attempts), head banging, wandering into the river, sleep walking and avulsion of toe nails are all recorded features of this group.

Absconding is a well known feature of institutional life, but it has seemed to me that different grades occur corresponding roughly with the level of intelligence of the person concerned. In this particular group it is a fairly frequent phenomenon—15 times in one particular case—but is usually aimless, and appears to be part of the picture of impulsive recklessness so characteristic of the group; thus one girl would run out of the house without shoes on. Truancy and wandering are of a similar nature. A few of these patients like to hide themselves or objects.

A fairly wide variety of violent attacks are also recorded by the usual means of kicking, striking and biting, whilst others use knives, chairs, tables, axes and missiles of various kinds, such as jars, coal, stones, plant pots, crockery,

cutlery, food, water, tea, chambers (with or without contents), blocks of wood and buckets. Some of these patients exhibit their violent outbursts on visiting day, when their relatives come to see them; others have been objects of great concern to both relatives and neighbours—for example, the male patient who pushed his sister into a pond and attacked his relatives with a knife; while a few of them have violently entered into premises for the purpose of theft. A common predisposition to this sort of violent behaviour is the liability to periodic outbursts of violent temper associated with great rage and feats of wild energy. One male patient had a predilection for striking doctors, but also struck nine patients one day and twelve the next! 60 violent episodes were recorded in another case in three years, and one girl was reported to have pulled the hair of 30 different girls. Some of them exhibit a kind of cyclothymia, in which their outbursts are followed by periods of docility and penitence. Some of them even have enough insight to know that they are being possessed by these recurring attacks, in which they are helpless, and will ask to be restrained and to be prevented from striking out. Others appear to have predilections for such peculiarly vulnerable places as the eye. In one case it is recorded that there was blindness in a father and grandfather, and that the patient himself had a congenital cataract, and he was disposed to try to poke out other people's eyes as a sort of protest against fate.

A certain ambivalence of conduct is recorded in a few cases where moods of tenderness and caressing will suddenly give place to one or other of these violent sequels. It will be easily understood that these violent propensities also render the subjects liable to be assaulted in turn. The post-encephalitic is peculiarly susceptible to alternating bouts of restlessness, perhaps with banging, screaming, shouting, and whistling, followed by listlessness, apathy, lethargy, and prostration. In these phases he will lie on the ground, almost as if he were in a state of coma; and quite frequently a patient who has exhibited Parkinsonian rigidity and tremor, in these phases will appear placid, inert and toneless. Grabbing, snatching and clutching represent other instances of the sort of spasmodic behaviour so typical of many of these patients. Generally speaking the more frank psychotic manifestations only occur in the higher grades, but solitariness, some degree of hallucinations and mildly persecuted attitudes are to be found. One patient exhibited the rather grandiose delusion that he had shot a lion and eaten it for dinner, while another used to pick up imaginary objects from the floor. Mannerisms, repetitive movements, such as ceaseless rocking, form a link with the tics so frequently found in the schizophrenic. Others exhibit gestures, grimaces and mimicry.

Many of the traits that have been outlined may be attributed to mischievous propensities which may prove to be very annoying to the community. Thus one girl in her wandering phases would enter houses and cars and would refuse to leave when so requested.

Another girl took away a painter's ladder and threw the paint into a neighbouring field. A male patient proved to be very difficult to manage because he would get on the floor when asked to go, and insisted on wrapping himself around a table leg.

The remainder of these patients comprise 130 males and 82 females in the

feeble-minded group, with an intelligence quotient of between 50 per cent. and 75 per cent. They conform fairly closely to Henderson's classification of the psychopathic state with his categorization into the following groups:

Group 1: Predominantly aggressive.

(*a*) Those who attempt to injure themselves, including cases of suicide.

(*b*) Those who attempt to injure others, including cases of murder and assault.

(*c*) The alcoholic and drug addict.

(*d*) The epileptoid.

(*e*) The sex-variants.

Group 2: Predominantly passive or inadequate, with cycloid and schizoid sub-groups.

Group 3: Predominantly creative, of the genius type, with inability to adapt themselves to their particular group, with Lawrence of Arabia and Joan of Arc as examples.

Even this classification, however, is open to a number of objections from the point of view of the present series of cases; thus, like other attempts at classification, it assumes that a given group can be neatly portioned out into sub-groups that do not for the most part overlap, whereas in actual fact there is the most wide assortment of cases in which conformity to the peculiarities of one sub-group is the exception rather than the rule. Furthermore, the classification suggests a broad delimitation between active and passive groups, whereas the present series as a whole shows features corresponding to both aggressive and passive reactions which usually co-exist, though at different times, in the same patient. The third group postulated represents a very unimportant category numerically, and though it suggests possibilities for development towards a particular socially useful end, it must be admitted that in general this fate is very exceptional.

Applying Henderson's particular classification to this feeble-minded group we have 64 (49·2 per cent.) males and 42 (51·8 per cent.) females who have attempted to injure themselves, and 45 (34·6 per cent.) males and 30 (37 per cent.) females who have been classed as suicidal, either on account of actual attempts or serious threats, of whom three males and one female were successful.

125 males (96·1 per cent.) and 78 females (96·3 per cent.) exhibited violent tendencies towards other people, while 50 males (38·5 per cent.) and 33 females (40·8 per cent.) exhibited destructive propensities to property, and 36 males (27·7 per cent.) and 39 females (48·1 per cent.) orgies of smashing windows.

Alcoholism does not appear to present any problem to the present group of post-encephalitics, partly because of the fact that many of them are certified before they are able to develop tendencies to addiction, and partly too because the patient's anti-social proclivities preclude them from the temptation to become convivial drinkers. One remarkable fact, however, is their tolerance to atropine, and there can be no doubt as to their capacity for assimilating this drug, which in course of time becomes a real addiction. Whereas the usual pharmacopoeial dose is $\frac{1}{2}$ mgm. three times daily, with gradually increasing tolerance, they can take up to 16 mgm. without much apparent discomfort, and though the drug has a markedly beneficial effect in some cases,

withdrawal is usually followed by so much deterioration that treatment by resumption is almost inevitable. Males appear to have much greater tolerance than females, and consequently are much more liable to become addicted. Theoretically, these patients who are highly tolerant to atropine should be classifiable as vagotonics, and although they appear to correspond more with the sympatheticotonic type in their strongly developed aggressive instincts (fight), the following selection of recorded features indicate signs of increased vagal and parasympathetic preponderance:

Contracted pupils; sialorrhoea; generalized hyperidrosis, lachrymation; respiratory dysrhythmias; obesity; lethargy; sexual hyperactivity (sacral plexus).

The probability is that the post-encephalitic is not merely suffering from a heightened activity of the vagal parasympathetic centres, but from an involvement of the diencephalic centres, in which there may be a hyposympathetico-tonia due to fatigue from over-expression of his aggressive propensities.

The epileptoid manifestations of the post-encephalitic state are so varied, and yet so different in many ways from idiopathic epilepsy, that some explanation of the use of the term is necessary. Henderson has drawn attention to the fact that there may be such a condition as the "epileptic character," even though the individual has never had an actual fit in the normal motor sense, and suggests the term "epileptoid" to cover these manifestations of the psychopathic state.

On the other hand, Kinnier Wilson (*Neurology*, pp. 126 *et seq.*) expresses a warning against including under the heading of epileptic phenomena many of the features recorded in the description of cases which have been attributed to epidemic encephalitis, and it is true that many of his contentions have substantial clinical backing. But allowing for this, it does appear that many of the post-encephalitics exhibit periodical attacks which, however they may differ from true epilepsy, have certain similar features, and for want of a better term can be described as "epileptoid." Our main purpose for the moment is to establish facts, and rather to defer the interpretation of them. An illustrative case will show both the difficulties of interpretation and the nature of the facts:

W. B— up to the age of 9 years was not notably different from other children except that he was backward at his lessons.

When 9 he had a fall. From the age of 10 he frequently had epileptic fits in which he lost consciousness for 6 to 8 hours and bit his tongue. Fits came on at varying intervals: sometimes he would go for 3 weeks without one; at other times he would have 3 to 4 weekly, usually at night, but after an attack for some days he was very irritable and spiteful to his smaller brothers and sisters. He would throw objects at them, including a chopper at his sister, and the father, who was a bricklayer's labourer, was afraid to leave home in case the boy injured his mother. He would strike his little brothers, take them by the throat, and if stopped by the mother, would attack her. He was disobedient, obscene, uncontrollable by the mother, and destructive to his toys. He needed supervision in dressing and washing.

He was considered at 13 to be incapable of receiving benefit from a special school, and never got higher than the 3rd standard at the Council school.

At Rampton, on admission in 1928, 3 years later, his mental age was assessed at about 8 years, and at first it was thought that he was simulating epileptic attacks, because they came on after being annoyed. These were characterized by general choreiform tremors and twitchings affecting trunk, arms and legs, but not the face, along with upward turning of the eyes.

For a while after admission he exhibited periods of muscular twitching which might last for seven days. On other occasions they might begin in the night and last 10 hours. They were separate from the epileptic convulsions, which would produce a loss of consciousness lasting for 3 minutes and were associated with incontinence. The staff could usually foretell when a convulsive attack was supervening by the fact that the eyes would become dull in appearance and turn up slightly, though not to the extent that they would in an oculo-gyric attack. At times a period of twitching would be followed by an epileptic convulsion which would terminate the twitching period. Less often fits would be followed by twitching. At the time of his first admission to hospital the nursing staff were quite confident that there was a large volitional element in the twitching episodes, and stated that they abated when he thought he was not being observed. The incidence of these attacks, both of twitchings and convulsions, continued to vary, but on the whole the latter attacks were rather less frequent than the former (ratio 2 : 3). The twitching attacks often followed violent outbursts of aggression, and were associated with periods of muteness and helplessness when it might be considered that he was unconscious, though after the attack was over he could usually tell what had been happening in the ward. In some of these attacks he was incontinent, but when the regular nursing staff were present who knew his peculiarities by giving him his urinal at regular intervals this could be avoided.

Examined during one of these episodes the following features were noted:

1. Prolonged oculo-gyric attack with external and upward deviation more marked in the right eye than the left.
2. Myoclonic twitchings affecting arms, legs and trunk, particularly on the left side.
3. Marked rigidity of the muscles around shoulders, elbows, wrists, knees and ankles on both sides.
4. Complete loss of abdominal reflexes, with no marked changes in deep reflexes.
5. Attitude of flexion at wrists, extension at metacarpo-phalangeal joints and flexion at the phalangeal joints.

Examined three days later when the attack was over, there was diminution of motor power in the arms and legs, and he was unable to roll from the supine to the prone position unaided. There was some wasting of the muscles of the arms, and to some extent of the forearms, along with spastic rigidity of the muscles of the forearm, shoulders, hips and knees on both sides. The extensor tendons of hands and feet stood out prominently. When he was asked to stand he showed the characteristic attitude of astasia-abasia, and on walking had a high stepping gait with some scissors action of the adductors. His reflexes showed absence of abdominal reflexes apart from a slight response in the right lower quadrant, absent cremasteric reflexes and a double extensor plantar response. All deep reflexes were exaggerated, and there was double ankle clonus. Hands and arms showed intention tremor, and there was gross ataxia to heel and knee tests. There was also ataxia on standing with the feet together with a tendency to fall to the left, and ordinarily he had to stand with feet wide apart to maintain his balance. There was no gross loss of sensation except after a fit, when sensation to cotton-wool was diminished as far as the middle of the thighs. Joint sense, sense of position, deep and superficial muscle sense did not appear to be grossly disturbed, but he was not a good subject. Variability in the reflexes has previously been noted, but repeated examination confirmed this, deep reflexes sometimes being grossly exaggerated, at other times appearing within normal limits, ankle clonus appearing and disappearing, and plantar responses being both flexor and extensor on different days and at other times being equivocal. The oculo-gyric attacks were not always accompanied by twitching, sometimes being associated with opisthotonic spasms. At other times they were accompanied by twitchings of the sterno-mastoids. In spite of the general impression that the attacks could be voluntarily induced, but not voluntarily terminated, occasions were reported when the attack was cut short by peremptory command or when the attention was fixed on some particular object.

At times he was noted to show phases of euphoria when he felt confident he was going to get better, and in these moods, attacks of twitching were likely to occur with oculo-gyric spasms.

Frequent loss of weight, as much as a stone in a month, were reported, which may have been due to stuporose periods when he refused food. In general he has maintained a fairly normal weight with a tendency to obesity (weight 10 stones). Sometimes polydipsia was noted, and occasionally pyuria, haematuria and phosphaturia.

Pyrexia of unknown origin has been noted with a temperature of 105·4° with a pulse-rate of 144. On another occasion it was recorded as being 95° with pulse-rate of 56. Obstinate constipation with scybala was a pronounced feature. Periods of confusion, excitement and wandering have also been recorded.

Sir Arthur Hall, who saw him in 1941, reported:

"This low-grade epileptic seems to have been subject to attacks in which there are movements of an athetotic kind. They begin with some deviation of the eyes and retraction of the head. They last for several hours, during which it is thought that he can bring one on, but that once it has developed he cannot stop it.

"I am inclined to think they may be oculo-gyric attacks of a rather exceptional kind, the result of an old epidemic encephalitis. My reasons for suspecting this are:

"1. They have been recurring at intervals for many years.

"2. They last for several hours, during which, though not unconscious, he is practically helpless.

"3. Although it used to be thought in the earlier days that he could bring one on voluntarily and did so at times, it is quite agreed that once an attack has developed, he cannot stop it. (This is quite characteristic of the oculo-gyric attack.)

"4. When an attack is over he is quite himself again, and even after all these years there is no evidence of any permanent after-effect of the attacks.

"5. They are said to begin with some turning of the eyes and retraction of the head.

"The one point in which this man's attack differs from other oculo-gyric attacks is in the extension of the body muscles generally, in the form of movements of an athetotic kind. Such a thing is, however, by no means unknown. I have seen one or two cases in which there has been widespread torsion spasms with similar athetotic movements during an eye attack.

"Against this view it may be said that the man does not show any other physical sign of encephalitis. This, however, is no criterion that he has not had it. I have more than one post-encephalitic attending my clinic at the Royal Hospital who, except for oculo-gyric attacks, appears to be quite well. One of them is actually a bus conductor on regular duty."

As to the etiology of the oculo-gyric attacks, Jelliffe has suggested that these are not pathognomonic of the post-encephalitic state, but that they may occur in association with paralysis agitans, epilepsy, cerebral syphilis, cerebral tumour, disseminated sclerosis, cerebral abscess, hemiplegia, and general paralysis.

A frequently occurring syndrome in the present series of cases is a previous history of convulsive attacks as some part of the illness, followed by periods of stupor in which the patient would be inert, either on the ground or in bed for several hours, to be followed by outbursts of violence when the patient would suddenly throw himself out of bed, roll around the room and bang his head or sometimes the whole body against the wall or the door. Attacks of howling, screaming and weeping sometimes alternating with helpless fits of laughter are recorded features. Enuresis is a common phenomenon, and frequently is ascribed to pure wilfulness. In a few cases faecal incontinence is associated with it. Many of these patients fall when they are walking, sometimes hurting themselves badly, and lie inert until they are picked up. In other cases periodic outbursts of fury occur in which the patient is homicidal,

and before admission some of them have been diagnosed as epileptic furor. Some of these violent patients will break out into fits of weeping and howling after a violent outburst because they are conscious of these powerful impulses which they are quite incapable of controlling. One patient had a predilection for striking members of the staff, and had enough insight to keep out of the way in case an attack should come on. Another patient would ask the staff to hold him so that he would not do any harm. Other cases, in their violent outbursts, would throw all sorts of objects within reach, often doing great damage in the process. Some cases have been diagnosed as suffering from " petit mal," in which the chief features are attacks of fainting, vertigo, pallor, pseudo-anginous pains, or with cyanosis and respiratory dysrhythmias. Attacks resembling narcolepsy are a fairly common feature of the post-encephalitic state, and occur long after the acute illness has subsided. The patients fall asleep at all sorts of odd times. Frequently they give an impression of trying to dodge work, but they will fall asleep at meal-times, when they are being interviewed, or in the recreation room, when they are playing games. Inversion of the sleep rhythm is a fairly frequent phenomenon in the acute attack, which is sometimes in evidence in the chronic state. Night terror, noctambulism, and periodic attacks of vacancy and wandering are also found. As many of the post-encephalitics try to abscond from institutions it would be quite natural to assume that this was attributable to their disregard of the laws and regulations of their detention, but as so many of them have also exhibited propensities for truancy, aimless wandering and vagrancy, it rather suggests that many of these episodes are of the nature of fugues. Thus Stengel (*J. Ment. Sci.*, **89**, 237) has reported a case of post-encephalitic Parkinsonism with typical fugues with the impulse to wander, and atypical fugues during oculo-gyric crises in which impulses to run away were associated with depression, ocular crises and violent attempts.

The oculo-gyric crises exhibit the same sort of fitfulness in incidence as cases of idiopathic epilepsy. As to the frequency of the attacks, Jelliffe reports from the literature 3 cases in 300 post-encephalitics (Bing), 5 in about the same number (Wimmer), 20 in 100 (Stern).

In the present series of 275 cases they have occurred in 33 patients, and seem to be more frequent in males than in females (26 : 7).

In many cases there occur frequent intervals of crises in a day with periods of remission; at other times there may be complete freedom from attacks; in others there is regular recurrence every two or three days, sometimes lasting a few minutes, sometimes a few hours. Some are induced by efforts of concentration, while other patients state that reading a book or some other occupation which helps to fix their attention will abort an attack. In one patient, going to the cinema will bring on an attack, whereas in another, anticipation of going is sufficient. Many patients are accused of being able to precipitate an attack when they are asked to do some routine task, though it is probable that when an attack has developed, time and relaxation alone will bring it to an end—the amount of time depending on the individual patient. In some cases, however, the attacks may be shortened by the use of hyoscine.

The volitional factor presents quite an interesting problem, for many of

these patients are recorded as having shammed fits, feigned faints, brought on ocular crises to serve their own ends, fallen into attacks of semi-stupor or deliberately urinated, and yet the specific nature of their action makes them fit into a syndrome which is so common to the total group. Thus, of 168 males, 32 and of 107 females 10 gave a history of convulsive seizures, only 5 males and 2 females of whom were regarded as genuine epileptics; 22 males and 17 females gave a history of narcoleptic attacks; 26 males and 7 females gave a history of oculo-gyric crises; 18 males and 9 females gave a history of fainting and *petit mal* attacks; 23 males and 2 females gave a history of repeated falls; 13 males and 11 females were recorded as subject to outbursts of throwing themselves on to the ground or through windows; 18 males and 12 females exhibited attacks of stupor; 17 males and 18 females are noted as being liable to enuresis, while 19 males and 18 females were liable to outbursts of howling.

The sex-variants of the feeble-minded group differ from those of the lower grades, in that they show much greater tendency to homosexuality and all its variations and also to heterosexuality. As in all the propensities we have so far discussed, the differences between the grades consist rather in the fact that the range of perversion is much more restricted in the lower grades; the higher grades exhibit all the tendencies that the lower grades show, along with greater variety, though sometimes a higher grade patient may become infatuated with a lower grade patient and induce him to a homosexual partnership involving mutual masturbation, sodomy and fellatio.

Of the total group of 168 males only 14 cases are not recorded to have shown sexual perversions, if one include urinary and faecal incontinence. Of the remaining 154 the variants are divided as follows:

	Urinary and faecal incontinence	31
Homosexual	Masturbation	58
	Mutual masturbation	22
	Masturbation of others (apparently not mutual)	5
	Sodomy	51
	Fellatio	41
Heterosexual	Offences against little girls	24
	Indecent exposure	15
	Sexual assaults with rape	24
	Other forms of sexual misconduct	2

In addition to this group there are 11 cases of rectal masturbation, some with an associated history of prolapsed piles, prolapsed anus, prolapsed rectum and melaena. In 5 cases the sexual perversions were associated with violence, as a result of which the fraenum was torn. In other cases the penis was injured by being bitten during fellatio, and in other instances match-stems were inserted into the urethra, and pins and ligatures of string were inserted or applied.

Of the total group, 35 (of 168) have had convictions against them for sexual offences; these include:

Sexual attacks on women and female children.
" " men and boys.
Indecent exposure (in one case 40 complaints in 4 years).
Indecent behaviour.
Bestiality and buggery.
Rape.
Carnal knowledge.

Of the 107 females 27 presented no indications of instinctual deviations. The different perversions are represented by the following figures:

Urinary and faecal incontinence	26
Masturbation	43
Rectal masturbation	4
Homosexuality	16
Sexual attacks on others	8
Indecent exposure	12
History of illegitimate children	13
Heterosexuality, including prostitution, gross immorality and false accusations against men	26

It is interesting to note that only one of these patients had a conviction against her for sexual offences.

For the sake of completeness it remains to say something more about the 13 males and 7 females with an I.Q. of more than 75 per cent:, though we have already noted their "epileptoid" and sex activities in relation to the whole series of cases. These higher grades exhibit the same gamut of violent tendencies as those found in the 50–75 per cent. group. They can descend to the same depths of degradation as the lowest grades, but show more variation in their propensities. They can also explain themselves more fluently. Thus one girl described how "something rose up" in her, making her feel that something would burst unless she fought. She seemed to pass her life alternating between terror and apathy. She, like other highest grade post-encephalitics, had a remarkable capacity for "agitating" the other patients. They can be most importunate, and never seem able to take "No" for an answer. She swallowed hair clips, safety pins, shoe buttons, leaves, and on one occasion, eight pebbles and five berries! She would throw herself violently out of bed and down stone steps, tore her hair, scratched herself, produced an otorrhoea by picking at her ear, went on hunger strike, and tried to commit suicide by tying up her neck. She was paranoid in outlook, and at times had auditory hallucinations. But for all this, she tried to give the impression of being rather studious, and professed a great interest in the poets, and read geology. She came to Rampton from a mental hospital and improved sufficiently to be allowed to go home, but the last I heard of her was that she was in a mental hospital again. With lower grades one does not expect to see much steady improvement, but in the patients with higher I.Qs. one is continually hoping that by the addition of insight these unfortunates may be able to reach sufficient stability to warrant consideration for life in the outside world again.

Henderson's gloomy prognosis for psychopaths in general is very much confirmed by the relapses of the post-encephalitic. Thus I have known a post-encephalitic, who had been convicted for indecent exposure, abscond from the institution and get his discharge from the M.D. act by lapse of his certificate,

only to find himself re-certified because he committed the same offence again. This perseveration shows itself in many ways: thus one post-encephalitic thief has an extraordinary penchant for bicycles; another one is a confirmed thief, and when he is detected in his crime he vows he will steal no more, but on search it is discovered that in his pockets are two handkerchiefs and a knife belonging to other patients! This particular patient stole ten hymn- and prayer-books from the church, and gave as his excuse that he "wanted to read." This purposeless stealing is seen in the way that they steal not only objects of little value to them, but also things that are obviously difficult to dispose of. One boy ran off with billiard cues, scooters, cycles, ponies, pigs and chickens that he could never "pass off" without being suspected. At another time he would steal objects and then give them away! But his generosity was not consistent, for he could be brutally violent for the most trivial of reasons.

The highest grade post-encephalitics usually provide a substantial part of the talent for the annual pantomime. Cinderella, Prince Charming, the fairy queen, Dick Whittington's cat—these are all roles that these patients have been known to take. The slight tremor of the voice in soprano or baritone can be quite effective! A few of them go in for writing poetry, and one of them wrote the script for two reasonably long plays. Others learn to play chess tolerably well, though they may be liable to upset the board and become abusive, if not actually violent, when the play is against them.

We have said something about the psychotic traits of the post-encephalitic, but it is to be specially noted that the highest grades are much more liable to frank hallucinatory and paranoid states than the lower grades. Their suicidal attempts also are much more likely to be successful.

Neurotic Symptoms following Encephalitis.

Of neurotic symptoms the following account gives some idea of their relative distribution and the nature of their manifestation:

A number of patients are liable to states of anxiety (7 males, 1 female), with extreme terror and apprehension. In the males, particularly, such attacks may be associated with vaso-vagal symptoms, of "angst," precordial distress, headaches, giddiness, and either bradycardia or tachycardia. Some of the cases exhibit profuse sweating, cold clammy extremities, bradypnoea, either with pallor or cyanosis, and complain of associated fainting attacks, though in the present number there are included only those cases in whom very obvious anxiety is present. In a number of cases, too, night-terrors and sleep-walking are associated. The onset of such symptoms as tremors of the hands, rightly or wrongly, has in some of the patients been attributed to anxiety, though they later developed the full Parkinsonian syndrome. It may be tentatively suggested, though little clinical evidence is adduced in support of the hypothesis, that many of the cases of tremor have a masked underlying anxiety neurosis. They shake because they suffer from unrecognized fear, and in some cases the extra-pyramidal system becomes structurally involved secondarily.

It is difficult sometimes to differentiate *hysterical attacks* from malingering, but here we are including such definite symptoms as hystero-epilepsy, hysterical

coughing, vertigo, transient paresis, functional ataxia, inability to walk (usually with astasia abasia, but without organic signs), anuria, and globus hystericus (15 males, 4 females). Self-infliction has been considered separately, and although not included under this heading numerically, has affinities with hysteria, especially in the wide range of different symptoms that may be presented, e.g. sucking gums and spitting blood, nose-picking with epistaxis or haemoptysis, dermatitis artefacta and swallowing foreign bodies, or soap to produce pyrexia.

Vomiting is another frequently recurring symptom that has not been listed numerically in this group. In a few cases it is a manifestation of recurring bilious attacks, but in others it is frequently self-induced. Some of these patients have a marked facility for vomiting, apparently without nausea, while induced vomiting recurred in six males and five females. In some of these, vaso-vagal attacks were associated.

Perversions of appetite are fairly commonly encountered. Refusal of food (8 males, 7 females) may occur as a fitfully recurring exhibition of displeasure from various causes, or may go the lengths of definite hunger strike. More commonly, voracity is met with (18 males, 8 females) which may be expressed as in an inordinately big appetite, with gulping of food in excessive quantities, or may be accompanied by eating frogs' legs, twigs, leaves, grass, paper, hair or swill. Sometimes vomiting is a natural sequel to such debauchery; at other times there occurs cyclic alternation of voracity with refusal of food. Less commonly polydipsia occurs, though this may in some cases be attributable to treatment with large doses of atropine. In some cases there appears to exist a syndrome analogous to that of anorexia nervosa, while in a few cases the picture actually resembles that of pituitary cachexia (Simmond's disease).

In odd cases regurgitation of food occurs analogous to those mentioned with effortless vomiting. These latter have been found with the additional characteristic that they re-swallow their vomitus, while one patient would pass regurgitated food through her lips to her homosexual partner.

Malingering has already been mentioned, but the present cases (9 males, 3 females) have exhibited a variety of different traits, such as feigning stupor or fits, sometimes for the purpose of earning a few coppers, or to escape some allotted task. A few have counterfeited typical post-encephalitic symptoms, such as oculo-gyric crises, while others have feigned other somatic illnesses. It is not always easy to differentiate hysteria, hypochondria and malingering, but for the present purpose we have regarded them as distinct in the sense that hysteria is usually unconsciously motivated, malingering is consciously motivated, while hypochondria is much more usually associated with a paranoid outlook and subjective misery with more delusional content.

Obsessional traits also present some difficulty in differentiating them from delusional symptoms, but in their grosser forms are relatively uncommon in the post-encephalitic (5 males and 4 females). The most common of these is obsessional touching. It is probable that the figures given are an underestimate of the real frequency of this symptom, as it is so frequently considered to be part of the post-encephalitic's playfulness. His teasing and

pestering frequently involve " hanging around " other people, who resent his attentiveness. But many of them display a very marked desire for contact with their fellows. In other cases there appears to be a marked obsession with the idea of death. One patient had a very persistently recurring obsession about post-mortems, another one had a persistent obsessive fear that he would " die a coward ", and yet another had a delusion that two patients were killed daily by brutal treatment by the staff. Syphilophobia, cancerphobia, claustrophobia and agoraphobia also were present in individual cases.

Neurasthenic symptoms appear in a frequent number of cases. Again there is some difficulty in differentiating on the one hand the fatigability that is a frequent accompaniment of lethargy, and also lassitude and exhaustion that is the usual sequel either to a patient's burst of violent energy, or to the epileptoid attacks described elsewhere. The present cases (12 males, 4 females) do not include those in whom fatigability is associated with lethargy or as a sequel to an epileptoid attack. They have, of course, some relationship with each other, as they also are related to symptoms attributable to effort syndrome. Thus many of the patients with ocular crises quite obviously suffer from their attacks towards the end of the day, but the neurasthenic symptoms mentioned are much less fitful or periodic in their incidence, and are frequently part of the general picture of depression, with its attendant incapacity for prolonged effort, flagging energy, distaste for work, or abulia.

Encephalitis and Trauma.

It is always difficult to establish a relationship between the onset of neurological disease, or any other organic disease, and trauma, but in some of the following cases the relationship appears so close that some sort of causal significance appears probable.

It is liable to be said that persons who develop neurological disease have accidents or fall because the pathological process has already begun its course. I certainly do not believe this to be true of all the following cases. In some of them the history of trauma is very slender indeed, but perhaps taken together the whole series is more impressive than an isolated example would be.

These are summarized as follows :

Males.

(1) At 9 years began with what appeared to be encephalitis one week after a fall from a street lamp from which he was swinging. He sustained a blow on the back of the head, and developed a haematoma of the scalp. A week later he began to have diplopia and strabismus, and to fall asleep while eating. He was in hospital five weeks, during two of which he was asleep for most of the time, and began his career of stealing one week later, for which he had three convictions. He became untruthful, lacking in control, exposed himself indecently and made assaults on old women and children. He was admitted to R.S.I. four years later, and has periods of homosexual conduct alternating with stealing from his wardmates. Physically he shows tremor of the tongue and eyelids, slowness of speech, Parkinsonian facial mask and still (17 years later) sleeps excessively.

(2) Already described under " Psychopathic effects." Had a fall on the head at 9, began with epilepsy some months later, with subsequent attacks of twitches, trance-like states and O.G.C. Diagnosed as a post-encephalitic in 1941 (i.e. thirteen years after admission), though he has no other features of Parkinsonism.

(3) Had a fall on the back of the head at 2, when he banged his head on the fender. No history of encephalitis, but exhibited a large variety of conduct disorders until he was certified 17 years later. These included a conviction for thieving, wandering from home, truancy, stealing knives and guinea-pigs, homicidal threats to girls, assaults, self-injury, attempted suicide, malingering, hypochondria, false accusations against staff with delusions of persecution (*cf.* W. H. Gillespie's case, *J. Ment. Sci.*, 1944, p. 582), bouts of mania with restlessness, noisiness, grandiose delusions that he has made inventions, and sexual attacks on the staff and throwing of faeces at them. He was eventually certified under the Lunacy Act, but had previously been diagnosed as a post-encephalitic on account of a Parkinsonism facial mask and posture, and an external strabismus.

(4) A patient who had encephalitis at 16, but whose condition was considerably aggravated by an accident a year later. He had many conduct disorders, but at the time of his admission to R.S.I. at 31 doubt was expressed as to whether he showed any features of Parkinsonism, and the opinion was expressed that he was not a post-encephalitic. Two years later, however, he showed undoubted Parkinsonism, with slurring of speech, general muscular rigidity (L. > R.), tremor of tongue and lips and Parkinsonian mask.

(5) Was knocked down in a cycle accident at 4, developed " brain fever " some months later, certified as a mental defective at 9, and admitted to R.S.I. at 15. He had been charged with stealing two keys, stole from shops, escaped from home and school, and wandered in the street, with a history of having two or three attacks of temper and depression a week. He had marked paralysis, tremor, slow monotonous and staccato speech and a Parkinsonian gait. He died at 19.

(6) Was very athletic, but at 16 fell off a roof, and developed a left-sided paralysis five days later. He had encephalitis a year later, but was said to have made a good recovery apart from a twitch affecting his left side. He had convictions against him for theft, exposed himself to girls, interfered with girls' clothing, and was admitted to R.S.I. ten years later. He attacked patients, injured himself, tore up sheets and books, soiled the floor deliberately, and was quarrelsome with other patients, often getting hit by them in consequence. He had marked Parkinsonism of speech and gait, with rigidity and tremors, especially affecting the left side, and died at 36, as some post-encephalitics do, from gradual dissolution, without other apparent cause.

(7) Fell on a railway line at 5, developed encephalitis at 6, and before admission to R.S.I. at 18 had had nine convictions against him for stealing, housebreaking and indecent exposure. He absconded, attacked staff, threatened suicide, and practised rectal masturbation. He had sialorrhea, a mask-like face, slurring of speech and tremor of the tongue.

(8) Says he had encephalitis at 9 in 1926, which came on after a hit on the head with a brick. This was followed shortly after by a conviction for theft, when he was sent to an Industrial School. He exposed himself indecently, openly masturbated, stole a purse by feigning faintness and being taken into a house, stabbed boys with a knife, was cruel to pets, killed rabbits and chickens, wandered and absconded a number of times from other institutions. He had a fixed immobile face, with blepharospasm.

(9) Had a bad fall at 7, followed by " meningitis." He went to a special school at 11, and some time later he began to develop attacks which were described as epileptic equivalents, with furor, in which he violently kicked and bit those around him, throwing objects at others, and described these attacks as " a storm that comes over me." He falsely accused a man of making homosexual advances to him, put his hands up his mother's clothes, but was not admitted to R.S.I. until he was 26. At first the signs of Parkinsonism were not very definite, but later showed marked Parkinsonism of attitude, speech and gait.

(10) Had a head injury at 14, in 1921, and was sent to a certified institution three years later, having first tramped the country, slept out, stolen food, and been convicted of stealing lead from a roof. There was no history of encephalitis in this case, and he was not diagnosed as a post-encephalitic until 1930, when he showed left hemiparesis with tremor, slow slurring speech, an attitude of flexion, and mask-like face. He has shown marked delusional formation, said that the staff were shooting people from behind sandbags, that he himself had been shot in the legs, and that a hole in his stomach had been made by a male nurse, who had placed a ball of nicotine or tobacco there. He also falsely believed that his mother

had left him some money (several hundreds of pounds) and that he had never received it. Other delusions were that Hitler had one of his agents in the hospital shooting at people, that somebody he did not know had taken one pint of blood out of him and given it to somebody else, that he had a baby in bed with him, and that he was going to be shot by a rifle aimed at him through the window while he was having his food.

(11) Sustained a depressed fracture of the occipital region of the skull by falling downstairs at school at 8. There are obvious signs of a fracture of the L. parieto-occipital region, confirmed by X-ray. This was followed by an illness described as encephalitis lethargica in which he hardly went to sleep at all for days at night-time, but was very sleepy in the daytime. At 13 he began with another attack of encephalitis in which excessive sleep was marked, and after being charged with offensive behaviour and indecent assault was certified as a defective two years later, and admitted to Rampton at the age of 21, where his chief propensity is the formation of irrational antipathies to other patients, whom he persistently tries to attack. This leads to retaliation, and in consequence much of his time is spent in seclusion both for his own sake, and for those whom he would try to injure. The chief physical signs are slurring of speech, Parkinsonian immobility of face, bent posture and Parkinsonian gait.

(12) Sustained an injury to the head at 8, when he was knocked down by a cyclist. No history of encephalitis, but up to the age of 16 when he was certified M.D. gave trouble to his parents by striking the different members of the family, interfering sexually with other boys, open masturbation, and by conviction for stealing money. At 14 other boys set on him and bumped his head fiercely on the pavement, no doubt after much provocation. He came to Rampton at the age of 28, with a record of vicious and hasty conduct, gave trouble by his frequent fights, masturbated other patients, was destructive and gluttonous with his food. Physically his face showed great immobility, all movements being slow and deliberate, with "quick and lifeless" speech; he had contracted sluggish pupils, frequent blinking of the eyes, Parkinsonian tremor of the right hand, and some spasticity of all limbs.

(13) Was perfectly normal until he fell from his pram at 15 months, when his development became retarded, and he had to go to a special school. He was certified at 10, and was sent to an institution. His chief propensities then were restlessness, mischievousness, irritability, bad temper, wandering, especially at night, frequent falls, when he often hurt himself, violent outbursts of temper, when he gave and received many blows. At 22 he was admitted to R.S.I. and committed sexual misdemeanours such as sodomy and mutual masturbation, He has Parkinsonian features, such as facial immobility, with gaping mouth. contracted sluggish pupils, slow drawling voice and kyphoscoliosis.

(14) Had a history of encephalitis at 10, which followed a fall from a roof, when he was subsequently unconscious for 24 hours. He was not long before getting about again, but attacks of oculo-gyric crises occurred at 15–16, and certification and admission to Rampton at 17. He had previously had convictions against him for rape and for stealing a motor cycle. He absconded three times, and after being brought back confessed that he had committed a murder. He had auditory hallucinations, marked Parkinsonism of gait with festination, sluggish pupils, increased muscle tone, tremors of fingers and tongue, sialorrhoea, thick monotonous speech and recurring oculo-gyric crises every few days, lasting eight hours.

(15) Broke his nose at 12, followed shortly after by an attack of encephalitis lethargica. His main features before certification eight years later were truancy, wandering, and violence to others. He was admitted to Rampton at the age of 27, but died two months later from lobar pneumonia. He showed Parkinsonian facies and speech, sluggish pupils, oculo-gyric crises, general tremors and incoordination of fine movements.

(16) Fell from a tree and cut his head at 11, followed shortly after by "cerebro-spinal fever," when he slept for a month and had to be taught to walk again, and developed what were thought to be epileptic fits. He was certified as a mental defective at 13, after convictions for stealing, which seemed to be quite purposeless. Thus he stole food, but if he was not hungry would throw it away. He was impulsive, endangered his life by running behind cars, struck at children and then laughed at them, stabbed a man in the back of the head with a cobbler's awl, and showed

strong propensities for climbing trees. After admission to Rampton at 18 he attempted to climb the roof three times, danced on the roof tiles in hob-nailed boots, and stood on a chimney top 60 ft. from the ground on one leg. He threatened suicide several times, bit his left knuckle so viciously as to expose his extensor tendons, frequently cut himself with glass, violently assaulted other patients, sometimes for the purpose of sodomy, picked their pockets, stole keys, and absconded. He had attacks of depression, suffered from auditory hallucinations, and manifested a divergent strabismus, sluggish pupils, frequent blepharospasm, proptosis of the eyes, tremors of the head and arms, with ataxia. He died at the age of 30 with signs of bulbar palsy and progressive muscular atrophy secondary to encephalitis.

(17) Had an injury to the head at 4 and an injury to the back at 5, and began with encephalitis at 7. He was certified as a mental defective at 15, and admitted to Rampton at 19, where his main propensities were impulsive and periodic outbursts of violence, in which he struck nine different patients one day, and twelve the next. He had a special predilection for striking medical officers, threw his food, and deliberately urinated on the floor of the patient's recreation hall. He had periods of mental confusion and showed characteristic Parkinsonian facies, with sluggish irregular pupils, slurring of speech and spasticity of the legs.

(18) After a knock on the head at 4½ developed encephalitis lethargica, but was not certified as a defective until 18, when he was admitted to Rampton. He had attacks of listlessness and helplessness when he lay on the floor and moaned, had frequent falls, soiled his room, lay about the day room half-dressed, and wandered around aimlessly. He tried to abscond and had periods of violence, destructiveness and fits of laughter alternating with depression. He had Parkinsonism of attitude, speech and gait, small pupils, attacks of oculo-gyric crises, and polydipsia. He died a year later from lobar pneumonia.

(19) At the age of 18 he had an accident in the pit when he sustained an injury to the right side of the head and was unconscious for three days, but he seemed to recover quickly and then joined the army. Four years later he developed encephalitis, i.e. at 22. From the age of 16, however, he was convicted of indecent exposure, and up to the time of his admission to Rampton at the age of 26 had 20 convictions against him for indecent exposure and assault, burglary, larceny and begging. He wandered around the country, took things from his own home and gave them to strangers, and proved himself to be an anxiety to his family and the neighbourhood. At R.S.I. he bullied and fought other patients, was liable to impulsive outbursts of violence, followed by helplessness and prostration, masturbated excessively, and practised sodomy. He had marked Parkinsonism of facies, speech and gait. Pupils were sluggish, his tongue and all his limbs showed tremor, though the left side was worse than the right, his posture was bent, and his musculature showed increased tone.

(20) States that he was run over by a lorry at 7, and developed " fits " shortly after. He never had an attack of acute encephalitis, but physically shows sialorrhoea, unequal pupils, nystagmus of the lids, slurring and slowing of speech, a left-sided hemiparesis with muscular rigidity. He had been liable to " attacks of epilepsy " about three times a year, in which the face flushed, the expression went blank, though consciousness was not completely lost, and were sometimes associated with vertigo and vomiting. He was certified as M.D. at 18 and admitted to R.S.I. at 29, and showed impulsively violent conduct, with some mild episodes of incendiarism, when he set fire to paper in the ward. He was liable to periods of depression, when he threatened suicide, and was addicted to fellatio.

(21) Had an accident at 6 when a number of ribs were broken, and developed encephalitis at 7. He was treated at the Winchmore Hill Hospital (L.C.C.) for encephalitis, certified at 14, and admitted to R.S.I. at 19. His chief propensities had been petty thieving, wild behaviour when he ran in and out of other people's houses, shouted in the streets, and used to pretend to have epileptic fits in order to gain sympathy and money. At Rampton he injured himself, was destructive to property, and was addicted to sodomy. He fought the other patients, accused the staff falsely of ill-treatment, grabbed food from other patients' plates, pretended that he was blind in one eye, and feigned illness. Physical signs included sluggish, irregular pupils that failed to react to accommodation, weakness of the left external rectus, inequality of the face, excessive salivation, some atrophy and weakness of the left pectoral muscles, and tremors of the hands. There was no definite history

of oculo-gyric attacks, but there was some fluttering of the eyelids and some tendency for upward deviation of the eyeballs when tested.

(22) Had a shrapnel wound of the head in the First Great War at the age of 16, when he was unconscious for an indefinite period, and began with fits of trembling which were ascribed to " shell-shock." There was no definite history of encephalitis, but he was admitted to R.S.I. at 25, after having two convictions for stealing, and five for drunkenness and begging. There was marked impairment of memory, with changes of a psychotic kind, such as hallucinatory phases, and strong paranoid colouring, depression alternating with grandiose ideas, and morbid obsessions about post-mortems. He had periods of violence, rectal and mutual masturbation, sodomy and absconding. He tried to make a key for absconding purposes, and injured himself. He had Parkinsonism with facial immobility, excessive salivation, monotonous speech, tremors of the eyelids, tongue, hands and feet, and muscular rigidity of both legs, and only in recent years has shown hypersomnolence.

(23) Had a bad fall with injuries to the head at 3, followed by a severe attack of " influenza " in 1923 at 12, which was subsequently considered to have been true encephalitis. He was admitted to R.S.I. five years later after being convicted for an assault on a woman. Had a record of stealing from 1925. He was a wanderer who was noisy, destructive, violent and aggressive, lazy, restless, pestered and bullied other patients. He picked his skin, threw his slippers at other patients, refused work, tried to abscond and indulged in mutual masturbation. He had a large head with circumference of 26 inches, marked internal strabismus and small pupils. Ten years elapsed (i.e. in 1938) before he showed any other physical residua of the post-encephalitic, when he began to develop tremor and rigidity of the right arm and leg, though later developed butterfly flutter of the eyelids, salivation, and tremors of the jaw, lips, tongue and both arms.

(24) Was involved in a severe pit accident in 1929, when he fractured his leg and had a spell of unconsciousness. He was certified as M.D. at 15 in 1929, and had convictions against him for stealing a cycle and setting fire to a hedge. He was involved in another accident in 1937 when he was concussed, and was admitted to Rampton in 1938 because of a sexual offence against a girl whilst he was on holiday from an institution. On admission he had slurring of speech, with fine tremor of the hands at rest, but was not considered at this time to be a post-encephalitic though the possibility was considered. Years later he showed definite Parkinsonism of the right side of the body with dullness of facial expression, the right side of the face being more affected than the left.

(25) Admitted in 1940 at 16, with a previous history of head injury in a motor accident and no previous history of encephalitis. He exhibited a number of mannerisms and habit-spasms, such as sucking his fingers, bending repetitively, putting his hands before his face and blowing into his fingers, rubbing both his eyes after speaking and biting his right thumb. He kicked, stole, tore his clothes, wilfully emptied urine and faeces on the floor and had a voracious appetite. His reflexes were sluggish, and he had lack of control of fine movements, deficient joint sense, and unsteadiness of gait along with Parkinsonian features.

Females.

(1) Had a fall on the back of the head at 10 months, followed by convulsions, and was backward in development, late in walking and talking, and was certified as defective at 22 and admitted to Rampton five years later for violent conduct, throwing stones, attacking people and throwing them to the ground, hitting out, spitting, going into people's houses uninvited and smashing chambers. She fractured another girl's jaw and tried to pull away a ladder a painter was using and threw the paint in the yard. She is dull in expression, salivates frequently, has fixed features and some muscular rigidity.

(2) Developed encephalitis at 14 in 1922, after a fracas in her father's public house, when she sustained a blow on the neck from a beer mug. She had ten convictions against her for larceny over a period of years, but was not certified until 1936, when she was admitted to Rampton. She had sudden outbursts of fury, violently assaulted others, injured herself, was destructive to windows and clothing and exhibited a number of persecutory ideas, especially against members of the staff. She had periods of agitation, and pestered both nurses and patients. She had Parkinsonian tremor of the left hand and foot, with fixed facies.

(3) Developed encephalitis at 12 in 1920, which was preceded by a severe blow on the head while bathing. She was treated at the Newcastle Royal Infirmary, and was away from school for three months. She was not certified as defective until 14 years later, when she was violent to her sister and ran away from her home in Newcastle to London, where she alleged that men molested her. She was admitted to Rampton at 29 in 1937 where she exhibited orgies of smashing, violent struggles and self-mutilation. On one occasion she climbed to the top of a three-storied building and threatened to throw herself down; on another occasion she barricaded the recreation room and smashed 31 panes of glass. She was a petty thief and made sexual attacks on the staff, tied her neck up and periodically had attacks in which she fell to the ground limp and motionless. Apart from periods of excessive somnolence, she shows no marked physical residua of encephalitis.

(4) Was a delicate child and was said to have cried all through each night until she was 2. She did not begin to talk until she was 3, at which age she was knocked down by a taxi, followed shortly afterwards by a fall downstairs. There was no history of encephalitis, but she was certified as a defective two years later and admitted to Rampton at 9 in 1928. The history was that she used to go into other people's houses or motor-cars and refuse to leave them when requested. She was vicious to the members of her family, would bite and kick her mother and baby sister, and would kiss her brother and then scratch him; she bit the legs of a cat and a dog. She wandered at large for miles. At Rampton she removed the blocks from between the hot-water pipes and threw them at other patients, and was so violent over such a long period of time that for many years she had to be kept apart from the other patients, as any opportunity for contact with other people, from the chaplain downwards, would be followed by a violent onslaught. Apart from myoclonic twitchings of the face and of both legs there were no physical signs of Parkinsonism, though Sir Arthur Hall diagnosed her as post-encephalitic. She exhibits a pituitary form of obesity which has been described in cases of this kind.

(5) Banged her head on the table at the age of 9 in 1922, and developed encephalitis seven weeks later which was associated with hypersomnolence. She was certified as defective at the age of 10, after a history of recurring drowsiness at school, nocturnal restlessness and wandering, and violent attacks on her mother. She was admitted to Rampton at the age of 15, where she was liable to recurring attacks of impulsive violence, stealing, and destructiveness. She is a well-marked case of Parkinsonism, with oculo-gyric crises, generalized tremors, spasticity of legs, attacks of hyperpyrexia (temp. 106°) and spends most of her time curled up in bed.

Behaviour Disorders Without Parkinsonism.

Out of 168 male cases, 31 gave a definite history of encephalitis without showing any gross signs of Parkinsonism, such as muscular rigidity or tremor, while 29 gave no definite history of encephalitis, and yet showed definite Parkinsonism. Of 107 female cases 26 gave a definite history without showing gross Parkinsonism, and 10 gave no definite history and yet showed definite Parkinsonism. Of those giving a definite history of encephalitis without gross physical residua, we find a group of behaviour disorders of the most vicious type:

A man who had encephalitis at 7 was admitted to Rampton 16 years later from prison, where he had been committed on two offences of larceny, and had three previous convictions, of fraudulent conversion, stealing a cycle, and stealing £5. He had been a wide traveller, had sought a living as a waiter and as interpreter, and had lived at Marseilles as a dock labourer, but had been deported from France for hitting out at a stranger. He had been dismissed from many jobs because he quarrelled with his employers about trivial things. His criminal career began only two years before admission, but his anti-social career began some years previously. He proved a most intractable case, assaulting other patients, attempting suicide by hanging, and in collaboration with another patient climbed the roof of the institution where he had stayed for 7½ hours, and did £300 worth

of damage by smashing windows and tearing up the roof. He made attempts to abscond, and was involved in a plot to make pass keys from a pattern he had managed to procure. He inflicted injuries on himself, scraped the back of his throat with a chiv he had made himself, and was a sexual pervert, a confirmed masturbator both by himself and with other patients. He also gave a history of having behaved indecently with women prior to admission. He was a Jew, and deludedly felt persecuted in consequence.

The other cases are interesting from many points of view. Details of them are summarized below:

Of 31 male cases with a definite history of encephalitis, without gross Parkinsonism, the details of their physical residua may be summarized as follows:

1. Ocular changes (11 cases):*
   - Contracted pupils 2
   - Irregular pupils 2
   - Unequal pupils 2
   - Failure to react to light or accommodation 3
   - Dilated pupils 1
   - Staring eyes 1
   - Strabismus 2
   - Faulty convergence 1
   - Diplopia 2
   - Ptosis 5
   - Blepharospasm 1
2. Disturbances of sleep rhythm (11 cases):
   - With excessive somnolence in the daytime 3
   - Lethargy 8
3. Disorders of the vegetative nervous system (10 cases):*
   - Fainting attacks 6
   - Bradycardia 4
   - Hyperidrosis of limbs 1
   - Acrocyanosis 2
   - Irregularity of respiratory rhythm . . 1
4. Perversions of appetite (1 case):
   - Voracity 1
5. Endocrinopathies (5 cases):
   - Effeminacy of physical constitution . . 3
   - Hypogenitalism 1
   - Hypopituitarism with sexual infantilism and mongoloid features . . . 1
6. Motor symptoms (18 cases):*
   - Convulsive attacks 3
   - Tics 2
   - Twitching attacks of limbs (myoclonus) . 2
   - Dullness of facial expression . . . 4
   - Speech defects 5
   - Slight tremors of hands . . . 6
   - Muscular hypotonia of limbs . . . 5
   - Slight hypertonia of limbs . . . 2
   - Kypho- or lordo-scoliosis . . . 4
   - Liability to frequent falls . . . 2
   - Urinary incontinence 1

* A number of the cases presented more than one feature under one or other of the 3 categories so marked.

Although the physical residua of these patients are much less in evidence than the main group, their anti-social menace is indicated by the fact that 25

of them had been at some time or other convicted of various offences classified as follows:

A. Classification of criminal offences of 25 of 31 post-encephalitics without gross Parkinsonism.

I. Damage to property:

1. Travelling on the railway without ticket, stealing cycles, money and articles.
2. Three convictions for larceny.
3. Stealing a cycle.
4. Convictions for housebreaking, larceny and stealing money.
5. Stealing a suitcase and motor-car.
6. Stealing a cycle and a motor-cycle at 14.
7. Thieving.
8. Convictions for stealing money and clothing. Broke into a shop.
9. Four convictions for larceny at 20.
10. Five convictions for stealing beginning at 8. Broke into shop.
11. Stealing tobacco.
12. Stole a cycle.
13. Conviction for larceny.
14. ,, ,, and stole a cycle.
15. Two convictions for theft.
16. Conviction for stealing a handbag.
17. ,, ,, ,, cycle.
18. Two convictions for larceny from age 21, and fraudulent conversion.

II. Damage to others:

1. Three convictions for assault.
2. Conviction for assault at 7 years 11 months.
3. Knifing other children.
4. Violent attacks on mother and another woman.
5. Cut a boy's head with a hatchet.
6. Violent assault on boy of 13. Grievous bodily harm.

III. Sex offences.

1. Indecent exposure to women.
2. Indecency with boys from the age of 14.
3. Two convictions for indecent assault.
4. Indecent exposure.
5. Violent sexual assaults on little girls.
6. Indecent assault on a girl of 7.

B. Summary of anti-social characters of the 31 patients without gross Parkinsonism, for which no convictions were made, previous to admission.

I. Damage to property.

1. Threw stones. Thieves.
2. Steals.
3. ,,
4. Broke into a canteen.
5. Cut gas pipes. Lit fire on bedroom floor.
6. Broke into a shop.
7. Tried to fire a boy's bed.
8. Stole key.
9. ,, ,,
10. Stole a cycle.

II. Damage to others.

1. Attacked the police.
2. Kicked his mother. Stuck pins into children.
3. Struck his father.
4. Struck people frequently with the poker.
5. Killed a patient at a mental hospital, and tried to strangle another with his neck-tie.
6. Tried to strangle his sister and another girl.
7. Strangled a cat and gave the entrails to another cat.
8. Deported from France for hitting a stranger.

III. Sex offences.

1. Talking indecently to small girls.
2. Sex impropriety with baby sister.
3. Sexual attacks on girls.
4. Molested and masturbated boys.
5. Indecent behaviour with girls.

IV. Miscellaneous.

1. Stowaway on a ship.
2. Stayed out all night. 15 situations in two years from age 13. Climbed out of window 13 ft. high.
3. Threw himself downstairs. Ran away from home often.
4. Absconded from another certified institution 14 times.
5. Stowaway on a ship. Left articles in ships. Truant.
6. Vicious wandering.
7. Begging.
8. Absconded from an institution—then convicted of stealing.
9. Twenty situations in six months. Discharged from sea and army because of unsuitability. Absconder from a certified institution nine times in ten weeks, stealing the keys on one occasion.
10. Frequently ran away from home. Wandered into rivers and on the railway. Sudden impulses to do wrong. Absconded eight times from a C.I.
11. Frequent jobs, wandering and begging.
12. Truant.
13. Careless about fire. Took things hot from pans.
14. Truant. Rode through the Severn Tunnel on the buffer of a petrol truck.
15. Dismissed from many jobs for quarrelling with employers about trivial things.

c. Summary of traits of anti-social nature observed at Rampton.

I. Damage to property.

Sixteen patients exhibited destructive properties; these included smashing, tearing clothing, damaging the roof and slates (to value of £300), throwing stones through windows, damaging a weaving loom by putting a pair of scissors into the machinery, trying to set fire to the ward, pilfering, trying to force a window with an iron bar for the purpose of absconding, deliberate breaking of dentures (on five occasions), smashing electric light with a chamber, throwing furniture about and wilfully damaging books.

II. Damage to others.

Twenty-five patients exhibited violent traits to patients and staff. These included homicidal attacks by strangling, impulsive attacks, striking, kicking, biting, scratching, pinching, spitting, attacks with dangerous weapons, such as chisels, buckets, brooms and spades, throwing stones, screwdriver, steel, food cups, knives and billiard balls.

III. Sex offences.

Twenty-eight patients exhibited abnormal sexual activities while in the institution. These included masturbation, rectal masturbation, fellatio and sodomy. One of the patients formed a gang for homosexual practices, three of them sustained injuries to penis during homosexual practices, either from bites or of tearing of the fraenum, two of them were noted as being male prostitutes and importuners, two of them were recorded as sustaining a prolapsed anus and prolapsed rectum from rectal masturbation. This appears to be a not very uncommon sequel to sodomy, and may occur with prolapsed piles and melaena. One patient pushed a match stalk up another patient's urethra, while others made a practice of exposing themselves indecently.

IV. Self-injury.

Sixteen patients were noted as displaying tendencies towards self-injury; seven of whom attempted suicide, one successfully. Others scraped themselves with knives or sharp instruments, deliberately burnt themselves with cigarette ends, reopened old wounds, violently precipitated themselves against a door or wall, swallowed foreign bodies, persistently induced vomiting, impulsively threw themselves out of bed, while another would eat garbage, including worms, plaster, and swill for the pigs.

Of the 26 female cases with a definite history of encephalitis without gross Parkinsonism the following case affords a good example:

It is the case of a girl who was admitted to the London Hospital at the age of 18 in July, 1931, who for 14 days had felt ill and drowsy. She complained of diplopia followed by drooping of the left eyelid, some difficulty in the selection of words, numbness of the upper left limb, and was incontinent of urine, but not of faeces, On examination at that time the chief abnormalities were:

1. Slow monotonous speech.
2. Ptosis oculi (left).
3. Slow nystagmus on lateral fixation to the left.
4. Left external rectus palsy.
5. Defective upward movement of the eyes.
6. On looking to the right, the left eye turns downwards and inwards.
7. Slight left facial weakness.
8. Pupils equal, not quite circular; react to light and on accommodation.
9. Coarse involuntary movements of all four limbs.
10. Spastic weakness of the lower limbs; equivocal plantar responses.

The course of the illness was afebrile; pulse and respiration rate varied between 80–90 and 20–22 respectively. The W.R. was negative in the blood and C.S.F., colloidal gold curve 0022211000, chemical analysis and W.R. were negative, as also that of the blood. Blood count: R.B.C. 5,100,000, Hb 75 per cent. C.I. = ·73. W.B.C. 9,000. Differential count normal.

After four weeks in hospital she became incontinent of faeces as well as of urine and haematuria also occurred. She was then discharged without much progress being recorded to an Isolation Hospital, from which she was sent home after five or six weeks.

At home her conduct was noted as being very eccentric, and in September, 1931, she was admitted to Brentwood Mental Hospital as a voluntary patient, but absconded the following March.

Subsequently she proved a very great trial to her parents, who spent a considerable amount of time trying to find her when the wanderlust came over her, which was fairly frequently. She had five convictions against her for stealing, lived a very immoral life, and was sent to Borstal.

On one occasion she accosted a porter, exposed herself, and offered herself or the price of a cigarette. At the time of her admission to St. Mary Abbot's

Hospital she admitted that all her clothing was stolen property. At this time in 1936 her mental age was assessed at 12 years with scattering. Since her admission to Rampton in October, 1936, she has justified all the remarks made as to her previous character. She exhibited flights of ideas, professed to be a student of music at the Royal Academy, talked at considerable length, was elated and lewd, masturbated openly, exposed herself at the window to male patients, stole other people's property, was destructive to windows, and showed such a strong addiction to snuff that she has been known to exchange valuable gifts sent to her by her own people for quite small quantities. Her mental age, however, has shown considerable improvement, and when it was last tested by Terman-Merrill scale was 17 years 2 months (I.Q. 114). To ordinary clinical examination there are no physical residua of encephalitis, except for contracted and sluggish pupils.

Of the total of 26 female cases with a definite history of Parkinsonism, the physical residua exhibited were:

1. Ocular changes (9 cases):
   - Pin-point pupils 1
   - Irregular pupils 3
   - Pupils with sluggish reaction to light . . 3
   - Pupils inactive to accommodation . . . 1
   - Dilated pupils. 1
   - Exophthalmos. 1
   - Strabismus 1
   - Diplopia 2
   - Ptosis of eyelids 1
   - Tremor of eyelids 1
   - Rotatory nystagmus 1
2. Disturbances of sleep rhythm with alternation of sleep and wakefulness (5 cases):
   - Noctambulism. 2
3. Disorders of the vegetative nervous system (5 cases):
   - Fainting attacks 3
   - Low blood pressure and bradycardia . . 1
   - Raynaud's disease 1
   - Acrocyanosis 1
4. Perversions of appetite (5 cases):
   - Polydipsia 2
   - Urine drinking 1
   - Anorexia nervosa 3
5. Endocrinopathies (15 cases):
   - Obesity 1
   - Sexual hypoplasia 1
   - Pituitary cachexia 1
   - Emaciation without assigned cause . . . 1
   - Amenorrhoea 6
   - Thyroid enlargement 11
6. Motor symptoms (12 cases):
   - Convulsive attacks 3
   - Pseudo-stuporose attacks with attacks of complete listlessness and tonelessness 3
   - Dullness of facial expression 2
   - Facial twitching 1
   - Lower facial palsy 1
   - Tremor of tongue 1
   - Speech defects 2
   - Tremor of an arm 1
   - Pes cavus 2
   - Urinary incontinence 3
   - Prolapse of rectum 1

A. Ten of the 26 cases had convictions against them; these were classified as follows:

I. Damage to property.

1. Five convictions for stealing.
2. Convictions for stealing a cycle, handkerchiefs, stockings and knickers.
3. Conviction for shop-lifting.
4. Conviction for stealing.
5. Conviction for begging.
6. Convictions for arson and stealing.
7. Convictions for begging, stealing and fraud.
8. Five convictions for stealing.

II. Damage to others.

1. Convictions for violent assaults.
2. Three convictions for assaults and wounding.

III. Sex offences.

1. Conviction for prostitution.

B. Summary of anti-social characteristics of the 26 female patients without gross Parkinsonism, without convictions previous to admission to Rampton.

I. Damage to property.

1. Destructiveness.
2. ,,
3. Smashing and throwing stones.
4. Destructiveness.
5. Stealing and smashing.
6. Destructiveness to clothing and smashing.
7. ,, ,, ,,
8. Barricading, smashing and stealing.
9. Destructiveness to clothing.
10. Destructiveness.
11. Stealing.

II. Damage to others.

1. Assaults.
2. Sudden impulsive violent assaults.
3. Stripped a child and put it in a bed of nettles.
4. Biting and scratching.
5. Fighting and throwing stones, etc.
6. Pulling out hair.
7. Pulling out hair of 30 different girls.
8. Excessive violence to others.
9. Fighting and biting.
10. Pulling out hair and throwing stones.

III. Sexual misconduct.

1. Gross immorality.
2. Had an illegitimate child.
3. Immorality and masturbation.
4. Had an illegitimate child.
5. Contracted gonorrhoea.
6. Falsely accused men of immoral intentions.
7. Had an illegitimate child.
8. ,, ,, ,,

IV. Miscellaneous.

1. Running in front of traffic to stop it.
2. Wandering on the railway lines, lying in the road, entering other people's houses and cars; hid herself in a bread van and rode in it for eight miles.
3. Disappeared from home for a few days. Absconding.
4. Absconding.
5. Wandering at large.
6. Absconding.
7. ,,
8. ,,
9. Ran away to London.
10. Absconding.
11. Absconded three times.
12. Absconding.
13. ,,

c. Summary of anti-social traits observed at Rampton.

I. Damage to property.

Eighteen patients exhibited destructive propensities to property, including three roof-climbers. One of these had the agility of a monkey, and even in seclusion developed the property of scaling her interior wall and holding herself in the most impossible of positions. Others would be content to climb the windows. Some stole food and other objects from their neighbours. Some of these cases exhibit the purposeless hiding of things, without any motive other than that of pure mischievousness.

II. Damage to others.

Twenty-four of these patients exhibited violent conduct to other patients and staff.

III. Sex offences.

Five exhibited abnormal sexual tendencies; these comprised two masturbators; one rectal masturbator; one homosexual; one indecent in manner; and one who made sexual attacks on others.

IV. Self-injury.

Twelve patients exhibited propensities for self-injury. These included rubbing the skin with blankets, cutting themselves with glass, throwing themselves downstairs, or out of bed, head banging, swallowing foreign bodies, and writing on the wall in their own blood. They include seven who were suicidal, and who tied up their necks, with one who drank Ronuk with suicidal intent.

Cases with no definite history of encephalitis, yet showing definite Parkinsonism now:

29 male cases (of 168).

10 female cases (of 107).

Of these we may enumerate the following, of whom 23 males and 8 females were not diagnosed as post-encephalitic for some time after admission.

No.	Previous history.	Psychopathic symptoms.	Physical signs and symptoms.
1.	History of measles. Certified M.D. at 10. Admitted R.S.I. at 14½. Diagnosed P.E.L. at 22	Wanton destructiveness at home. Truancy from home for long periods. Roof-climbing. Plays with fire. Noisy. Hypochondriac. Self-injury. Eats rubbish. Masturbator. Threatened suicide	Restless purposeless movements. Lachrymation. Parkinsonian features. Stares. Tremor of hand. Slurring of speech.
2.	M.D. from early age. No history of encephalitis. Brought up at Dr. Barnardo's. At an industrial school at 9. Admitted R.S.I. at 16½. Not diagnosed as post-encephalitic till 24	Conviction for larceny at 9. Many thefts. Violent attacks against patients and staff. Bites. Epileptoid attacks—throwing himself on the floor. Impulsive. Smashes glass. Homosexual. Masturbator	Marked Parkinsonism. Gapes. Spastic R. leg. Self-induced vomiting. Helpless without atropine. Attacks of howling and lachrymation.
3.	Observed as M.D. from childhood. Certified at 18½. Admitted R.S.I. at 20½. No history of encephalitis. Diagnosed P.E.L. at 30	Epileptoid attacks—fits of temper; falls and cuts face. Fell through train window. Attempted drowning. Fights. Impulsive. Got out through skylight. Interferes with children	Coarse Parkinsonian features; fixed, immobile. irregular uneven pupils. Parkinsonian speech. Spastic L. leg. Frequent falls. Pes cavus (R. and L.). Improved on atropine.
4.	Head injury at 9. Epilepsy from 10. Certified M.D. at 16. Admitted R.S.I. at 16. Diagnosed P.E.L. at 29	Violent, destructive. Impulsive. Injures self	Ocular crises. Myoclonic attacks, as well as epileptiform changes. Variable pyramidal signs.
5.	Certified as M.D. at 9½. Admitted R.S.I. at 9½. No history of E.L. Signs of P.E.L. noted from 18—gradually increasing	Conviction at 9—of killing a rabbit maliciously. Has an obsession with death. Pilfers. Wanderer and absconder. Violent. Suicidal. Homosexual	R. hemi-Parkinsonism, with muscular hypertonia noted in 1938. Two years later general muscular hypertonia. Slight tremor of both hands. Fixed Parkinsonian facies.
6.	History of measles. No history of E.L. Fall on back of head at 2. Not diagnosed P.E.L. until 32. Certified M.D. at 20½. Admitted R.S.I. at 21	Conviction for thieving. Wanderer. Truant. Extremely violent and vicious. Self-injury. Sexual attacks on staff. Masturbator. Homosexual. Malingerer. Hypochondriac. Suicidal. Threw faeces at staff. Paranoidal. Delusions of persecution. Certified insane	Parkinsonian facies and posture. R. external strabismus.
7.	Noted as defective from 18 months. Certified at 3½. Admitted R.S.I. at 14½. Unable to read, write or talk properly. No history of E.L. Diagnosed P.E.L. at 19½	Violence to self and others. Screaming fits—? epileptic history. Passive homosexual. Masturbates openly. Bangs his head violently on chairs. Grimaces. Impulsive. Incontinent	Parkinsonian facies. Slurred speech. Rigidity and choreiform movements of arms. Tremors of legs. Festinant gait. Flexion posture of trunk.
8.	Head injury at 14. No history of E.L. Certified M.D. and admitted R.S.I. at 19. Diagnosed P.E.L. at 31	Conviction for stealing lead pipe from a roof. Vagrant. Absconder. Sleeps out. Steals food. Voracious. Hypochondriac. Destructive. Violent. Homosexual. Masturbator. Fantastic delusions. Hallucinosis	Fixed immobile features. L. hemi-paresis, with tremors of arm and leg. Flexion posture. Parkinsonian speech. Chronic otitis media and aural polypi.

No.	Previous history.	Psychopathic symptoms.	Physical signs and symptoms.
9.	Head injuries at 8 and 14. Certified as M.D. at 16. Admitted to R.S.I. at 28. No history of E.L. Diagnosed P.E.L. on admission	Conviction for stealing. Violent. Vicious and hasty. Destructive. Homosexual. Masturbator. Absconder. Voracious. Apathy. Lethargy with impulsive outbursts	"Quick lifeless speech." Palilalia. Stutters. No facial signs of animation. All movements slow and deliberate. Contracted sluggish pupils. Blepharospasm. General spasticity. Tremor R. hand.
10.	Measles in infancy. No history of E.L. Certified as M.D. and admitted to R.S.I. at 11½. Diagnosed P.E.L. two years later	Charged with malicious wounding at 9. Fits of screaming, kicking, biting, throwing objects, smashing and destructiveness. Steals. Climbed fence. Restless. Impulsive	Drowsiness in daytime. Wakefulness at night. Parkinsonian facies; slow and expressionless. Irregular pupils; fail to react to light. Ataxia.
11.	No history of E.L. Certified M.D. at 23½. Admitted R.S.I. at same time. P.E.L. condition gradually increased from 29 when it was first noted.	Five convictions for bestiality, indecent behaviour, exposure and assault. Interfered with little girls. Throws objects, bites, gambles and absconded twice. Defiant, restless, often unsettled. Smashed. Paranoid	Loss of facial expression. Slurring of speech. Loss of motor control. Sluggish pupils. Tremor of eyelids. Spastic R. arm and leg. Tremor of R. arm and leg. Some wasting of R. thigh and calf. Reflexes ++. R. plantar extensor.
12.	No history of E.L. Backward from birth. Certified and admitted to R.S.I. at 18½. Diagnosed P.E.L. on admission	Conviction for thieving. History of absconding. Maniacal outbursts. Wandering. Attacks of violence and destructiveness. Homosexuality. Male prostitute. Swallowed foreign bodies. Self-injury. Attempted suicide. Resistive. Precipitation to floor. Hiding on fire escape. Attacks of screaming and shouting	Fainting attacks. Slurring of speech. Tremor R. arm (on admission). Affected both arms five years later. Two years afterwards showed wasting and weakness of R. arm, with spasticity of both arms and legs, and increased reflexes.
13.	No history of E.L. Backward from early age. At special school for eight years. Certified M.D. and admitted R.S.I. at 20½. Diagnosed P.E.L. at 27	Four convictions for stealing and assaulting a girl. Suicidal attacks and depression. Paranoid. Destructive to windows. Homosexual. Absconded	On admission, noted as fidgety, restless, with poor motor co-ordination and tremor of L. hand and Rombergism. Seven years later: Coarse tremor of all muscles, worse on excitement. Unequal eccentric pupils. Scoliosis to R. Drowsy in daytime. Sialorrhoea. Fainting attacks with precordial distress.
14.	No definite history of E.L. but diagnosed as such before certification and admission to R.S.I. at 14½. Admitted from Home Office School. I.Q. 100 per cent.	Convicted for stealing a cycle. Four unprovoked assaults on women. Attacked mother and sister with a knife. Maniacal outbursts. Impulsive. Absconds. Homosexual. Destructive. Stole hymn books, prayer books and a dictionary from the Institution	Slight tremor R. hand and foot. Voracity. Double incontinence. Myopic.

No.	Previous history.	Psychopathic symptoms.	Physical signs and symptoms.
15.	Certified M.D. and admitted R.S.I. at 14½. No history of E.L. Diagnosed P.E.L. on admission	Violent to mother. Threatened father. Indecent exposure. Asked girls to expose themselves. Beggar. Persistent demands for attention. Sly. Homosexual. Provokes others	Blepharospasm. Facial tics. General muscular tremors. Dorsal lordosis and scoliosis. Monotonous speech. Paralysis and spasticity of L. leg. Absent knee-jerk (R.). Nocturnal incontinence.
16.	Certified M.D. and admitted to R.S.I. at 14½. No history of E.L. Diagnosed P.E.L. on admission	Stole a cycle and other articles. Frequently destructive. Homosexual. Noisy, restless, violent to other children. Deliberately soiled his room	Palilalia. Irregular R. pupil. Tremor R. forearm. Diminished R. knee-jerk. Frequent falls (ataxia). Urinary incontinence. Frequent bouts of fever. Liable to labial herpes.
17.	Shrapnel wound in war—1918. Began with "nerves" at 16. No history of E.L. Certified M.D. at 25½ in 1927. Diagnosed P.E.L. 14 years later and admitted to R.S.I.	Five convictions for begging and drunkenness; two for stealing. Homosexual. Depression. Self-injury. Paranoid. Grandiose. Says he has a piece of iron in his head. Hallucinated. Obsessed by the idea of post-mortems	Advanced Parkinsonism with oculo-gyric crises, rigidity of legs, tremor of eyelids, tongue, hands and feet. Monotonous speech. Sialorrhoea.
18.	No history of E.L. Certified and admitted to R.S.I. at 21½. Illiterate. Diagnosed P.E.L. on admission	Conviction for indecent assault. Outbursts of temper and violence. Homosexual and masturbator. Tried to abscond. Confusional attacks with disorientation. Self-injury.	Retardation of speech. Sialorrhoea. Gaping mouth. Parkinsonian facies. Inco-ordination, rigidity and tremor of forearms. Lethargy. "Epileptoid" attacks. Chronic otitis media.
19.	No history of E.L., though conduct disorders were noted at 15. Certification and admission to R.S.I. at 18½. Diagnosed as P.E.L. at 28	Ten convictions for indecent assault on girls, sexual misconduct with males and animals, and stealing. Indecent exposure. Masturbator. Violent—throws objects. Smashes. Suicidal	Twelve years after admission first noted as showing signs of Parkinsonism. Now has small sluggish pupils, right-sided hemi-Parkinsonism with rigidity and tremor. Tremor of L. hand. Coarse fixed facies. Chronic otitis media.
20.	No history of E.L. In the army at 17. At two mental hospitals before certification as M.D. and admission to R.S.I. at 28. Diagnosed as P.E.L. for first time at 36½	Five convictions—three for stealing, one for indecency, and one for assaulting mother. Violent outbursts—fighting and throwing stones; hypomania. Stole food; begged; pestered patients and staff. Homosexual. Marked addiction to tobacco	Sluggish pupils. Polypnoea. Rapid onset of Parkinsonism a year after diagnosis of P.E.L.
21.	No history of E.L. Had had many situations in employment, and was discharged from the army as an "anxiety neurosis." Certified M.D. at 18 and admitted to R.S.I. at 18½, though I.Q. was assessed at 90 per cent. Diagnosed P.E.L. a year after admission	Two convictions for indecency to small boys. Homosexual pervert. Slovenly, untidy; very persecuted. Depression. Absconder	Diagnosed by Sir Arthur Hall as a P.E.L. with butterfly tremor of lids, unequal pupils, and salivation.

No.	Previous history.	Psychopathic symptoms.	Physical signs and symptoms.
22.	No history of E.L. Certified M.D. at 19½. Admitted to R.S.I. at 20. Only reached standard IV at school. Did not learn to write. History of "fits" in first year. Never worked. Diagnosed P.E.L. at 29½	Morbid attacks of fear; strikes out impulsively. "Talkative and morose" in turns. Delusions of impending death. Attacks of screaming and excitability. Throws objects about. Destructive. Homosexual. Agoraphobia. Is solitary because he knows he might strike out	Hypospadias. Sexual under-development. Increasing muscular hypertonia. Manneristic. Grimaces. Restless movements. Lethargy. Stays in bed for days at a time.
23.	No history of E.L. Certified M.D. at 18. Admitted to R.S.I. at 19½. Diagnosed P.E.L. at 21½	Impulsive outbursts of striking. "Epileptoid" attacks; attacks of blankness, without loss of consciousness, flushing of face, vertigo and vomiting. Homosexual. Threatened suicide. Set fire to paper in the ward dayroom	Slow slurred speech. Sialorrhoea. Nystagmus of eyelids. Flexion posture. L. hemi-paresis with spasticity. Immobility of L. facial muscles. Eunuchoid bulld (hairless). Genu valgum.
24.	No history of E.L. Certified M.D. at 7. Admitted R.S.I. at 13¾. Imbecile grade. Diagnosed P.E.L. at 17 years 5 months	Violent attacks—bites others and himself. Bangs his head on the wall and door. Shouts that he is going mad. Wishes he were dead. Asks others to hit him. Tried to abscond. Destructive to light shades and electric bulbs	Parkinsonian facies. Increased muscular tonus and tremor L. arm. Staring and infrequent blinking. External strabismus. Upward nystagmus. Ataxic gait. Walks on broad base. Defective and slurred speech.
25.	Premature at birth. 5 lb. at birth. M.D. from infancy. No history of E.L. Certified M.D. at 12. Admitted to R.S.I. at 17	Steals, wanders, out late at night. Aimless, impulsive, solitary, destructive, teases other patients. Kicks, bites, scratches. Homosexual and masturbator	Restless and fidgety. Internal strabismus. Paresis of R. face, arm and leg, with some wasting, more in arm than in leg. R. extensor plantar and knee-jerk ++. R. chest moves less than L. Tremor of eyelids. R. hemi-anaesthesia—cigarette burns R. face. Sialorrhoea. Frequent falls (ataxia). Spastic gait.
26.	No history of E.L. Certified M.D. and admitted R.S.I. at 13½. Never went to school. Imbecile grade. Diagnosed P.E.L. at 25	Aimless wanderer; stripped himself in the street. Ran away from home. Turned on gas and water taps mischievously. Violent to other children. Smashes. Throws food at attendants. Spits. Masturbator	Parkinsonian facies. Spasmodic torticollis. Stooping and lurching gait. Scoliosis. Speech slurred and defective. Bilateral spasticity along with hyperextension and flaccidity of fingers. R. extensor plantar. L. facial tic. Double otitis media.
27.	Parents convicted 30 times of neglect to children. Never went to school. Illiterate. No history of E.L. Certified M.D. at 14½. Admitted to R.S.I. at 14½. Diagnosed P.E.L. at 27 after readmission	Convictions for arson, sodomy, theft and rape. Tried to abscond. Roof-climber. Gambler. Fighter. Bully. Smashes	Parkinsonian facies. Dull and slow in speech and general motility. Flat-footed.

No.	Previous history.	Psychopathic symptoms.	Physical signs and symptoms.
28.	Epilepsy from 6–10. No history of E.L. Can't read or write. Imbecile grade. Mother sent to prison for neglect. Immoral and alcoholic. Treated violently by parents. Certified at 16 years 11 months. Admitted to R.S.I. at 21½. Diagnosed P.E.L. at 39	Restless. Threw plant-pots about at night. Destructive to clothing and windows. Violent attacks of striking and kicking. Precipitated himself on the ground. Threw faeces through the window. Impulsive. Agitates and pesters others. Homosexual. Paranoid	Fixed Parkinsonian facies. Sialorrhoea. Stares. Dilated sluggish pupils. Bilateral optic atrophy. Staccato and precipitant speech. Coarse tremor of hands and of legs. Pill-rolling movements of hands. General loss of sensory acuity. Pes cavus. Genu valgum. Serological evidence of syphilis.
29.	M.D. from birth. Certified at 8. Admitted to R.S.I. at 13 years 10 months. Imbecile. Diagnosed P.E.L. at 25	Destructive from 6. Very impulsively violent. Set fire to himself from a lamp. Excitable and restless. Ran away from home. Attacks of alternate laughing and crying. Absconded twice. Hides himself. Urinates on floor deliberately. Injures himself. Tried to cut his throat. Rectal masturbator	Fixed Parkinsonian facies. Salivates. Very hesitant and defective speech. Springy gait. Drooping jaw. Sexually under-developed at 25.
Females.			
1.	Certified M.D. at 19½. Admitted to R.S.I. at 20½. Imbecile. Diagnosed P.E.L. on admission	Pilferer; beggar. Restless, noisy. Jumped out of window; ran away from home. Broke through panel of door and escaped from it. Threw objects. Smashed windows. Destructive to blankets. Injures herself by rubbing skin with a blanket. Attacks of confusion. Fell out of bed	Parkinsonian facies. Slowness of movements; R. more affected than L.
2.	No history of E.L. Certified M.D. at 16½. Admitted to R.S.I. at 16½. Diagnosed P.E.L. at 22½	Convictions for theft and assault. Contracted V.D. before 16. Wanders. Absconds. Impulsive attacks of violence. Stuck a needle in her breast. Agitates	Parkinsonian facies. Poverty of movement. Frequent falls.
3.	No history of E.L. CertifiedM.D. at 16. Admitted to R.S.I. at 19½. Diagnosed P.E.L. at 25½	Convicted of "false" pretences for money. Threw herself down a flight of stairs. Wanders. Absconds. Makes false accusations. Suicidal. Smashes. Agitates others. Injures herself with needles. Tied her neck up four times. Depression. Fainting attacks when she is anaesthetic. Hypochondriac	Oculo-gyric attacks lasting for some days, alternating with vertigo and suicidal turns. Fixed facial expression. Stares blankly. Slight tremor of hands. Occasional internal strabismus.
4.	No history of E.L. Certified M.D. at 21½. Admitted to R.S.I. at 21½. I.Q. 98 per cent. Diagnosed P.E.L. at 33	Conviction for stealing in 1925. Sent to Home Office School. Had an illegitimate child in 1931. "Can't leave men alone." Always defiant and obstinate. Worse after 1923. Attacked mother and sister. Makes violent sexual attacks on staff. Delusions of persecution	Parkinsonian facies. Drooping jaw. Recurring dislocation of shoulder.

No.	Previous history.	Psychopathic symptoms.	Physical signs and symptoms.
5.	Doubtful history of birth injury; attributed by parents to air raids. History of measles and whooping-cough. Certified M.D. at 15½. Admitted to R.S.I. at 20½. Diagnosed P.E.L. at 24	Fits of rage if not given her own way. Attacks children. Hides. Tried to abscond, and ran in front of motor cars. Fits of weeping. Smashes. Threw objects. Voracious eater. Pesters others	Epileptoid attacks. Restless. Blepharitis. Marked Parkinsonian facies. Slurred speech. General muscular rigidity. Lethargy.
6.	Doubtful birth injury. Defective from an early age. Illiterate. Imbecile grade. Certified M.D. at 7¾. Admitted R.S.I. at 15½. No illnesses. Diagnosed P.E.L. at 24	Restless; violent attacks in which she strikes or bites. Ran away from school. Throws stones. Destructive to clothing. Impulsive and noisy. Soils and wets herself. Masturbates openly. Injures herself	Tics of shoulder and face. Grimaces. Parkinsonian facies.
7.	No history of E.L. Certified M.D. at 16½. Admitted to R.S.I. at 16½. Diagnosed P.E.L. at admission	Throws objects. Steals. Tried to get out of bathroom window to run away. Threatened to climb roof. Bites and strikes. Destructive to clothing. Openly masturbates. Makes false accusations	Fixed facial expression. Paresis and atrophy of L. arm and L. leg with rigidity. Scoliosis. Speech monotonous. Tics of shoulder, neck and face. Spastic gait.
8.	Attributed to ill-treatment by father of mother in pregnancy. No history of E.L. Certified M.D. at 28½. Admitted to R.S.I. at 31½. Diagnosed P.E.L. at 33½	Impulsive. Absconds. Thief. Immoral. Smashes. Liable to depression. Injures herself.	Immobile features. Excessive somnolence. Lies down in the ward in daytime to sleep.
9.	No history of E.L. M.D. from 4. Certified at 19¾. Admitted to R.S.I. at 21½. Frequent employments. Diagnosed P.E.L. at 27	Two convictions for stealing. Sent to Industrial School at 18 years 10 months. Ran away from home. Wanders. Absconded. Out late with men. Had an illegitimate child at 20. Depressed. Violent attacks. Attempted suicide. Smashed. Masturbator. Obscene	Oculo-gyric attacks from age 26. "Eyes stuck up" in the evenings.
10.	No history of E.L. Certified and admitted to R.S.I. at 14¾. Diagnosed P.E.L. at 19½ on readmission	Convicted for stealing at an early age. At an approved school. Runs away from home. Romancer. Injures herself.	Fixed Parkinsonian facies.

From the evidence presented by the above cases and others of the series the following tentative conclusions are suggested:

(1) The post-encephalitic state may follow in the course of an acute infectious disease known as epidemic encephalitis. This state may follow shortly after the acute illness, or it may follow much later, and not be diagnosed as the chronic Parkinsonian state for many years after.

(2) The Parkinsonian state or other post-encephalitic syndromes may follow an encephalitis after any of the acute fevers or vaccinia.

(3) Although it is often assumed that a post-encephalitic state must have been due to an acute illness of epidemic encephalitis, cases of this series suggest that it may also be associated with meningitis, chorea, epilepsy, infantile hemiplegia (with or without birth injury), acute anterior poliomyelitis, or cerebral trauma.

(4) It may occur *de novo* as a slowly progressive disease, either following or coincident with mental deficiency. (Grinker, *Neurology*, p. 708.)

(5) There is some evidence that some cases are caused by sepsis of the nasal sinuses or of the middle ear.

(6) There is some susceptibility of the patients to herpes; this may or may not be causative of a post-encephalitic state, but Levaditi and Harvier are of the opinion that it is an important cause. (Grinker, *Neurology*, p. 703.)

(7) Congenital syphilis occurs in some cases, and this may be an aetiological factor in the causation of Parkinsonism. (See W. R. Brain's *Diseases of the Nervous System*, 1933 edition, pp. 408, 445 and 455.)

(8) A few cases gave a history of "sunstroke" as the original cause of the acute illness. Exposure to sun, heat, and fatigue, both physical and mental, have long been considered important contributory factors in bringing on the form of encephalitis known as Japanese B encephalitis. Naka and his associates (quoted in No. 3 Report of the Matheson Commission on Epidemic Encephalitis, Columbia University Press, 1939, p. 167) gave physical exertion in hot sun as the immediate cause of the attack in 74 per cent. of cases.

The Social Background of the Post-encephalitic.

In this present age of social medicine it is not surprising that we should find that in common with many other diseases the post-encephalitic is suffering, not merely from an organic disease of the brain, but also from a "disease" of his social milieu.

There can be no doubt that the post-encephalitic exhibits violent and dangerous propensities, not merely because of his cerebral disease, but also because his environment both cramps and distorts his potential development. We may illustrate this by comparing our present series of 275 cases with the environmental factors found in a series of 262 violent and dangerous juvenile defectives under the age of 16.

Bearing in mind the inadequacy of information about the different factors listed among the environmental predisposing causes, it is probable that the post-encephalitic is less liable to belong to a defective family than the ordinary defective, but the history of defectiveness in the family in 23 cases must bear some relationship to his mentally defective constitution.

Environmental factors.	Post-encephalitic group.	Juvenile defective group.
1. Family history of mental defectiveness	23 (8·4%)	56 (21·3%)
2. Family history of insanity	30 (10·9%)	25 (9·5%)
3. „ „ of invalidism	46 (16·7%)	35 (13·3%)
4. Poor economic circumstances	39 (14·2%)	54 (20·6%)
5. Overcrowding	17 (6·2%)	28 (10·7%)
6. Living in slum conditions	28 (10·2%)	11 (4·2%)
7. Illegitimacy	17 (6·2%)	32 (12·1%)
8. Orphanism	104 (37·8%)	106 (40·4%)
9. Parental lack of control	7 (2·5%)	7 (2·7%)
10. Influence of maternal anxiety	3 (1·1%)	9 (3·2%)
11. Prison record in family	6 (2·2%)	9 (3·2%)
12. Parental alcoholism	16 (5·8%)	21 (8%)
13. Immorality of one or other parent	18 (6·5%)	20 (7·6%)
14. Syphilitic parentage	1 (0·4%)	7 (2·7%)
15. Other causes	51 (18·5%)	13 (5·0%)

Insanity, apparently, bears approximately the same relationship to the post-encephalitic group as it does to the generally defective group.

Invalidism presents a relatively more important relationship to the post-encephalitic than to the other defective group. Included in the figure 46 are 18 cases in which neurosis was present in one or other of the parents, 26 cases in which one parent suffered from chronic ill-health, and 7 with a family history of tuberculosis.

Overcrowding and poor economic circumstances appear to be an important associated condition in the post-encephalitic group, though not to the same extent as in the juvenile defective group.

Illegitimacy is approximately half as prevalent in the post-encephalitic group as in the juvenile defective group.

The high incidence of orphanism in some form or other appears to be of equal significance in both groups. The condition of orphanism includes such factors as:

1. Death of one or both parents.
2. Separation of both parents from whatever cause.
3. Upbringing by foster-, step-, or grandparents.

If we try to analyse the relative importance of father or mother, we find that among the males 51 were handicapped by lack of paternal control and 45 by lack of maternal influence, while among the females 52 were lacking in paternal control and 26 in maternal.

The other factors, such as maternal anxiety, prison record in family, alcoholism, syphilis and parental immorality, are of less importance in the post-encephalitic group as compared with the juvenile group.

Other factors which appear to be of some importance in the post-encephalitics are the size of the family.

The post-encephalitic very frequently has a marked inferiority sense which may undoubtedly be aggravated by the physical and mental residua of his disease, but it is also apparent that he suffers from a strong feeling of inferiority as compared with other members of the family.

Of the social classes, by far the largest proportion of the patients came from mining families. These include 16 out of the whole group.

The Course of the Post-encephalitic State.

The progress of the post-encephalitic state, as revealed by the study of the 275 patients admitted to Rampton, is disappointing.

In the males their progress is briefly summarized:

Still remaining at Rampton	108
Slight improvement permitting transfer to Moss Side (a sister institution to Rampton for slightly less violent and dangerous patients)	14
Showing improvement enough to warrant transfer to certified institutions	9
Improved to allow for transfer on licence	1
Discharged from the Mental Deficiency Acts	4
Transferred to mental hospitals	3
Dead	29
Total	168

In the females the corresponding series of figures is:

Still at Rampton	59
At Moss Side	11
Other certified institutions	14
Mental hospital (of whom one was first allowed home on licence, and then went into a mental hospital)	4
Dead	19
Total	107

In view of the difficulty of following up cases after they leave Rampton, little can be said of their subsequent course, but the total of 28 out of 275 to certified institutions, and on licence and final discharge, cannot be considered a very large proportion (10·2 per cent.), though in keeping with other observations (physical effects and social consequences) it appears to be evident that the males fare worse than the females (ratio of 8·3 per cent. : 16·8 per cent.).

As far as morbidity is concerned the post-encephalitic sometimes slowly deteriorates both physically and mentally, and appears to flicker out like a light in the night. In these cases the pathological process may be likened to the degenerative changes that cause death in Schilder's encephalitis, or Pick-Alzheimer's pre-senile dementia. It is more usual, however, for death to be caused by other pathological effects.

In the total of 48 deaths (29 males, 19 females) the causes assigned may be summarized:

1. Progressive dissolution and deterioration without other assigned causes	4
2. Suicide	4
3. Acute confusion	1
4. Bulbar palsy	3
5. Pituitary cachexia	1
6. Acute haemorrhagic pancreatitis	2
7. Heart conditions, including fatty myocarditis, atrophic heart, coronary atheroma, malignant endocarditis	5

8. Respiratory conditions:	
Asphyxia in a fit	1
Croup	1
Lobar pneumonia	6
Broncho-pneumonia	4
Pulmonary tuberculosis	6
9. Septic conditions:	
Septicaemia and pulmonary abscess	1
Cellulitis of face (pustule of nose)	1
Perforated duodenal ulcer	1
Intestinal perforation (traumatic)	3
Ulcerative colitis	1
Renal abscess	1
Pyelitis	1
10. Malignant disease:	
Carcinoma of cervix	1

Summary.

1. A study of 275 post-encephalitics is presented, based on the cases admitted to Rampton State Institution as violent and dangerous mental defectives.

2. Of 208 cases in which the date of onset is given, 90 occurred in the years 1923, 1924 and 1925.

3. The largest number of admissions in any one year was in 1930, when 43 cases were admitted, but the remaining years between 1929 and 1939 showed a fairly steady admission rate of 14–19 per year. Cases are still being admitted, though in smaller numbers.

4. Whereas the peak years for onset of encephalitis lethargica were 1923 and 1924, the peak years for certification were the five years between 1928–1932.

5. Admissions came from a wide variety of institutions, but those from certified institutions for mental defectives comprised the largest number.

6. Sex incidence is discussed.

7. The effect of encephalitis on mental development is indicated by illustrative cases.

8. Head measurements indicate that encephalitis tends to be associated with shorter head lengths and wider head breadths than those of the average general hospital population.

9. Consideration is given to the incidence of psychotic symptoms, and particular reference to confusional states indicates the importance of the parent-child relationship.

10. The psychopathic effects of the post-encephalitic state are considered in relation to mental grade.

11. Neurotic symptoms following encephalitis are outlined.

12. 30 cases are described in which trauma appears to have played some etiological part.

13. 57 cases without gross Parkinsonism are summarized, especially from the point of view of behaviour disorders.

14. 39 cases of Parkinsonism without definite histories of acute encephalitis are outlined.

15. A summary of the social background of the post-encephalitic is presented.

16. An outline of the course of the condition in the complete series, along with the terminal cause of death in 48 cases, is given.

I am indebted to the Chairman of the Board of Control for permission to use the case material of Rampton State Institution for publication, although the Board of Control cannot take any responsibility for any of the statements contained herein.

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CONTINUOUS NARCOSIS: THE ADVANTAGES OF ORAL SOMNIFAINE—A COMPARISON.

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CONTINUOUS narcosis is a method of treating psychiatric conditions by producing a state of narcosis or intoxication for a prolonged period. It was first adopted seriously by Klaesi (1921), and has proved to be a valuable therapeutic weapon. Klaesi used large doses of somnifaine by intramuscular injection, and these were repeated as often as was required to maintain unbroken sleep for 8–10 days.

The method was introduced into this country by Dawson and Barkas (1926), but following the original technique, alarming complications and fatalities were met with. Strom-Olsen (1933) introduced insulin in combination with glucose, and claimed a greatly increased safety with this technique. However, Palmer (1937) and Parfitt (1936) and Gillespie (1939), in a review of the literature up to that time, concluded that the avoidance of complications was more a matter of experience and vigilance than of using any adjuvant.

Meerloo (1933) was the first to draw attention to the underlying cause of the alarming complications and fatalities which resulted from this treatment. He pointed out the increased susceptibility of certain patients to the barbiturates, and placing the emphasis on the intoxication produced, proceeded to bring this about by easy stages, thereby allowing idiosyncrasy to show up before too large doses have been given. He also suggested that the process of disintoxication may be a factor in producing results.

In this paper it is proposed to describe two series of cases treated with somnifaine. The first series consists of cases treated by intramuscular injections between 1936–1940. Part of this series has already been described by Menzies (1937). The second consists of cases treated by the oral method between 1943–1946.

Continuous narcosis, using somnifaine orally, has received scant attention. Hennelly (1936) tried it, and finding it more toxic, reverted to the injection method. It is not clear which solution he used, but the intramuscular solution cannot be used orally, as it quickly causes nausea and vomiting due to direct action on the stomach.

The experience gained by the oral method has been so favourable that it deserves to be recorded.

Somnifaine is a water-glycerin-alcohol solution of the diethylamine salts of two dialkyl-barbituric acids, each c.c. containing 0·1 gm. of diethyl-barbituric acid (barbitone) and 0·1 gm. of allyl-isopropyl-barbituric acid. The oral solution contains aromatic flavouring essences. The intramuscular solution is made up in 2 c.c. ampoules and contains a small quantity of local anaesthetic.

SERIES No. 1.

By Intramuscular Injection.

The drug is introduced by gradually increasing doses until a state of intoxication is produced, and this state is maintained for 10–14 days. There is a gradual withdrawal at the end of treatment so as to reduce the risk of withdrawal seizures.

A thorough physical examination of the patient has been made and organic disease excluded. The patient is nursed in an open ward.

The following notes on the nursing and management of somnifaine narcosis were displayed for the guidance of the nurses:

"The object is to produce prolonged drowsiness and sleep. The patient is awakened at regular intervals for feeding, toilet, etc. The patient must be under constant observation. Somnifaine is given as recommended by the physician. Symptoms of intoxication to be expected—the patient is limp, ataxic, unable to articulate properly, and has difficulty in swallowing. Vomiting, pyrexia, retention of urine or oliguria may occur, especially in the early stages.

"*Important points in nursing.*—(1) Four-hourly charts must be kept of temperature, pulse and respiration. A rise in temperature to 99° F. or over is a signal to suspend the treatment by omitting one or two doses of somnifaine. Increased pulse rate to 85 or over should be reported and treated as for pyrexia. (2) The 24 hours' urine must be measured and a specimen sent to the laboratory each morning. (3) A record must be kept of the amount of liquid (milk, etc.) consumed by the patient daily. (4) The patient must be raised at regular intervals and assisted on to the commode. Bed pans must not be used. (5) When taking food and liquids the patient must be supported in an upright position. Two nurses may be required if the patient is very limp. Care must be taken that the patient does not choke, and as a rule spoon feeding is required. (6) Diet: Ample nourishment is essential. As far as the patient can swallow, solids, semi-solids and liquids are given. In addition to the ordinary diet, three pints of milk with glucose, one tablespoonful to each glass of milk, must be given. The patient should take about 5 pints of liquid in the 24 hours. (7) Bowels: Simple enema to be given on each third day.

'Important Points to Watch.

"(*a*) That the patient does not roll or fall out of bed.

"(*b*) That he or she is upright when feeding and is fed slowly.

"(*c*) Temperature and pulse rate."

Treatment.—On the 1st, 2nd and 3rd days 2 c.c. somnifaine are injected deeply into the gluteal or lateral thigh muscles at 2 p.m., after the patient's dinner. On the 4th day a second injection of 2 c.c. is given about 7 p.m., after the patient's supper. This is continued on the 5th, 6th and 7th days.

The depth of narcosis will, by this time, have required attention.

On the 8th day, if the patient is not sufficiently drowsy, a third injection of 2 c.c. is given at about 9 a.m., after the patient's breakfast. The majority of patients take this amount, i.e. 6 c.c. in the 24 hours. A few, however, require 8 c.c., and in these cases, on the 10th or 11th day a further 2 c.c. is

given—either as an extra dose at 7 a.m., after an early breakfast, or it may be added to the midday dose, making this 4 c.c.

If there is great restlessness, and this occurs mainly in the induction period, paraldehyde in 2-drm. doses may be given.

Atropine sulphate gr. $\frac{1}{100}$ was used to control vomiting.

Two hundred and thirty-three treatments were carried out on 212 patients —21 had a second course. Forty-eight treatments had to be stopped because of complications. These were rarely alarming, and it would be more correct to say that treatment was abandoned because of a risk of more serious trouble. It soon became evident that, in the majority of those cases who failed to complete the treatment because of complications, the part of the treatment already completed showed an unsatisfactory course from the beginning.

In eight cases treatment was ended prematurely for various other reasons.

Complications.—The following, with the number of cases in brackets, occurred: Pyrexia (100), vomiting (44), difficult, resistive and refusing food (7), tachycardia (5), rash (3), too drowsy, with nystagmus or other toxic signs (3), abscess at site of injection (2).

In 177 completed treatments the following facts were noted: The total period of treatment averaged 21·8 days. After deducting 8 days for induction and withdrawal, the period during which the patient was under full narcosis averaged 13·6 days, and for this period the average daily dose was 5·3 c.c. somnifaine. To be more specific, 162 cases had 6 c.c. for 9 days, 11 cases had 8 c.c. for 2 days, and only 4 cases completed treatment on 4 c.c. daily.

Paraldehyde was given to 109 cases, with an average of 8 doses per case.

Sleep averaged 14·1 hours in the twenty-four.

Weight.—Ninety-four cases showed an increase, averaging 5·5 pounds. Thirteen cases showed a decrease, averaging 3 pounds.

Table of Results. All Cases included whether Treatment Completed or Not.

Diagnosis.	Recovered.	Relieved.	Not improved.	Total.
Schizophrenia	14 (31·8%)	5 (11·4%)	25 (56·8%)	44
Paraphrenia	5 (17·8%)	4 (14·3%)	19 (67·8%)	28
Melancholia	83 (67·0%)	17 (13·7%)	24 (19·3%)	124
Mania	12 (80%)	1 (6·7%)	2 (13·3%)	15
Anxiety states	4 (50%)	4 50%)	0	8
Other neuroses	0	2 (66·7%)	1 (33·3%)	3
Confusional states	6 (86%)	0	1 (14%)	7
Mixed states	2 (50%)	1 (25%)	1 (25%)	4
Totals	126 (54·1%)	34 (14·6%)	73 (31·3%)	233

Observations.—At first paraldehyde was used to ensure sleep, but later was used only to calm restless, excited patients, and prevent them from interfering with their own or their neighbours' treatment.

Transient glycosuria occurred in 62 cases, but had no significance. It may be attributed to the sudden increase in glucose intake.

Epileptiform seizures occurred in 13 cases within 48 hours of the end of treatment. These fits cannot be related to the cerebral irritation met with during treatment by McNiven (1936). Kalinowski (1942) suggested that for each anti-convulsant drug there is a specific time interval between withdrawal and the occurrence of the fit, and this interval bears a close relation to the rate at which the drug is eliminated from the system. He was, however, referring to chronic cases, and did not believe that fits occurred after acute intoxication. There was nothing of significance to be noted during treatment in these cases.

There were no deaths. Hennelly (2) (1936) and McCowan (1936) reported safe treatments, but rarely used more than 4 c.c., using quiet and darkness, and, if necessary, paraldehyde to produce sleep. It may be doubted whether sleep under these conditions represents true narcosis. In the cases described in this paper it is held that though the patient may not be actually asleep, he or she is still under narcosis, and there is no true revival of thought or feeling as in a waking period. For the same reason I have preferred to call the treatment " continuous narcosis."

Strom-Olsen (2) (1933) stated that the average effective dose was 5–6 c.c. daily.

Series No. 2.

Somnifaine by the Oral Method.

Though somnifaine narcosis has been accepted as a valuable method of treatment, alternative drugs have been sought. However, somnifaine remains the most effective and appear to be as safe as any other drug or combination of drugs. Wilson and Gillman (1938) used a medinal-luminal combination, but had alarming complications and two deaths in 60 cases. They used insulin in combination. Brody (1940), using paraldehyde and dial, succeeded in producing prolonged narcosis, but had two deaths in 90 cases. Horsley (1937) used soneryl. He aimed at continuous sleep, and found that though this was rarely achieved, the results were almost as good. He concluded that it was safer, though less effective, than somnifaine.

Staffing difficulties during the war suggested the oral method and its advantages soon became evident.

One hundred and forty-three treatments were carried out on 120 patients —23 patients had a second course.

The principle of treatment is the same—to produce a state of intoxication by gradually increasing doses, and to maintain this state for a prolonged period. There is a gradual withdrawal.

Patients are nursed in an open ward, and when the weather is fine and warm they are wheeled on to an adjacent verandah for the greater part of the day.

Cases with organic disease are excluded, and particular attention is paid to the state of the cardio-vascular system.

The dose is measured in a graduated 1 c.c. or 2 c.c. syringe—larger syringes should not be used—and given in 1–2 ounces of milk or water, at regular intervals.

On the 1st day a dose of 1 c.c. or 1·5 c.c., according to the general impression

of physical fitness of the patient, is given at 7 p.m., after the patient's supper.

On the 2nd day two similar doses are given—at 2 p.m., after the patient's dinner, and at 7 p.m.

On the 3rd day three similar doses are given, at 9 a.m., after the patient's breakfast, at 2 p.m., and at 7 p.m.

Three doses only are given on any day, and further increases are made by increments of 0·5 c.c. No variation of this increment was allowed.

The depth of narcosis will now require attention.

On the 7th day, if all goes well, 0·5 c.c. is added to the morning and evening doses, and on the 8th day, 0·5 c.c. is added to the midday dose. According to the size of the starting dose, it will now appear the patient is receiving 4·5 c.c. or 6 c.c., but modifications may be made in the lower doses, if required. In this way a patient who is not showing adequate narcosis on three 1 c.c. doses may, on the 5th day, have 0·5 c.c. added to the morning and evening doses and, on the 6th day, have 0·5 c.c. added to the midday dose. On the 8th day a further 0·5 c.c. may be added to the morning doses, and on the 9th day 0·5 c.c. added to the midday dose.

In this way all patients should be under full narcosis and have reached their maximum dose by the 8th or 9th day. A few cases show a slight revival in a few days, and require a further 1 c.c. or 1·5 c.c. to keep them fully under.

The following data were derived from the series treated:

Duration.—Average total period of treatment was 20 days. Average period of full narcosis was 15 days.

Amount.—Average dose for period of full narcosis was 5 c.c. daily. The largest amount given was 7·5 c.c. daily. The state of intoxication was the deciding factor in recommending dosage.

Weight.—Increase in 40 cases—average increase 4·6 pounds. Decrease in 11 cases—average decrease 2·5 pounds.

It may be mentioned that the amount of nourishment available in the past three years fell far short of that of pre-war years, and I believe that if sufficient milk and eggs had been available, there would have been a more striking improvement in weights.

Complications.—The almost complete absence of serious complications and the reduction in the incidence of minor complications has been the most noticeable feature of the oral method of somnifaine narcosis. Only 4 cases failed to complete treatment. Two of these were too restless and resistive and disturbing others. The third case was a man of 43 years who had some chronic bronchitis and showed respiratory embarrassment on the 4th day. He recovered completely in 24 hours. The fourth case was an asthenic woman of 42 years who, one month after a first course, and on the 8th day of her second course of treatment, developed a deep thrombo-phlebitis of the right leg. She recovered gradually but completely.

The only other serious complication was a similar thrombo-phlebitis in the right leg in a man of 63 years, four days after completing treatment. He also developed auricular fibrillation of the heart. He recovered gradually but completely.

A slow circulation rate due to prolonged immobility in bed constitutes an

important causal factor in spontaneous coagulation. Palmer (1939) first drew attention to this complication of somnifaine narcosis and recorded four cases.

Minor complications with number of cases were: Pyrexia (21), vomiting (9), toxic signs—nystagmus, diplopia (3). Epileptiform seizures occurred in 6 cases following treatment—within 48 hours in all cases except one who had a fit 6 days after treatment.

A feature of the oral method was, as a rule, the absence of the excitement and restlessness which was so common in the early stages of treatment by injection.

Paraldehyde: 66 cases had 2-drm. doses with an average of 6 doses per patient.

Table of Results.

Diagnosis.	Recovered.	Relieved.	Not improved.	Total.
Schizophrenia	6 (16·7%)	8 (22·2%)	22 (61·1%)	36
Paraphrenia	0	2 (18·2%)	9 (81·8%)	11
Melancholia	22 (55%)	10 (25%)	8 (20%)	40
Mania	5 (62·5%)	3 (37·5%)	0	8
Anxiety states	20 (66·7%)	6 (20%)	4 (13·3%)	30
Other neuroses	3 (33·3%)	3 (33·3%)	3 (33·3%)	9
Confusional states	5 (100%)	0	0	5
Totals	61 (43·8%)	32 (23%)	46 (33·2%)	139

In tabulating these results a strictly clinical assessment was made. Patients were considered to be recovered if they showed a return to normality directly after treatment and maintained this state so that they were recommended for discharge from hospital. In the "Relieved" group there are cases who also were discharged because of their improvement due to treatment, but in whose case a clinical recovery could not reasonably be claimed. In the third group there are a small number who showed a complete though temporary recovery from their symptoms. In at least two of these cases I was able to associate their relapse with extremely difficult home conditions which they were unable to face.

It will be observed that the results in the schizophrenic-paraphrenic group are not encouraging. They are particularly good in the mania, melancholia, anxiety and confusional states. Parfitt (1946), comparing prolonged narcosis and electro-convulsive therapy, concluded that the cure rates were about the same in schizophrenia, but not as good as those obtainable with insulin.

Continuous narcosis, using somnifaine, has much to recommend it as a form of treatment for mental illness. It offers a means to recovery to which few patients are likely to object, and provided the right principles are adopted and adequate nursing skill is available, the physician need have no fears as to its safety. There are no ill-effects from the treatment.

Conclusions.

Somnifaine narcosis, using the method of intramuscular injection, is a safe form of treatment provided it is produced gradually and provided that nursing and observation are good.

Somnifaine narcosis by the oral method is a considerable improvement on the injection method. The same dosage is employed, the narcosis is complete, and serious complications are rare. The patient is spared the ordeal of receiving up to 50 deep intramuscular injections, and the nurse has more time to devote to the nursing and observation of the patient.

The cardio-vascular system appears to be the most vulnerable to somnifaine.

If adequate doses are given a state of continuous narcosis is produced, and this state may be maintained with safety for about 15 days.

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TYPES OF NERVOUS SYSTEM IN MAN, THEIR HEREDITY AND EVOLUTION.

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THE theory concerning the various types of nervous system in man, generally acknowledged by Russian neurologists, is based on the principles established by Pavlov in his investigations on conditioned reflexes in dogs. It was Pavlov and his collaborators who succeeded in establishing that all variations in the nervous types of dog are due to three main differences. These differences may consist in varying intensity in the essential processes (excitation and inhibition), peculiar to the nerve cell of the cerebral cortex, with the result that some specimens are of a stronger, others of a weaker nervous type. There may also be differences in the degree of equilibrium attained between the two processes, with the result that some specimens are well balanced, while others are unbalanced. Finally the differences may consist in the rate at which the nerve cell is able to pass from one state to the other, in the rate at which the concentration of the excitation or inhibition process is reached after the primary phase of irradiation, and in the rate at which the excitation process becomes extinct within a cell after the action of the stimulus has ceased. As a result of these latter differences some specimens may be more mobile, others more inert. At the same time it was established that the differences with respect to all these three functions could develop independently of one another, owing to which fact the resulting typologic combinations are extremely varied.

The following four types are the most frequent: Strong alert and well balanced; strong alert, but unbalanced, the lack of balance being due to the inhibition process greatly lagging behind that of excitation; strong, balanced, but inert; and the type characterized by a weakness of both the excitation and the inhibition processes. Weak and unbalanced specimens, while subjected to the formation of such conditioned reflexes as proved to be too great a strain on their nervous system, were precisely the ones which most readily developed complex dynamic breakdowns, or the so-called experimental neuroses, that have been studied in detail by Pavlov and his school (M. K. Petrova and others). It was also found in the course of these investigations that such breakdowns develop along one of the three following lines: they are either the result of an overstrained excitation process, or of an overstrained inhibition process, or yet, again, of an overstrained mobility of the cortical functions.

It was of great interest to apply the above principles in interpreting the typological peculiarities in man and in analysing human neuroses.

The application of physiological principles in interpreting human neuroses proved to be exceptionally fruitful. It was discovered that the pathological causes of nervous breakdown in man were the same *mutatis mutandis* as those of experimental neuroses. In the symptoms of neuroses were discovered

physiological mechanisms similar to those observed in experimental neuroses, such as the phenomena of "transliminary" inhibition, negative induction, etc. This method of interpreting neuroses proved to be particularly valuable when applied to various kinds of fixed conditions (obsessions, phobias and impulsions), characterized by the spontaneous origin under certain conditions of stereotyped pathological experiences which, in spite of the critical capacities remaining intact, were not subjected to the regulating activity of the rest of the cortex. This is precisely analogous to what occurs in experimental nervous breakdowns, when points of pathologic inertia or "stagnation" of the excitation or inhibition process are sometimes formed in the cortex, when any stimulation, conveyed to such an impaired point, always produces the same stereotyped effect, which is no longer controlled by any other parts of the cortex. Likewise it was easy to see that with respect to the different types of nervous system in man the main variations could be distinguished along the same lines of intensity, degree of equilibrium and mobility of nervous processes. However, to understand the qualitatively novel functions of the human cerebrum, Pavlov, having defined the cerebral centres of direct perception as "the first signal system of reality," introduced the notion of "the second signal system" (peculiar only to man), by which he meant all those complex cortical mechanisms, which were no longer based on the direct perception of outward impressions, but on conditioned signals; speech, images, notions, etc.

The two systems may either be well balanced, or insufficiently balanced. In the latter case, if the first signal system is prevalent, the individuals are of "an artistic type," characterized by a direct and concrete perception of the outward world.

If the second signal system is prevalent, the individuals are of "an intellectual type" and live in a kind of logical abstraction and are to a great extent detached from actual life.

The fact that in individuals of "an artistic type" neuroses mainly develop along the lines of hysteria, while individuals of "an intellectual type" mostly suffer from breakdowns of a psychasthenic nature, proved to be of great value to the clinician and has been fully confirmed by clinical observations.

A further study of the different types of nervous system in man and of the peculiarities of human neuroses has shown, however, the particular importance of the function of mobility for the human brain. Thus, as compared to dogs, man shows a far greater variety within the range of mobility and inertia of nervous processes. The lack of mobility plays an exceptional part in characterizing individuals who are particularly liable to nervous breakdown, and finally, anomalies of mobility are an outstanding symptom among those characterizing human neuroses. This exceptional role played by the mobility of the higher nervous activity, which is also revealed in its pathology, forms one of the most specific peculiarities of man.

It is easy to trace a number of pathologic manifestations of inertia both in neurotics and in many perfectly sound individuals. Variations of the normal in this case readily increase to the stage of pathologic symptoms, while observation almost invariably confirms that here we have to deal with insufficient mobility, which can be usually traced throughout the life of the given individual

down to his early childhood. Besides, it should be born in mind that by the term mobility or inertia of the nervous processes we only mean that function of the nerve centres which has been previously defined and by no means the general motor mobility, which may in no way coincide with the degree of mobility displayed by cortical functions, and may even be in a state of seeming contradiction as regards the latter. For instance, the unrestrained motor activity of puppies, which, however, are far more inert than adult dogs.

Inertia in man is not determined by Russian neurologists with the aid of any special psychologic or physiologic tests, but only by means of a detailed study of the individual's life and his behaviour in the different circumstances built up by his environment.

Inert people can be recognized by different symptoms. It is with difficulty that such people put up with any change in the conditions of their life, and not infrequently they react to a sudden change of stereotyped conditions by an onset neurosis. In these cases the mechanism of the neurosis-formation often remains undiagnosed. Moving to another town (nostalgia) or even to another flat, or changing the habitual place of work, etc., always causes such people a great deal of trouble; sometimes they even object to any changes in their mode of life, such as arranging furniture in their flat, or even changing their suit or underclothing; these kind of people cannot stand any work requiring a rapid change from one kind of activity to another. They often feel embarrassed when faced by the necessity of completing one task and taking up another, and occasionally spend some time in total inactivity, only because they lack the determination to take up any new kind of work. Sometimes they mention their utter inability to stand being rushed. They are able to form abnormally stable conditioned connections, and it is my belief that it is precisely this kind of mechanism that is the basis of many anomalies of sexual life; they are slow in going to sleep and slow in waking.

It is probable that "eudetism" mostly characterizes precisely those inert kind of people. Apart from the above examples, life presents many opportunities for testing the degree of mobility or inertia of a given individual.

I also think that the over-anxious, mistrustful disposition which is a favourable background for the development of massive symptoms of pathologic inertia (obsessive conditions), and which manifests itself in constant indecision and doubt, should essentially be attributed to the same insufficient mobility of cortical processes.

Indeed the correct choice of the proper form of behaviour always presupposes a rapid inhibition of all other forms of behaviour which might be possible in the given situation. The process can best be illustrated by analysing the behaviour of some animals, for instance that of some predatory beast on catching sight of its prey. Under the circumstances there are a number of different actions which may be performed by the animal. It may, for instance, spring at its prey at once, or it may remain stock-still on the spot waiting for the prey to approach it so as to shorten distance for the final jump, or again it may creep noiselessly towards its prey, etc. There is, however, one condition which is equally indispensable for all different solutions of the problem, i.e. that the animal should at once choose only one of the possible solutions, while

all the other solutions, which have arisen in association with the given situation, should be checked, or to put it in physiological language, it is necessary that a negative induction should be formed as soon as possible from the cortical mechanism which has been set in operation.

An animal that lacks sufficiently rapid negative induction and that would simultaneously have several possible solutions, disputing for some time which was to act the leading role, would soon be swept away by natural selection.

It is precisely the simultaneous existence in a man's consciousness of several possible solutions of a given situation, or, in other words, the same insufficient mobility, which characterizes the psychology of indecision and constant doubt, which makes a person feel uncertain of himself and gives rise to a feeling of inferiority and to a desire of constantly "making sure of oneself," that is so typical of an over-anxious and mistrustful disposition. It is precisely against this background that conditions of a stable pathologic inertia involving either the excitation or the inhibition processes and manifesting themselves as various obsessions, phobias or impulsions are found to develop most readily.

To analyse the origin of all these intensity, equilibrium and mobility variations of the cortical functions in different individuals often proves to be a very complicated task. There is no doubt that upbringing, training and various pathological influences play a part in the formation of these properties. The role of these factors can be traced with particular clarity in the formation of the inhibition process. It is beyond doubt that the development of these functions is to a great extent determined by congenital and hereditary factors.

It appeared that since the above described essential physiological properties of cortical activity could be successfully determined—and, at any rate experimentally, this could be done with great exactitude—the problem of establishing their intimate genetic structure would not present any great difficulty. It even seemed, at first, that by interbreeding dogs specially selected for the purpose, it would be easy to establish the presence of special weakness, disequilibrium and inertia genes and their corresponding alleles of intensity, equilibrium and mobility. However, besides our being—as we have since found—practically ignorant as to the normal alleles of mutant genes, this method of tackling the problem was faced by an unexpected difficulty which, being a matter of principle, might be briefly formulated as follows:

All these characteristics can be classified according to two large groups, one of which involves such characteristics as are more or less readily subjected to genetic analysis, the other comprising characteristics whose genetic analysis always presents the greatest difficulty. An attempt to find out in what way the two groups of characteristics differ from one another clearly shows that those belonging to the first group, i.e. characteristics which are readily subjected to the usual genetic analysis, consist, in the first place, of pathologic characteristics which are manifestly harmful and undergo the process of continuous elimination by means of selection (such as all our "hereditary diseases"), and, in the second place, of characteristics which are entirely neutral with respect to the fate of their bearers (such as blood groups, taste groups, dactyloscopic types). The point in common in both these types of characteristics is, that neither the former nor the latter participated in the evolution of species.

Contrary to this, these characteristics which constitute the second group (i.e. those that present considerable difficulty for the usual genetic analysis) are precisely such characteristics as *have* participated in the evolution of species. In the process of evolution each newly formed mutation has such a large number of modificators and such extensive correlative connections that the gene structure of the characteristics formed often remains entirely concealed, in spite of their evidently being hereditary. For instance: We can easily study the gene which causes insufficient development of both the upper extremities in man, though the methods which are at present available would scarcely enable us to discover the "gene of normal two-handedness," in spite of the fact that man's possession of two hands with four fingers and a thumb on each is a heredity-conditioned property. I am apt to believe that the same idea has been expressed by J. B. S. Haldane in his *Causes of Evolution* when he wrote that geneticists are far better able to say why a white cat differs from a black one than to explain why they resemble each other.

If we consider from this point of view the problem of the different types of nervous system—which are complex variations of the norm—we shall have to admit in advance that, contrary to the hereditary diseases of the nervous system, the types of the nervous system should be regarded as belonging to the second group of characteristics, and that for this reason their gene structure must be exceedingly complex. The fact that to some extent these types are hereditary is testified by our everyday clinical experience. It is even possible to trace in the hereditary transmission of some of these properties as, for instance, inertia or a tendency to hysteria, certain dominant components (not unfrequently an analogous encumbrance along one of the parent lines). Yet we have so far either entirely failed to reveal in detail the hereditary structure of these types by means of studying our genealogies, or have succeeded in doing so in a very general way, perhaps with the exception of single, clearly aberrant forms.

For this reason the consideration of the types of the nervous system from the point of view of their evolution becomes of particular importance.

It is obvious, of course, that the substitution of individualized behaviour for instinctive behaviour having been connected with the development of a complex system of conditioned reflexes was one of the most striking progressive changes—or "aromorphoses" according to A. N. Severtsov's terminology —which, together with the formation of the thermo-regulation apparatus, enabled the Mammalia to oust the Reptilia in the course of the Tertiary period. Ever since, the evolution of the Mammalia has proceeded along the lines of an invariable improvement of the higher nervous activity. The main peculiarities in the work of the cortical cells—their intensity, equilibrium and mobility —were the object of natural selection for a very considerable period of time.

From this point of view many investigations on the comparative physiology of conditioned reflexes conducted by Russian physiologists (J. P. Frolov and others) have come to be of exceptional value. Besides their having yielded a number of novel facts of considerable interest, these studies have disclosed a certain lack of similarity in the essential cortical processes, viz. nerve cells of highly developed mobility proved to be characteristic of the most progressive

forms. Rats, guinea-pigs, dogs and monkeys differ from each other precisely with respect to the mobility of their nervous processes, which depends on the level of development reached by the animal's nervous system. The ability to form rapidly new conditioned connections proved to be an indispensable property as soon as individualized behaviour based on the specimen's own experience took the place of fixed instincts in becoming the object of natural selection. The exceptional value of this ability to form swiftly new conditioned connections can be illustrated by the appearance on the earth of a new enemy, i.e. man. His appearance proved to be a kind of " examination in mobility." Species capable of swiftly forming new conditioned connections survived, while those lacking in this ability were soon extinct, as, for instance, the *Rhytina borealis Stelleri*. The latter were discovered by Russian seafarers in the eighteenth century on the practically unapproachable islands off the north-eastern coasts of Asia, and became entirely extinct within 2½ decades. These animals let themselves be killed without making the slightest attempts to escape, while seals inhabiting the same islands were found to dive into the sea on sighting a man at a distance of 200 metres as early as in a year's time after they had been first hunted.

Within the period of anthropogenesis, evolution was characterized by a further development of the higher nervous activity, which enabled man to gain a dominating position over the rest of the animal world. Here we are faced with a somewhat mysterious phenomenon which might be called a peculiar *paradox of neuro-psychic evolution.*

Indeed, it might have been reasonably assumed that the higher nervous activity of man, being the result of natural selection, which invariably served to improve the work of the cerebrum, ought to have been characterized by maximum co-ordination, regularity and precision. Yet it is in no other than man that we observe so great a number of typological deviations of an unfavourable nature and a tendency to develop dynamic cortical breakdowns. The question arises how could natural selection, which in the course of hundreds of thousands of years had served to select all the best and most favourable variations, eventually result in creating so fragile an apparatus with so great a tendency to nervous breakdowns of the most varied nature ?

Investigators have long since been interested in the problem, and, as early as in 1875, Galton pointed to the fact that the evolution of man had not yet created an entirely adequate psychic form. I further venture to make a few suggestions on the probable solution of the problem which are based on Pavlov's physiological interpretation of the psychic life of man. Considered from this point of view, the history of man's appearance must have occurred as follows :

Since the time our most distant human ancestor, the pithecanthropus, made his appearance on the earth (800,000–1,000,000 years ago), natural selection started working in the direction of a further powerful development of the higher nervous activity. However, the different physiological properties of the cerebrum could not always make equal progress in the process. The pithecanthropus, which still led an entirely wild existence, could not have survived if he had not been endowed with nervous processes of sufficiently high intensity and equilibrium, for these qualities are absolutely indispensable

to a primitive huntsman. There is no reason to suppose that the further pre-history of mankind contributed towards any considerable intensification of precisely these properties of the nervous system. On the contrary, it is more probable that life in a collectively protected community would make lesser claims to the inhibition process than life under conditions of utter savagery. On the other hand, the powerful development of the second signal system and of the mobility of nervous processes was the most necessary condition for any further progress; the appearance of speech, which apparently coincided with the transformation of the Neanderthal man into modern man (30–100,000 years ago) meant that the two latter functions had been enormously intensified. In considering the pre-history of mankind from the view-point of the history of cortical functions, one is led to admit that the appearance of the modern, super-rapid mobility of the cortical processes, and the development of the second signal system that is in perfect equilibrium with the first, are phylogenetically the most recent acquisitions of man. This fact in itself would have been important for a better understanding of the great variability displayed precisely by these functions, as the high changeability of phylogenetically young characteristics is generally known. However, I don't believe that this alone might serve as a satisfactory explanation.

The other factors which have been usually underestimated were apparently the consequences that must have inevitably occurred as a result of natural selection having been gradually limited. Man himself, the creation of natural selection, eventually served to destroy this natural selection. It might be of interest to note that natural selection probably underwent a process of gradual elimination which covered a long period of time. The first blow that fell on natural selection was struck with the stone weapon of the pithecanthropus, while Darwin's species-forming selection ceased finally with the transformation of the Neanderthal man into *Homo sapiens*, whose physical structure has not changed since the Upper Paleolithic. Moreover, it is very important that selection was not being uniformly eliminated with respect to the different functions of the human organism. Thus, selection as regards resistance to temperature fluctuations or as regards the capacity for masticating and digesting raw food must have become extinct as soon as man gained the knowledge of fire and dwelling, i.e. it must have ceased much earlier than selection of the mentally gifted specimens. However it might have been, it all ended in man's final victory over nature. No sooner had he gained this victory than he began paying for it.

Indeed, if the survival of the most fit is the essence of natural selection, then the elimination of natural selection must have in the first place resulted in the expansion of the least fit, which had been impossible before that time. Of course, this expansion must have occurred at the expense of the most recently developed functions which have the largest number of variations. Individuals of an inert disposition or people having a lagging second signal system must have necessarily come to make up a greater part of the earth's population. At present there is reason to suppose that the process must have been still further intensified by the fact that the vast majority of the most progressive properties of the nervous system which had formed at the time

when Neanderthal man was transformed into modern man were essentially based on the formation and accumulation of small mutations of a recessive nature. This is indirectly confirmed by the fact that typologic anomalies, particularly those of mobility, are revealed in the genealogies of our neurotic patients for the most part as a certain dominant element.

Are there, however, sufficient grounds for believing that at its dawn the prehistory of mankind abounded in so great a number of neurotic phenomena that it is possible to speak of some sort of " neurotic phase " in the early history of mankind? To my mind, the history of primitive religion may provide a satisfactory answer to this question.

Already specimens of Magdalenian pictorial art contain some strange images of half-men and half-animals which apparently express some vague beliefs of primitive man. It is possible that the imprints of hands with cut-off phalanges found on the walls of Aurignacian and Solutrean caves had a similar meaning. It is beyond doubt that primitive religion first originated at a very early date. Of course we have no knowledge of its details, but if we assume that there is any analogy between the psychology of a modern savage and that of our paleolithic ancestor, we shall have to admit that ethnography provides us with exceptionally abundant material for the problem in question.

What could have given rise to animism, this universal and most surprising error of judgment and this also universal form of primitive religion? Such is the question that has been much discussed in ethnography. In my opinion the solution of the question might be considerably promoted by interpreting these phenomena in the light of such regularities as have been found to operate in the physiology and pathology of the higher nervous system. It should be noted that any attempts at attributing this erroneous judgment of the savage to some qualitative peculiarities of primeval logic, such as Levy-Bruhl's "*prelogism*," or the " affective-," " collective- " or " complex-thinking " of other authors, proved to be a failure. On the other hand, such ethnographic data as speak in favour of the theory that man began practising certain magic acts directed against nature before the time his belief in its being animated had first arisen are growing more and more numerous (Frazer and others). According to this view-point man's religion did not begin with ideas; it began with a ritual, with a definite set of performances and actions. Later, however, he passed on to the general animation of nature with all the ensuing consequences (therotemism and totemism). Now, how could this have happened? Ethnographers suggest the following answer: magic produced animism because man became convinced of the inefficiency of magic and began seeking other explanations. A neurologist, however, believes another explanation to be more to the point: magic was by no means inefficient; on the contrary, it was most useful to primitive man. Having repeatedly convinced himself of the efficiency of magic performances and arguing with the help of the most natural human logic, man must have necessarily found some explanation of his direct influence over nature. The only possible explanation, of course, lay in the belief that nature was animated, inasmuch as primitive man had no knowledge of Pavlov's physiology of the higher nervous activity in general, or of negative induction in particular.

To understand the expediency of primeval magic actions it is necessary to interpret them in the light of the physiology of cortical processes, and especially in the light of their physio-pathology. A conditioned action has in the first place a sedative effect and removes the sense of fear on the ground of exactly the same physiologic regularities, on whose ground the ritual action of a neurotic eliminates his phobia, i.e. by forming in the cerebral cortex a new affectively-tinged excitation focus, which produces a negative induction in all the other parts of the cortex. Hence the feeling of calmness which results in a more successful solution of some difficult life problem. Indeed, what interpretation can we give in the light of the dynamics of cortical processes to the actions of an Australian native who is hurrying home and breaks the branch of a tree to stop the progress of the sun? He is in a state of anxiety and alarm, owing to the stagnant and affectively-tinged excitation involving certain cortical complexes; this anxiety makes him suffer, troubles him, and begins to acquire all the features of an obsession. Then the man builds up in his cerebral cortex a new point in which the excitation process is concentrated (it is quite indifferent what kind of point this is, as long as it is causally connected with the main point of over-excitation), and uses the negative induction proceeding from this second focus as a means of producing a sedative effect on the rest of the cerebral cortex. The sense of alarm is lost and the man becomes better able to control his actions, with the result that he has a greater chance of reaching home before the sun has set. The ritual action has had the necessary effect, and when next time the Australian native again resorts to the same method, whose efficiency has already been proved, he can duly be regarded as a man whose actions are based on experience and observation.

Thus fear was the essential background against which all this mechanism was found to develop. It is also fear which, like a psychic pandemic, can be traced throughout the life of a present-day savage, who aggravates his existence by endless absurd ritual practices and taboos. However, it is not so much the element of reasonable apprehension as that of an obsessive phobia that we can find in this latter kind of fear. Yet, of course, initially it was derived from apprehensions caused by real danger. According to clinical observations, phobias as well for the most part develop against a background of entirely real apprehensions. It is beyond doubt that Freud was quite right in drawing an analogy between phobias and taboos. In order to gain a true understanding of the matter, however, Freud's argument has to be entirely reconstructed; it is not the neurotic who is endowed with some kind of peculiar primitive psychology and archaic constitution, but it was the primeval culture which bore a marked impress of neurosis. One of the causes which brought about this neurotic impress lay in the excessive spreading among the earth's population of inert personalities, particularly liable to indecision, doubt, and the development of obsessive conditions—the excessive expansion of such individuals having been made possible by the elimination of natural selection. Their psychology became dominant during that first stage in the pre-history of mankind, and resulted in the organization of ritual practices into definite systems, and in the development of numerous cults into which the better balanced nervous types were likewise drawn in.

However, the elimination of natural selection must have resulted not only in the spreading of inert individuals alone, but also in the expansion of individuals having a lagging second signal system, who are known to have a tendency to reactions of an hysterical type. Indeed, they also left their marked impress over a lasting historical period, having become specialists in keeping in touch with the spirits of whose existence mankind had already become convinced. There is no doubt that shamanism in all its different manifestations has made use of mechanisms of a clearly hysterical nature.

History knows no other example of hysteria being organized on so large a scale into almost a state system, beside which the medieval epidemics of diabolism and the hysterical women of the Salpêtrière seem to be practically of no importance.

It goes without saying that these psycho-physiological mechanisms were not the factors which served to determine mankind's progress, whose mainsprings were the production activities and the toil of primitive man (hunting, the manufacturing of tools, then later land tilling, etc.). Tribal formations came into being. History continued to run its own course. The primary neurotic stage of human pre-history could only remain fixed in small backward tribes which had come to an impasse with respect to their cultural and historical development owing to certain complex historical and geographical conditions (such as isolation, exceedingly hard conditions of life, subjugation by more powerful neighbours, etc.). Under more favourable conditions this initial neurotic phase had necessarily to be compensated in some way or other. However, this time the compensation no longer proceeded along the lines of natural selection, i.e. along the lines of an improved genotype, but along the lines of an improved phenotype, viz. along the lines of education, upbringing, training and the development of more reasonable forms of behaviour. Since then the display of neurotic reactions has ever been made more and more difficult. Neuroses have ceased to be cultivated and have been " driven underground," while upbringing has come to be the factor by which a man's behaviour is being determined to an ever-increasing extent. This progress—which no longer proceeded along the lines of heredity, but along those of succession—has not ceased up to the present day, while the genotype of modern man still remains very imperfect.

This, apparently, is what accounts for the " paradox of the neuro-psychic evolution " which has been previously discussed.

There is one objection which might be made against our arguments that I should like to reject in advance, namely, the great abundance of unfavourable typological variations among dogs and their susceptibility to all kinds of nervous breakdowns might seem incomprehensible at first sight, and might lead to the conclusion that a similar fragility of the higher nervous activity may also occur at lower evolutional phases. However, leaving aside the fact that the dog can by no means be regarded as a possible ancestor of the primates, this comparison is actually an indirect confirmation of the correctness of our views, as the above mentioned properties of a domestic dog are also an evident result of eliminated natural selection, with the only difference that in the case of the dog natural selection was to a great extent replaced by artificial selection

on the part of man, while in the case of man natural selection was destroyed by man himself. Moreover, there are good reasons to suppose that in creating a domestic dog man must have made use of some aberrant forms of behaviour displayed by individual animals, and thus must have dealt from the start with somewhat pathologic material for the purpose of further selection. Thus, the hereditary faculty of entering the state of catalepsy at the sight of some prey, which has been used by man to develop the kind of dog that will stand stock-still for a considerable length of time pointing to the game it has discovered, could hardly have been retained in a wild animal under the conditions of natural selection.*

* The argumentation which has been laid forth in brief in the present paper is discussed *in extenso* in the Russian manual bearing the title *Evolutional and Genetical Principles in Neuropathology*, which is now ready for print.

MORAL DEFICIENCY.*

By L. S. PENROSE, M.A., M.D.

THE harmonizing of legal administrative practice with the development of scientific concepts in the field of medicine is sometimes difficult. The law has to be understood by everybody, whereas scientific knowledge is too often considered the privilege of the educated few. Thus, the law must be simple and directly applicable, leaving for the expert, critical examination of causes and effects. When the definition of a situation depends upon physical findings, a decision can be made without very much difficulty as to how the law is to be interpreted; but in questions of behaviour interpretation of rules may be much more troublesome, and special care is required in drafting laws which define psychological concepts.

It is not altogether surprising that the definition of mental deficiency in the 1913 Act should have little relationship to scientific concepts. The surprising fact is, as it seems to me, that the law, which normally has no intention of intruding upon the scientist's domain, has attempted to do so in this case. It is most important *not* to assume that the class of legally certified persons can be treated in any way as a scientific entity. Presumably the Law should provide a convenient instrument for certifying or otherwise handling individuals whom most people are agreed would be best under the care of institutions, guardians, etc. This state of affairs was underlined by the attitude of the authors of the Wood report in 1929, who went to some lengths to explain that the real criterion of mental deficiency was a social one, i.e., not a judgment based on clinical medicine or psychology. Social incompetence is not a scientific concept; it is a relative quality estimated differently by different people in different places according to circumstances. It must, therefore, be considered anomalous that the law relating to mental deficiency takes great pains to give the outward signs of following scientific classifications by specifying Idiots, Imbeciles, Feeble-minded and Morally defective. The foremost authority on mental defect Tredgold, in the first edition of his text-book (1907), referred to two other types of defect. One of these, Religious deficiency, was the incapacity to feel reverence towards "a Supreme Being, who has superhuman control over the destiny of man or the powers of nature." The other type, Aesthetic deficiency, was lack of appreciation for "all that is beautiful in form, colour, sound, etc." Perhaps it was fortunate that no further complications were added to the Acts, but there are some who might have argued that the religiously or the aesthetically defective were more dangerous to the community than the intellectually defective.

According to modern standards, if a mental deficiency Act had any real intention of being scientific, it would distinguish those types of defect, which

* Read at a meeting of the Mental Deficiency Section of the Royal Medico-Psychological Association, 28 November, 1946.

can now be clearly defined. We should have a long list. American recommendations for statistical classification recognize defect associated with cranial anomalies, congenital paralysis, mongolism, post-traumatic and post-infective types, those with endocrine disorder, familial types and mental defect without signs of clinical disease; but the Americans are wise enough not to include any of these ideas in statutes which determine certification. As scientific inquiry advances, methods of diagnosis and treatment change. The Law, which is intended to be as permanent as possible, should beware of accepting the definitions of types which are in vogue at the moment. In 30 years' time, details of statutory descriptions of all types of defectives made now, backed by the best clinical opinions, would appear as foolish then as the definitions of the 1913 Act seem to us now. Consider, for example, the definitions of idiocy and imbecility. These take no heed of test results, which are the main basis of grading in practical work. The way in which imbeciles are singled out as those who are "incapable of managing themselves or their affairs" strikes rather a ludicrous note. Moreover, when three categories of intellectual defect were specified, why were three categories of moral defect not also specified? "Moral idiot" and "morally feeble minded" would have been picturesque designations to extend logically the category of moral imbecile. Had legislators accepted the ideas of religious and aesthetic defect, symmetry would have demanded that atheists should be catered for by the diagnosis of religious idiocy, and I think quite a large proportion of the population might have qualified for the diagnosis of aesthetic imbecility. I draw attention to such trivialities because they emphasize the absurdity of attempting to categorize psychological types by Act of Parliament. Not only are the present legal categories unsatisfactory for descriptive purposes, they are also totally unnecessary. The Acts could specify what constitutes mental defect and leave it there. Indeed, the M. D. Act of 1927 does define "mental defectiveness" as "a condition of arrested or incomplete development of mind existing before the age of 18 years, whether arising from inherent causes or induced by disease or injury." If we add, "in a person who requires care, supervision and control for his own protection or welfare or for the protection of others," what more is required? If, moreover, following the advice of the Wood Report, the definition of arrested development of mind should be based upon criteria of social capability, this could be explicitly stated. On the other hand, if, as some people think, the definition of mental defect should be based upon intellectual capacity, the maximal performance required on tests could be specified. Simplest, however, is to leave the matter open and to assume that the certifying physicians know their job, can recognize mental defect and need for care when they find them, and can give their reasons adequately at the same time. Such common-sense procedures do not seem to lead to misunderstanding or abuse in the United States or in Canada. Lack of detailed specification leaves more freedom for the development of clinical or statistical research than too rigid criteria. Furthermore, it is hard enough on the parents to have their child labelled mentally defective without calling it legally an idiot as well.

Turning now to focus on the concept of "Moral Deficiency" (the 1927 Act euphemistically drops the term "Imbecility"), it is of some interest to inquire

whence this concept originated. In his 6th edition Dr. Tredgold admits that the inclusion of this concept in the Acts has led to much diagnostic and administrative difficulty, yet he believes that there is a real, though small, group of cases to whom it rightly applies. Dr. C. Mercier, who drafted the original definition of Moral-Imbecility, evidently intended it to apply to a type of defective not ordinarily regarded as being defective. The crux of the matter, then, for the present purpose is to ascertain, first, whether or not such a class of persons exists and, secondly, to consider whether or not, if they exist, they should be regarded as mentally defective. It is obvious that, if such cases were recognizably defective in the ordinary sense implying intellectual impairment, no separate legal category would be needed under which to deal with them. To understand how this group of cases has come into prominence we must delve into the past.

In the latter half of last century, the investigation of criminals, from both morphological and psychological points of view, became very fashionable. The study had the dignified name of Criminal Anthropology, and it is still sometimes pursued even at the present time, though with much less enthusiasm than formerly. The "science" grew up on the basis of work of anatomists like Broca (1859), and of students of heredity like Prosper Lucas (1847) and Morel (1864). Thus Maudsley in 1872, speaking of "instinctive criminals," remarked that it was a matter of common observation that this criminal class constituted "a degenerate or morbid variety of mankind, marked by peculiar physical and mental characteristics." These physical characteristics were easy to observe. "I do not need to see the whole of a criminal's face to recognize him as such" said Vidocq; "it is enough for me to catch his eye." Such views were supported by the observations of Dr. G. Wilson, who read a paper at the British Association in 1869 entitled, "The Moral Imbecility of Habitual Criminals as Exemplified by Cranial Measurements." Bruce Thomson made observations on 5,000 prisoners at Perth and this survey, together with the researches of Despine (1868), laid the foundations for the study of criminals throughout Europe, which reached its apex in the work of Lombroso of Turin (*L'Uomo Delinquente*, 1889). The result of all these inquiries, conducted often with prodigious energy and summarized by Havelock Ellis (1890), added up to this, namely, that a great many physically and mentally abnormal human beings found their way into prisons. However, these investigations entirely failed to prove that there was anything which could be recognized as a "criminal type." To take one example, Galton suggested that, if the physiognomies of criminals showed a common factor characteristic of criminality, then a composite photograph should extract this quality. The exact reverse proved to be true. Composite photographs of faces of criminals, particularly those who were defective or insane, gave rise to portraits, rather pleasing and noble both in feature and expression, which would pass well for rather blurred photographs of clergymen. The factor common to all kinds of criminals is that they are basically human. There is, in fact, no "criminal type" as emphasized by the results of Charles Goring's very complete survey made in Parkhurst Prison (1913). It follows, as a corollary, that there is no "morally defective type".

Rather paradoxically, the popular attention devoted to criminal anthro-

pology tended to relieve the lot of the criminal, for, if crime is due to inborn defect, punishment is obviously useless. Given that a criminal type exists and that some people are born with uncontrollable innate vicious tendencies, there are only two possible courses of action. "The evil doer," wrote Diderot in 1782, "is one we must destroy, not punish"; that is an early example of advocacy of what now is politely called "euthanasia." In England the liberal background to legislation rejects altogether such a harsh alternative, and thus the second possibility of certification under the heading of moral deficiency has been welcomed. I think it is correct to say that among medical psychologists at the present time, the teachings of Lombroso and of his school of criminal anthropologists have been discredited. We no longer look for or dream of finding a criminal type. On the contrary, we have taken over the study of criminal behaviour as a branch of psychiatry in its broadest sense. We speak of the scientific treatment of delinquency. We do not need a concept like moral imbecility any longer unless we wish to return to the ignorance which prevailed a century ago.

As a good general approximation for practical purposes, it seems satisfactory to differentiate between mental defect and mental disorder. The total intellectual capacity of the individual (which may not, of course, be scholastic in character) is a quantity like physical strength, which can be measured reasonably well by existing tests. Disease or developmental defect may impair the intellectual capacity but that which remains can be measured. This property of the mind is distinct from disorder, which implies active illness of an acute or a chronic type. Under disorder are included psychosis, neurosis, psychopathic personality, sexual perversion and epilepsy. Any and all of these can be combined and superimposed on any degree of mental capacity. Some of the oldest workers in the field of mental defect believed that defectives were exceptionally innocent and free from mental or moral disorder. Later workers tended to go to the other extreme, and to teach that defectives were specially prone to psychopathy. In my view, the two qualities psychopathy and defect are distinct and not closely correlated—except possibly in the case of epilepsy. In practice, it is often extremely difficult to distinguish the combined effects of disorder and defect and to assign credible causal factors, e.g., to distinguish early schizophrenia from defect. However, we do now know what causes to look for. Inherited characters are physical and chemical differences between individuals, not deficiencies in moral or religious appreciation. Nature can lay the groundwork on which the development of a delinquent character may be favoured, but the delinquency itself cannot be inborn. Adverse environment or unfavourable nurture acts by way of infectious disease, injury or malnutrition in the physical realm and by way of abnormal conditioning in the psychological realm. The positive effects of the mental vitamins of parental love or its equivalent in foster parents are beginning to be appreciated. All these advances in thought have completely superseded the concept of moral defect, which, I repeat, should be abandoned completely in the interests of scientific research and progressive administration.

In conclusion, I would like to mention one practical question, which seems to me of importance in connection with this discussion. The cases for whom

the category of moral defect was planned and for whom it is presumably still used (though the Board of Control's Reports are not informative on this point) fall in a region which lies between those usually covered by experience in the fields of psychosis and mental deficiency. These are the cases of repeated anti-social behaviour in young persons too intelligent to be easily classed as defective and not enough mentally disordered to be easily classed as insane. They are neither fish, flesh nor fowl and no one wants them. The specialist in psychosis is very glad to get rid of them and to have them handed over to the mental deficiency expert. This he can do legally, under the category of moral defect, and the mental deficiency expert, on receiving them, naturally must assume them to be defective in one way or another. If the Binet score is normal, then perhaps some other test can be found on which they will fail and, if so, his conscience will be eased. I am, however, convinced that this is a matter for co-operation between administrative psychiatrists and experts in defect.

Since only about one feeble-minded child out of 50 actually gets certified, the institutional group of high-grade cases consists largely of patients selected on account of social lapses or, perhaps, anti-social tendencies. Sometimes it is the parent and not the patient who is socially undesirable. Moreover, the psychopath with rather low intelligence, who is prone to anti-social conduct, is much more liable to be caught than the clever one. This selection of psychopathic defectives for institutionalization tends to give rise to the erroneous idea that defectives, as a whole, are prone to crime. Surely, institutions for defectives are loaded heavily enough with such psychopathic cases as these without being burdened with psychopaths, who are not even intellectually defective! Administrative psychiatrists would not all be enthusiastic about accepting a burden of extra patients, but perhaps they might be induced to give up a few good working non-psychopathic defectives in exchange. I wonder! Wherever they should go—to approved schools or special colonies—delinquents who are not intellectually defective, should emphatically not be sent to institutions for defectives, where other patients are sent for their own protection.

A SURVEY OF SUBNORMAL TYPES.*

By D. CARADOC JONES, M.A.
Recently Reader in Social Statistics in the University of Liverpool.

WHEN I was invited to take part in this Conference it was suggested that I should speak on some aspects of the population problem in relation to poverty, social inefficiency and mental disorder, as illustrated by the Merseyside Survey. At first I confess I felt very hesitant about it, for I did not want to go over ground that might already be familiar to you. But then I reflected that the purpose of the Conference was, no doubt, to recall and discuss work done in the past having some bearing on the *quality* of the population—an aspect of the problem that is only beginning to receive the attention it deserves. Before replying I therefore consulted Dr. Blacker as to whether it might meet your purpose if I attempted to summarize quite simply a few of the conclusions reached in the course of the Merseyside Survey concerning certain subnormal types in the community. It was only after I had been fortified by his reassurance and that of Dr. Cook that I ventured to accept your kind invitation, and I make my apologies here and now to any of you who find it tedious to listen to a reproduction of what you may have read in the published account of the Survey.

I had better begin by outlining the scope of our work. We attempted a fairly detailed description of the social and industrial structure of Merseyside as it was round about 1930. The region surveyed took in four County Boroughs —Liverpool and Bootle on one side of the Mersey, Birkenhead and Wallasey on the other, besides certain adjacent urban districts. The picture we drew included most of the normal features of social life, such as an analysis of the population by sex, age and marital state, their housing conditions, and way of life at work and at leisure, their earnings and how they were spent, education, organized religion, and the contribution of the social services to health and welfare.

In addition, we broke some new ground by a survey of certain subnormal elements in the population. The particular aspects of the selected subnormal types which we studied were, of course, not medical in character, but sociological, and the two aspects on which I shall concentrate in this paper are social class and size of family. I choose these because the analysis appears to show that subnormality, no matter what type one selects, is associated predominantly—sometimes more, sometimes less—with the lowest occupational grade. and it is found in families which are significantly larger than the average, If that be so, we have a combination of factors making for increasing social inefficiency, unless there are other counterbalancing factors, such as a higher mortality rate in these same families, operating to maintain stability.

We took extreme care in the delineation of our subnormal types, consulting medical specialists at the beginning of the inquiry in framing such definitions

* A paper read at the Winter Meeting of the Royal Medico-Psychological Association at 11, Chandos Street, W. 1, on 21 February, 1947.

as came within their province, and also receiving their kind help when any doubt arose as to border-line cases. Fundamental to our method of analysis was the use of a control group, a standard against which we could set any subnormal group for comparison. This control group was a random sample of the normal working-class population. The criterion by which the working class was distinguished was the occupation and, for non-wage earners, the probable net income. The random sample was obtained by selecting from the Voters' Register 1 in 30 of all houses or buildings in which private families slept in every street throughout Merseyside, omitting only such buildings as hotels and institutions. All these dwellings, if inhabited by working-class families, were included in the survey, and certain information was sought about each of them by our investigators, who received very detailed written instructions, which were also carefully discussed with them, to make sure that everyone knew what procedure to follow in order to get the information wanted. These investigators were, by calling, school attendance officers, and each was assigned an area with which he had grown familiar in the course of his routine day-to-day duties; they already knew a good deal about every family containing children of school age in their own areas, so that it did not prove very difficult to get the additional information desired. This included, among other matters, the composition of the family by sex and age, number of children living and dead, occupations of those at work, earnings and other sources of income, and housing accommodation. I might mention here that the occupations were subsequently subdivided according to grade, non-manual and manual, the manual being classed as skilled, semi-skilled, and unskilled. The total number of families in the random sample investigated was 6,906, comprising a population of 28,845. In Liverpool alone the number of families sampled was 4,834, with a population of 20,080. Information was, in fact, obtained from 93 per cent. of the families approached.

I had intended to illustrate the use made of this household sample by a control group, by comparing the families in general of which it was composed with families which were subnormal in regard to income and housing conditions, that is to say, all families in the same household sample which fell below carefully defined standards of poverty and overcrowding. But time will not permit of this, so I pass on at once to that part of our survey which related to such subnormal types as the deaf, the blind and the mentally deficient. Here our investigation was very much in the nature of a first effort, made necessarily along a fairly broad front. But, tentative and experimental though our work was, some of the conclusions reached can, I think, be accepted as reliable. I mean that any defect in definition, classification, or method of analysis would scarcely be serious enough to reverse the conclusions reached.

Deaf.

Sources.

(*a*) Liverpool Education Authority: particulars of children up to 16 from all parts of Merseyside attending a special school for deaf.

(*b*) Liverpool Deaf and Dumb Institute: access to register of all known adult deaf on Merseyside.

Definition (after consultation with medical experts):

Congenital included all recorded as *born* deaf, or where deafness stated to be *probably congenital*, or where *onset* was presumably *under one year of age* and without adequate cause (e.g. measles, meningitis, tonsillitis were judged adequate, but *not* a fall or a shock).

Acquired included all cases where *onset* was recorded as *gradual*, or at *a definite age*, or associated with an alleged external cause (an adequate cause, if the child was under one), or if there seemed to be no adequate cause but some doubt as to whether onset *was* under one year of age.

Altogether 922 cases were observed, a slight excess of congenital over acquired and of males over females, the sex difference being probably significant. Of 348 cases of acquired deafness, where age of onset was given, 85 per cent. became deaf under 10 years of age.

Occupational grade and employability.—The families in which deaf children appeared were rather below the average of the general working-class population; 43 per cent. of the fathers of deaf children were of the unskilled labouring class, as compared with 39 per cent. of the heads of normal working-class households. On the other hand, a high proportion of occupied deaf men were found to be engaged in skilled work. In qualification of this last conclusion it must be added that a high proportion of deaf men failed to get work of any kind, 38 per cent. as against 18 per cent. of male adults in the general working-class population. Moreover, the deaf retire early from the scramble for work. In a random sample of 4,662 adult occupied males in the general working-class population of Liverpool, 25 per cent. were of age 50 or over, whereas of 292 adult occupied deaf males, only 18 per cent. were 50 or over.

Marriage and size of family.—Deaf people marry less than the normal population, but in about 4 out of every 5 such marriages recorded on Merseyside, both partners to the marriage were deaf. This was due to the fact that the deaf are usually very sensitive, and they understand one another much better than they are understood by people who hear. Consequently there is a natural bond of sympathy between them and, when they meet, they are drawn to one another. Frequent occasions for meeting were provided in Liverpool, first in the special schools and afterwards in the Deaf and Dumb Institute.

Is the marriage of a deaf person to be deplored? What about the offspring? As a result of 192 deaf marriages, i.e. marriages in which at least one partner was deaf, only 10 children were recorded as born deaf, <3 per cent. of all known living children. Also, the mean number of living children per deaf marriage was 1·90 as compared with 2·97 in the normal working-class household.

It would thus appear that the number of children born to deaf parents is not great and the risk of them being born deaf is very slight. If only one partner to the marriage is deaf, and the deafness is acquired not very early in life, the child of such a marriage may suffer no special hardship, especially if the father is in regular work. We ought clearly to judge the question in view of the probable effect on the children and their future social efficiency. Two deaf persons without children might add to one another's happiness in life by marrying and so sharing their common burden. But if even one partner to

the marriage is congenitally deaf, and therefore in all likelihood also dumb, any child born to such a parent is bound to be handicapped in its early years. Though children born to deaf parents are not as a rule themselves deaf, parenthood of the congenitally deaf is not without danger. Even if no disability is evident in the immediate offspring, it may come to light after skipping a generation, as some of our pedigrees showed.

We have discussed size of family resulting from deaf marriages. We have now to consider marriages in which both parents appear to be normal, but at best one child is deaf. The mean number of living children in 219 such families, each containing a deaf child between the ages of 5 and 21, was 4·27 per family. This is appreciably above the average in size, for the mean number of living children per family in a large random sample of working-class families, each containing at least one living child, was found to be 3·39. There was no significant difference in size of family according to type of deafness in the deaf child.

Blind.

Sources.

Since 1920 the law requires that a Register be kept of the Blind in the area of each Local Authority. This task and the promotion of their welfare was delegated in Liverpool to the Liverpool Workshops and Home Teaching Society for the Blind. Also, for children of 5 to 16, too blind to profit by ordinary school teaching, the Local Education Authority provided two Special Schools, and advantage was taken of permission to provide education beyond the age of 16 for blind persons to learn a trade.

Number and definition of cases.

From these two sources information was obtained concerning 1,195 blind persons on Merseyside, 623 males and 572 females. The blindness was classed as congenital in 367 cases and acquired in 828, where the *congenital* included those born blind or partially blind; those afflicted at birth with a disease or defect which causes blindness, though the blindness may not always become evident until later.

Acquired included all cases where onset was recorded as gradual, or at a definite age, or associated with an alleged external cause (which must have been an adequate cause if the child was under one), or if there seemed to be no adequate cause, but some doubt as to whether onset *was* under one year of age. Blindness which was the result of accident or war service was excluded.

Age of onset.—Unlike deafness, acquired blindness is a condition that normally comes to people—if it comes at all— relatively late in life. Omitting ophthalmia neonatorum, the incidence of which is steadily diminishing, out of a total of 720 cases where the age of onset was recorded, nearly 60 per cent. became blind after the age of 40.

Rather more than 2 out of every 5 cases of congenital blindness had a syphilitic association, the rate of incidence of blindness of this class being

nearly twice as high among the unmarried as among the married over the age of 21.

Occupational class.—More than half the fathers in families containing a blind child were unskilled labourers, and nearly half the men who became blind after their youth had been of the same low grade when occupied, as compared with less than 40 per cent. so classed among normal working men. Those who become blind have much less chance of becoming self-supporting than the deaf. This is recognized by the granting of a pension to the blind at the early age of 50. Out of 198 occupied blind men on Merseyside no fewer than 121 were employed in special workshops for the blind. They could not hope to compete on equal terms in the open market.

Marriage and size of family.—The blind do not intermarry like the deaf, but their marriage rate is higher. Out of 943 adult blind persons in Liverpool 64 per cent. were married, as compared with 71 per cent. in the general population and 54 per cent. among the deaf. Among 603 marriages of the blind, both partners were blind in only 6 per cent. of the total as compared with 80 per cent. in the case of the deaf.

The mean number of living children per marriage resulting from 503 marriages where at least one partner was blind did not differ significantly from the mean number born to normal working-class parents. The mean number born to the congenitally blind was rather less than the number born to the acquired blind. And, in general, the earlier the onset of blindness the less the chance of marriage, and the smaller the average size of family.

The risk of a child of blind parentage being itself born blind is very slight, as in the parallel case of the deaf. The number of blind children resulting from 603 blind marriages was only 2·5 per cent. of all living children. But clearly, the handicap to any child born to a parent who is blind is bound to be great, so that one is disposed to question the advisability of the blind becoming parents. And there is always danger of transmission where the blindness is congenital. In the Merseyside Survey several families were reported in which blindness showed up in successive generations.

Turning now to marriages of a type which to all outward appearance were normal but which produced a blind child, the mean number of living children in 94 such marriages was 4·42 per family. This result may be compared with the mean number of living children in normal working-class families containing at least one child, namely, 3·39.

Mentally Deficient.

Mental defect, as you well know, is a deficiency of intelligence, in the great majority of cases present at birth, though not always immediately discovered. Idiocy and imbecility, the more serious grades of defect, are liable to appear, as if by chance, in any class of the community. The feebleminded (higher grade defectives), on the other hand, occur in patches, associated conspicuously, according to Dr. E. O. Lewis and others, with the Social Problem Group, the breeding ground of other problem types, such as the criminal, the immoral, paupers and unemployables.

Sources.

(1) The Education Departments of Liverpool, Bootle and neighbouring urban districts gave access to their records of all children between the ages of 5 and 16 attending special schools and classes for the mentally deficient.

(2) The West Lancashire Association for Mental Welfare supplied particulars of persons who were, or had been, under their supervision; these might be of any age, but only 6 per cent. turned out to be over 30. A child is placed under supervision only if likely to prove ineducable, even in a special school, so that the Mental Welfare Group is one suffering from a more serious grade of defect than the Special School Group.

Grade of defective.—The Special School Group contained 841 cases and the Mental Welfare Group 784, with a slight excess of males over females in each. The higher grade defectives come from a lower social class as judged by the father's occupation than the Mental Welfare Group; 63 per cent. of the fathers of mental defective children attending special schools were unskilled labourers, and 49 per cent. of the fathers of children under supervision were of this class.

Size of family.—The mean number of living children recorded in 1,115 families containing at best one mentally defective between the ages of 5 and 22 was 4·69. The corresponding figure in a large random sample of normal working-class families containing at least one child was 3·39. Moreover, about one half the total of families containing one or more defectives were families with 5 or more living children per family, whereas only one-quarter of the group of normal families sampled had each 5 or more children.

Not only are families containing one or more defectives larger than normal families, but the difference between them would be even more striking if all dead children could be brought into the calculation, for, in the 1,115 families recorded in the Merseyside Survey containing defectives, the mean number of children reported dead per family was as high as 2·47. This, incidentally, is evidence of poor physical stock as well as inferior environment. There is some ground for the belief that feebleness of body tends to go with feebleness of mind.

Transmission of Defect.

Among 1,880 defectives, concerning whom records were available, less than 1 per cent. had one or both parents certified as defective; as many as 15 per cent., however, had a parent judged to be of subnormal intelligence by head teachers of special schools or by experienced Mental Welfare Visitors. But if the parents of defective children are seldom themselves certifiably defective, it does not follow that the children of defective parents are most likely to be normal. In fact there is quite a strong chance that they will not be normal. Families containing a defective child included in the Survey were classified in such a way as to bring this out. In 24 marriages where both parents were judged to be subnormal, it was found that nearly 60 per cent. of their children also were subnormal. In 176 marriages where only one parent was subnormal, over 40 per cent. of the children were subnormal; while in 1,399 marriages where both parents appeared to be normal, 30 per cent. of the children were subnormal.

When there are two defective children in a family, either ineducable or attending a special school, there is little doubt that an hereditary taint must be present in one or both parents, outwardly normal though they may appear to be. No fewer than 217 such families were found on Merseyside. The mean number of living children per family in this group was 5·4, which may be compared with 3·98 per family in a large random sample of normal working class families each containing at least two living children. The mean number of dead children was also abnormally high, amounting to between 3 and 4 per family. In 58 of these 217 doubly-defective families, at least one of the parents was recorded as subnormal, and nearly one out of every three (32 per cent.) of these 58 families had 3 to 6 defective children apiece.

Epileptics.

A total of 107 were included in our survey. Of these, 48 were children under 16 attending special schools or notified by the Liverpool Child Welfare Association. The rest were resident in the Maghull Epileptic Home. Eighty-one of the total sample were under 30. The fathers of 54 per cent. of the young epileptics were unskilled labourers. The mean number of living children per family was 4·4 and of dead 1·6 per family.

Defect in Near Relatives.

By near relatives I mean parents and children, brothers and sisters, uncles, aunts, nephews and nieces, cousins and occasionally grandparents. Information beyond this range was doubtful.

Since deafness can be acquired, the extent to which acquired deaf persons have relatives also with deafness acquired may be taken as a guide to a measure of the chance occurrence of deafness. At least we may reasonably argue that the chance incidence of deafness is not likely to be greater than this. It might well be less because, owing to some hereditary weakness, the near relatives of deaf persons may be more prone to become deaf than the near relatives of hearing persons, although the immediate cause of deafness in both the primary case and in the relative of the primary might seem to be accidental. The same line of reasoning applies to the acquired blind, but clearly not to the congenitally deaf, the congenitally blind, or the mentally deficient.

Among 475 persons who had themselves become deaf, no more than 12, or 2·5 per cent. of the total, were recorded as having near relatives who had also become deaf. Among 845 persons who became blind, only 31, or 3·7 per cent. of the total, were recorded as having near relatives who had also become blind. Thus we might expect not more than about 2 to 4 per cent. of the congenitally deaf, blind, or mentally defective to have near relatives also deaf, blind, or mentally defective, respectively, as chance happenings. Actually, out of 471 congenitally deaf persons, 150, or 32 per cent., were recorded with congenitally deaf relatives. Out of 472 congenitally blind persons, 124, or 26 per cent., were recorded with congenitally blind relatives. Out of 1,625 mental defectives attending special schools or under statutory supervision, 383, or 24 per cent., had relations who were mentally defective, insane or

epileptic. The somewhat higher percentage of near relatives afflicted among the deaf, as compared with the blind and the defective, is due very likely to the high intermarriage rate observed between deaf persons. This would fit in with the simplest explanation one can offer for the high rate of like defects generally in the near relatives of the congenitally deaf, the congenitally blind and the mentally defective—far too high to be due to chance—namely, that there is an hereditary taint at work transmitted from one generation to another. And the figures I have quoted are not a full measure of the evil, for they only take count of the *fact*, not of the *number*, of near relatives affected. There may be more than one affected relative, or secondary, to the same primary case observed. It will suffice to illustrate this possibility by an examination of the mentally deficient class.

When we combined the Special School and Mental Welfare cases, making a total of more than 1,600, and counted the *number* of their defective relatives, we found that to every 100 primary cases observed, 37 near relatives were recorded as mentally defective, insane, or epileptic, and to this number 23 more were added, making a total of 60 affected relatives, secondaries, to every 100 primary cases observed, when relatives reported by skilled visitors as mentally retarded and unstable or subject to fits were included with the certifiably defective.

Physically Defective.

This group consisted of 662 children attending special schools under the Liverpool Education Authority or in tuberculosis institutes, or under the care of the Liverpool Child Welfare Association. They were subdivided into—

(1) Those with a congenital deformity, congenital heart, or congenital paralysis.

(2) Those with an acquired defect, such as rickets, tuberculous joints or glands, rheumatic heart, or infantile paralysis.

In addition to these 662 children, we came across 81 persons of all ages recorded as tuberculous, crippled, deformed, paralysed, or otherwise disabled, *not* as the result of accident, in the random household sample, and 345 persons suffering from ill-health, chronic or otherwise.

Occupational grade.—58 per cent. of the heads of families containing children with acquired defects were unskilled labourers; the corresponding percentage for the congenital group of physical defective children was 52 per cent. For the physical defective in the household sample it was 50 per cent. and for the sick it was 44 per cent. as compared with 39 per cent. in normal working-class families.

Size of family.—For all the physical defective groups combined the mean size of family was 4·33 children alive and 1·50 dead; for the sick the corresponding means were 4·90 children alive and 1·30 dead.

Delinquency.

Under this head 109 juvenile offenders from the area were included, reported from reformatory schools and from the Borstal Association; also, 56 offenders under 50 years of age (but 60 per cent. were between 16 and 21), sent by the

Courts to the West Lancashire Association for Mental Welfare on the ground of mental deficiency.

Of those under 25, nearly 60 per cent. of the first group and over 30 per cent. of the second were reported to have come from homes where the father was dead or had deserted.

The occupational grade of the father was recorded in 91 families containing an offender in the combined grades; 55 per cent. were classed as unskilled.

The number of living children per family was recorded in 144 families containing a young offender in the combined groups; the mean was 5·5; and in 36 families where there was a record made of dead children, the mean number dead per family was 2·7. I should perhaps explain that special care was called for in filling up the space as to number of dead children. The space was to be left blank in all these investigations if there was no information as to number dead, and such cases were not included in the count. Only when it was known that no child had died was a "0" to be inserted in the space provided.

Chronically Destitute.

Data concerning the destitute were collected with the collaboration of the Liverpool Public Assistance Authority. When we compared a random sample of families below a defined poverty line with normal families, it was found that by far the greatest causal factor in poverty at the period of the survey was unemployment, and the next important factor was the absence of any adult male earner by reason of death, illness, accident or some other cause.

In our subnormal survey we therefore decided to investigate two groups, defined as follows:

(1) A subnormal unemployed group comprising all able-bodied men, between the ages of 22 and 50, who at the time of the inquiry had been continuously in receipt of public assistance on the ground of poverty due to unemployment for two years or more. Men over 50 were ruled out because they might have been without work on account of the infirmities of advancing age. Also, anyone suffering from unemployment on account of sickness or accident was excluded.

(2) The second group was composed of deserted or separated wives, between the ages of 22 and 50, who had also been in receipt of public assistance for two years or more, excluding as before accident and sickness cases.

The total number of subnormal unemployed men satisfying the above definition was 754. Over 90 per cent. were married men as compared with 70 per cent. of men married between the same ages in the random household sample. Also, 71 per cent. were classed as unskilled labourers as compared with 39 per cent. among males in general in the household sample.

There were 283 women satisfying the definition of deserted or separated wives. A high proportion of their husbands, nearly 60 per cent., were seamen or ships' firemen, who had no difficulty in disappearing from sight if wife or home began to lose their attractions.

Size of family among the chronically destitute.—The mean number of living children per family for the subnormal groups is consistently higher than the mean number in the control group. With one slight exception, the same is true for the mean number of dead children per family.

Illegitimacy.

The Liverpool Public Assistance Authority also gave us particulars of 200 women, each of whom had entered a public assistance institution for the birth of a second illegitimate child. Of these women 90 per cent. were under 35 years of age, one out of every three of whom was recorded as having had 3, 4, or 5 illegitimate babies; 43 per cent. were under 25 years of age, and one out of every five of these had had 3 or 4 illegitimate babies.

Of the 481 illegitimate babies born to the total of 200 women, 116 were known to have died—an abnormally high mortality rate.

Where there was any record of the father, the same man was alleged to be the father of 2 or more children born to the same woman in only 17 per cent. out of a total of 142 cases.

Among the 200 women investigated, 22 were reported as having no moral sense, 27 as mentally retarded, and 25 as physically defective or unstable.

General Conclusion.

From an examination of these subnormal types, collected from sources which were quite independent, whatever form the subnormality takes, whether the cases observed are below normal in hearing, or sight, or intelligence, or physique and health, or in such factors as make for employability and a successful home life, the general impression one gets is that they are discovered most frequently in the unskilled, labouring class and they occur in families which are above the average in size. It cannot be claimed, please note, that the subnormality is the cause of the descent into a low occupational grade when the subnormality is in the child and the occupational grade is that of the father.

Since, moreover, it may be taken for granted that only a low order of intelligence is required for unskilled labour, it would seem to follow that there is some degree of correlation between low intelligence in parents and subnormality in their offspring; it is in fact the most obvious connecting link, if a link be sought, with the parents, and the high fertility of such parents is not a hopeful sign for the future of our population.

These results, I venture to think, incidentally are not inconsistent with the trend of the conclusions reached by Sir Cyril Burt in his recent highly important study of *Intelligence and Fertility*; they are consistent, I mean, with the direction in which he thinks we may be moving, though I can say nothing at all precise, as he did, as to the estimated rate of movement.

His conclusions were that (*a*) it seems almost certain that there is in this country a negative correlation between innate intelligence and size of family,

large enough to demand urgent practical attention; that (*b*) it seems highly probable that the average level of intelligence among the general population may be declining at a rate which might produce serious consequences if at all sustained; and that (*c*) it seems more probable than not that, with characteristics other than intelligence (e.g. temperamental or moral qualities, such as relative freedom from neurotic or delinquent tendencies, and physical characteristics, such as health and strength), the effects of the differential birth rate are, if anything, unfavourable rather than favourable.

The reader is referred to Vol. 3 of the *Social Survey of Merseyside*, chapters 12–18, for a full account of the investigations briefly described in this paper.

HIGH GRADE MENTAL DEFICIENCY IN RELATION TO DIFFERENTIAL FERTILITY.*

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Mr. Caradoc Jones this morning emphasized very clearly indeed the important distinction between high and low grade mental deficiency. He showed us some very striking figures suggesting, not that heredity is not involved in both, but that it is a different sort of heredity. It always seems to me that in considering this and related matters the analogy of stature is a helpful one. Many of us remember those posters of the last war but one, which said " Your King and Country Need YOU," coupled with the statement that " You " had to be 5 ft. 4 in. high—a standard which went down afterwards. If one rejects for any purpose a segment of the population on a measurement of this kind one is rejecting people for very different reasons. The arbitrary standard cuts off, of course, the dwarfs; the achondroplasics, the midgets, the cretins, the rachitic dwarfs, and so on; but it cuts off far more of those who are simply short. In causation we can normally expect the dwarf's condition to be due to hereditary factors, actually a single factor in achondroplasia; or it may be something environmental, as in the rachitic dwarfs or the cretins, but when we come to the people who are just short, it has been shown fairly conclusively that in a civilized community in which the standard of nutrition is adequate, at least 90 per cent. of the differences are due to heredity; but it is a different sort of heredity. We have a whole host of genetic factors, each one of which has a small effect; but the effect is cumulative; some factors make for greater stature, some for smaller, and it is on the sum total received from the parents that the stature of the individual depends.

In mental development we have something rather similar, but our analogy is not yet complete because no one supposes that mental deficiency can be defined in terms of I.Q. or in terms of what Sir Cyril Burt calls innate cognitive ability, which is measured in children with fair success by a Binet test. It is important whether the person is stable or not temperamentally, and we have to say that our standard is no longer rigid; we exclude wholly everyone below 5 ft. 2 in., between 5 ft. 2 in. and 5 ft. 3 in. we exclude most, at 5 ft. 4 in. we exclude a few, above that we exclude very few; in other words, we exclude those who are short and notably lacking in other ways. Although with a certain measure of I.Q. we can be certain that the individual will require some sort of care and control, above that level decreasing numbers of persons will,

* A paper read at the Quarterly Meeting of the Royal Medico-Psychological Association at 11, Chandos Street, W. 1, on 21 February, 1947.

in fact, require care and control, whether they do or not depending upon emotional and temperamental factors which we cannot measure, or can only measure with the very greatest difficulty. I stress that because what I want to say refers to general intelligence and not to mental deficiency. It is relevant, of course, but it is not the whole story. It is the measurable thing, as measured with fair efficiency by the Binet I.Q., that I want to talk about.

If the frequencies with which different I.Qs. occur are plotted out the curve is normal down to an I.Q. of 45; we get the familiar "cocked hat" curve, which will include the great bulk of the defectives classified as feebleminded; but below that level we find an excess—the 4 per 1,000 children found by Dr. Lewis in his survey—and so we have the low-grade defectives who owe their condition sometimes to a genetic factor, sometimes to purely extraneous things, sometimes to complicated interaction of factors which we do not understand, while on the other hand we have the dull, not separated in any sharp way from the rest of the population, but merely those who are socially inefficient and require care and control. The differences one expects to find between these two groups are not, I think, principally in their clinical characteristics. I think that Dr. Lewis has said since that he rather regrets that in that pioneer work of his he used the word "pathological" in distinguishing between the low-grade and high-grade, the pathological and subcultural, because it has to some slight extent tempted people to look for actual pathological deviations in the low grades and make that the criterion. I doubt if it is likely to be so. I do not suppose that the distinction is necessarily clear cut in that way, because though the very dull are, as it were, part of the normal curve, nevertheless one will expect, and I think find, that at that low level of mental development physical abnormality is often present, that neurological signs are present, that psychosis is present. The farther you go down the scale the more frequent these other abnormalities become, and this obscures a distinction which may be rather clear cut. The real distinction is likely to be in the family histories when we are able to study them in sufficient numbers and sufficient detail.

Some years ago my colleagues and I carried out a survey at Bath. We tried to obtain a complete sample of 3,400 school-children defined simply by age and residence in the city on a given date; and we did, in fact, by taking a good deal of trouble, succeed in making our sample practically complete. In it there were 13 children classified as idiots and imbeciles. It was true that two or three of them had similarly affected brothers and sisters, but not within the range of the brothers or sisters we could ascertain with certainty. In fact, the average I.Q. of the measured brothers and sisters of these 13 children was practically 100. The average I.Q. of the dullest 8 per cent. of our children was 72; the average I.Q. of their brothers and sisters was 88. Here we have in a very small sample this clear-cut distinction in the family history of the low-grade and high-grade.

One further thing we were able to do with our figures seems to throw some light on this distinction. In high-grade mental deficiency supposing one had influences which operated against a particular child, as there are in low-grade deficiency, then one would expect to get families in which one child only was

mentally defective and all the others more or less normal. If, on the other hand, certain sorts of environmental factors were very potent, one would expect to find them operating against whole families because the families would share those conditions. One would expect to get, on the one hand, an excess of families with one dull child and the rest normal, and at the other end an excess of families with all the children dull. This does not happen. In fact the distribution of intelligence of siblings of children in our group was just what would be expected from the simple assumptions of multifactorial inheritance, and the tendency for sibs to resemble each other.

What about the differential birth rate? In our population, as we know, different groups are reproducing at a very different rate. You heard this morning from Mr. Caradoc Jones some figures on occupational classes. The figures I want to give you refer to intelligence as measured on intelligence scales.

Amongst our group at Bath we selected for special study the brightest 4 per cent. of children in the group, and found that the number of living brothers and sisters they had was 1·70. We had to make an allowance, which can be calculated from the data, for the extra children which will be born to those mothers by the time they have passed the age of 50; this is 0·25, making altogether 1·95. In the middle 4 per cent. the average number of brothers and sisters was 2·78, others to be born 0·76, giving altogether 3·54. In the dullest 8 per cent. of children the average number of living brothers and sisters was 3·72, with an addition of 1·31, giving a total of 5·03. When ascertaining families in this way one starts, of course, with families in which there is at least one child, and one is more likely to include a family if it contains a large number of children. That seems a little complicated, but an approximate allowance is good enough; if the child who brought the family to notice is left out, the figures which remain are the effective family size; so that we can say that our brightest children come from families of average size 1·95; the dullest children come from families of average size 5·03—that is, families 2½ times as large as those of the brightest children. That shows, in a nutshell, the differential birth rate in regard to intelligence. It is a linear relationship; as you go up the scale of mentality the size of the family falls perfectly steadily.

Where do the mental defectives come from? (I am talking of high-grade mental defectives.) Let us see how many children with an Intelligence Quotient below 70 (I choose 70 because Prof. Burt used 70) parents of different I.Q. levels will have? Without allowing for the fact that there is a strong tendency in intelligence for like to marry like, on the average a parent of I.Q. 130 will have only 0·1 per cent. of children with an I.Q. below 70 (plus the chance that 4 in 1,000 will be idiots or imbeciles); the chances of a parent with an I.Q. of 115 having a child below I.Q. 70 is 0·6; a parent of I.Q. 100 will have 2·3 per cent. of children below 70; a parent of 85 I.Q. 6·7 per cent. of children below 70; I.Q. 70, 15·9 per cent.; I.Q. 55, 30·9 per cent. That is where the very low I.Q. children are coming from, and, of course, low I.Q. has a very close relationship to high-grade mental deficiency.

Mr. Caradoc Jones told you that the lower the intelligence of the parent,

the lower the intelligence of the child on the average, but there are many more people who are dull than there are people who are actually feebleminded. In fact, the bulk of the high-grade mental defectives do come, not from mentally defective parents, but from dull parents. There are many more people in the population of I.Q. 70 than of I.Q. 55, and we can be quite certain that there will be more children with an I.Q. below 70 born to those of I.Q. 85 than to those of I.Q. 55.

One cannot separate the problem of high-grade mental deficiency from the problem of intelligence levels in the entire population from top to bottom. I hope I am not quoting from something which Dr. Slater has not yet published, but he once said that one could never understand the stream as a whole if one concentrated one's attention on the foam at the top and the sludge at the bottom. This problem of the differential birth rate and high-grade mental deficiency is not a problem confined to the feebleminded; it is a problem of intelligence levels in the entire population.

Given this differential birth rate, given the fact that children in the lower ranges of intelligence have more brothers and sisters, is it possible to deduce what the fall in intelligence of the population is likely to be if present trends continue? It can be done by an indirect calculation, making certain assumptions. I used to make some complicated assumptions about what was hereditary and what was not. Prof. Fisher pointed out that these complicated assumptions were unnecessary; he used a different formula and arrived at 2·0 points of Binet I.Q. per generation. Prof. Burt simplifies it yet further. Do not let us think of the parental generation and the generation of children; let us see what the difference is between the population as it is with all the differing sizes of families and with an average I.Q. about 100, and the intelligence of the population as it would be if all families were of equal size. Prof. Burt, using this method of calculation and making certain modifications and adjustments, comes to the conclusion that the fall in I.Q. is likely to be of the order of 2 points or so. Of the 2 points not less than half is likely to be hereditary causing a relative loss of valuable genes. That figure of 2 from my own data must be increased. Taking samples of school-children one is bound to get incomplete families, which increases the estimated fall to 2·6 points of Binet I.Q. per generation. If one guesses at the amount to allow for the people who do not appear in the survey at all because they have no children, then one might say 3 points of Binet I.Q. per generation.

That is far too big. If the average decline in intelligence in the population were 3 points Binet I.Q. per generation, we should have noticed a much bigger increase of mental deficiency in the last 25 years and a much greater decrease in scholarship children. Prof. Burt thinks that there has been a fall, but it is much smaller than the indirect calculation indicates. I will give you one possible reason which might account for that in a moment. Prof. Burt's figures are as follows—they all refer to people of I.Q. less than 70: In 1920 the estimated proportion in London was 1·5; in 1950, if we assume a fall of 2 points, it will be 2·3; by the year 2000 the percentage of the population with an I.Q. below 70 will be 4·1. Prof. Burt sums up by saying that it looks as though the proportion of people with I.Qs. below 70 is likely to double in the

next 50 years, and the corresponding proportion of scholarship children with I.Qs. above 130 is likely to be halved.

A number of factors may affect this indirect calculation, and I should like to mention some of them. One is the question of maternal age, and its effect upon intelligence. Maternal age and birth order are so closely related that it is difficult to distinguish between the two, but let us suppose that it does turn out to be unfavourable for the child and its level of intelligence to have a mother who is old or to be 6th, 7th or 8th in the family as compared with the first or second child. The effect would naturally be to give a higher mean I.Q. for the smaller families and a lower figure for the larger families; and it may be that a part of the effect we see when we try to relate fertility to intelligence is due to this factor. The results of experimental work are exceedingly confusing; Prof. Burt comes to the conclusion that only part of the association is likely to be attributable to this cause. But if it were big enough it could be entirely responsible, and it might be that instead of the intelligence of the population declining it would increase. I had hoped to present you with some figures from our own data, but I have not yet been able to work them out because it involves a good deal of restandardization of our norms with regard to age. I do not know what the answer is, but we have to bear in mind that it may be a measurable disadvantage on the average as regards intelligence to come late in the family or to be born to a relatively elderly mother, and this may account for part of the association between small size of families and intelligence. It may indeed be that this accounts for the discrepancy between the indirect calculation and the probable actual fall, which is considerably less.

The next factor which affects the calculation is a decline in inbreeding. During the last hundred years transport facilities have increased notably, the population has become not only much more numerous, but more mobile, and there has been a growing tendency for people to marry those who are less related to themselves. Someone had said (I do not know if the calculation is correct) that in this country some years ago the average marriage was one between fifth cousins. The degree of inbreeding has been steadily relaxed during the last hundred years. Does it affect this calculation? It certainly will affect the proportion we may expect of low-grade defectives, because some are due to Mendelian recessive genes, and so as inbreeding is relaxed we should expect a fall in the number of low-grade defectives. What about the high-grade defectives? It may or may not affect the numbers. Dahlberg in Sweden did some work years ago on stature amongst recruits in the Swedish Army, and he found that there had been a notable increase in stature over a period of years. He was convinced that this could not be attributed entirely to improvement in nutrition, and his theory was that it was due to precisely this factor—the relaxation of inbreeding. When hereditary factors are involved, such as are likely to apply to intelligence, it may be that on the whole the individual factors which make for higher intelligence are more often dominant, and if that is so less inbreeding would mean that similar recessive genes would not come together so often. This is all speculative, but it is not inconceivable that although the indirect calculation indicates a fall in intelligence in the population, although it is true that the dull have far more

children than the bright, yet that might still be combined with a rise in the general intelligence of the population. In one sense it is not a real rise; it does not mean that the units of intelligence available in the population are increasing in number; they are not; they are decreasing, but they are arranged in a more useful order—the good are being used to conceal the bad.

People are not only marrying those who are less related to them, but they are marrying those who are more like themselves. It appears to be a strong universal tendency that like should seek out like, and in nothing is this more true than in intelligence. It is probably true to say that to-day the average husband and wife in our population are more like each other in intelligence through deliberate choice than are the average brother and sister because they were born of the same parents. The strong tendency of like to marry like is a very powerful factor, but one hundred years ago the choice of a marriage partner was far more restricted than it is to-day, and this tendency had less scope. It may be that the correlation coefficient of likeness in intelligence between husbands and wives is now as high as 0·6. The effect is to increase variability, and it is easy to see why. If the dull marry the dull there is a stronger tendency for their children also to be dull. Similarly with the bright, if the very bright tend to marry the very bright, then their children tend to be very bright. It does not alter in any way the average of the population or the units of intelligence available; all that is happening is that they are being sorted out differently. The effect on these calculations may be considerable, and if the tendency increases it will increase the number of feebleminded because it will increase the number of low I.Qs. Let us say we have a population with a mean Binet I.Q. of 100 and with a standard deviation of 15, then the proportion of people below 70 is 2·8; but supposing that population, without altering at all in average intelligence, has its variability increased by this assortative mating to a standard deviation of 17, then we should have 3·9 per cent of people with Binet I.Qs. below 70. The increase in the proportion of the feebleminded would, however, be counterbalanced by a corresponding increase in the proportion of very bright children.

The last point I shall mention which affects this calculation is rather an obvious one. A low Binet I.Q., unless it is very low, does not mean that the person needs to be certified. Dr. Gordon and Dr. Thomas some years ago carried out a study at Bath and came to the conclusion that if a child at the age of 14 had a Binet I.Q. of not less than 60, and if that child were thoroughly stable and well adjusted, then he or she should be able to get on in the community without supervision. Emotional and temperamental factors, of course, come into the picture. This question of being well adjusted and stable is extremely important, and there may be developments in the next 50 years in regard to these other and varying important components in determining mental deficiency which requires certification. I entirely agree with Mr. Caradoc Jones about the positive association between good qualities of all sorts and bad qualities of all sorts. If we are losing units of intelligence which are available in the population we shall be likely to lose other things of value too. But we may be able to use what we have got to much better purpose. We know very little about the determination of emotional qualities which make for

stability and for the social success of the individual in the community. I am continually struck by the big difference in these qualities between identical twins, who have an absolutely identical hereditary constitution. I saw a pair of twin girls a month ago; they were unquestionably identical. The mother volunteered the information that they were absolutely different in character, and when she was asked why, said that one was very shy and sensitive and very fond of dolls, very fond of clothes, jewellery and dressing up; the other was self-reliant, did not care a hang about anybody, had no interest in clothes whatever, but was interested in mechanical things and ought to have been a boy. To make it more difficult, there was a size difference in these twins which had persisted since birth; it was the larger twin who was the shy, sensitive one, and the smaller one who was the more extraverted.

Another pair of identical twins, just about as identical as any twins one could ever see, are apparently similar in intelligence, extremely similar in appearance, and yet the mother describes one of them as neat and orderly, her room always kept in perfect order, while the other is careless about her possessions, her room always in confusion. These are fundamental differences, and yet they are differences in people with identical genetic constitutions. They are non-inherited differences, determined in some way we do not yet understand. We can surely look forward to advances in knowledge which will help in prescribing and obtaining the best conditions for development before birth, after birth, during school and training, which will mean that fewer and fewer of those who are potentially certifiable because of low intelligence will actually require it. We can hope that as the years go on, although there may be more very low intelligence in the population, fewer people will need to be certified and more will be able to live useful lives in the community.

DISCUSSION.

Dr. E. O. Lewis said that he felt he was not in sufficiently close touch with investigations of recent years to be able to contribute very much to what had been said by the openers. He would like to make one point, however. Before becoming too pessimistic it would be well to ask whether such things as intelligence quotients were being interpreted correctly. Everybody regarded intelligence quotients as a measure of intelligence and intelligence only, that is, of innate mental endowment. It must be admitted that intelligence tests were influenced to a great extent by cultural levels and by temperamental development, and when there was a lowering in the intelligence quotient that lowering might not be due to the fact that intelligence, that greatly graded inherited factor, had changed very much, but that secondary factors were producing the lower intelligence. The recent work in America had shown that mental tests were influenced to the extent of 20 per cent. by factors which were not innate, and this must be taken into account before pessimism was admitted.

It was a very serious consideration if the quality of genes could be modified at the rate it was said they could be modified. He could not challenge the recent work, but he felt that they should make quite sure that they knew what they were dealing with when dealing with an intelligence quotient. He was inclined to think that what was thought to be a lowering of intelligence was a slipping back of cultural level to some extent.

His own thoughts on this subject had gone along rather different lines. What should interest them as psychiatrists was the variation and distribution of mental illness and mental abnormalities, and in his own investigations in 1925 and 1929 he found that in the distribution of mental deficiency one of the great disparities was

the difference in distribution in the rural and urban areas. From whatever angle data were collected he found that mental deficiency had an incidence at least 50 per cent. higher in the rural areas than in the urban areas. He did not mistake rusticity for mental retardation, being careful to avoid that obvious pitfall. At the same time, he did not say that the average level of intelligence was lower in the rural areas. If he did colleagues from across the border would soon correct any such tendency, because the Scottish Education Department applied educational tests throughout all the schools both in the rural and urban areas, and they found that the average level was not lower in the rural areas than it was in the urban areas, but as far as mental deficiency was concerned (and he did not think that the Scottish figures could give much evidence on this particular point because the test was a little too crude to differentiate the lower levels of intelligence) there was undoubtedly a higher incidence in rural areas. In investigating that data or that result he thought some very interesting sidelights were thrown on how mental deficiency cropped up. In the rural areas mental deficiency was to be found in very small pockets. In Cardiganshire, which was totally rural, the incidence of mental deficiency was high because there were a dozen or 15 small pockets of mental defectives, and when these were investigated it was found that there had been a great deal of migration from these districts to the urban areas. The brighter people had left the district and left a small group of retarded people to inbreed and produce defectives and throw up the incidence considerably. He wondered if there was a similar incidence of psychosis in the rural areas. The numbers in the mental hospitals were not a complete guide to the actual number of people suffering from psychosis, because a number of such patients were kept by the public assistance institutions, especially in an area such as Lancashire.

Coming to the towns the distribution of mental deficiency was very well marked. There, as Mr. Caradoc Jones and Dr. Roberts said, he found he was working in certain wards in the large towns where there were slums and poor surroundings, and there was a great disparity in the incidence of mental defect amongst the school population in the various schools; the ward which belonged to the professions had very few mental defectives. He soon found in the towns that mental deficiency was really a question of social stratum, and it struck him how much social deficiency there is which could not possibly be brought within the scope of the Mental Deficiency Act. Those who had read the Report of the 1905 Royal Commission would remember that people gave evidence thinking that the new Act would deal with all forms of social deficiency due to poor mental intelligence. With regard to crime one very responsible doctor said that 80 per cent. of recidivists were mental defectives; and many people thought that once the Mental Deficiency Act was passed the recidivists could be effectively dealt with, but it only enabled 5 to 10 per cent. of recidivists to be dealt with. There was a great deal of mental retardation which could not be brought within the scope of the Mental Deficiency Act, and the social inefficiency which could not be dealt with under the Mental Deficiency Act or any other Act produced most serious problems. Psychiatrists should address themselves to the group of people with I.Q.'s between 70 and 85, because from that group many of the most serious problems arose.

Dr. FERGUSON RODGER was very grateful to Dr. Lewis for his optimism. It was a serious thought which had been presented by three experts that by the year 2,000 there should be such a profound fall in the intelligence quotient. Dr. Lewis had raised the question whether this might not be largely cultural, and he found it difficult to understand how the experts seemed to ignore the striking work which was being done in America which showed the association between the intelligence quotient and culture. There was a correlation between the intelligence of children and their foster parents in the fact that there were such striking differences between the environments and the intelligence.

Another point which struck him as very important was the one which Prof. Penrose raised about stature—the fact that in Toronto at one time statisticians predicted, because the children of large families tended to be shorter than the children of small families, there would be a fall in stature in the next generation. He thought that these speculations that the I.Q. was falling was an affront to common sense. If these very large falls were expected it should be possible in the Scottish survey of intelligence of schoolchildren to come to some estimate as to whether the fall which had occurred since the last survey (in 1931) had occurred. The I.Q. test was subject to the culture in which it was performed and the culture

would change in 15 years and it was difficult to get a test which would act from one generation to another.

A further point was the fact that stature had been described in these genetic terms, other things, too, including infantile mortality. There was an echo of that in Mr. Caradoc Jones's paper, in which he said there was an association between feeblemindedness and feebleness of stock. He drew attention to the fact that in the families of feebleminded children there was a greater fatality, presumably that was due to bad care and environment; presumably there was genetic feebleness, but not so long ago the infantile mortality amongst the lower groups was described as due to feeble stock. They did not any longer believe that, but there was a suggestion of it here. There had been pessimism in the past about other things which, in the end, had turned out to be unjustified, and he had the feeling that it would turn out all right again.

Dr. NOEL BURKE said that they had seen the table of the possibility of 70 I.Q. children according to the I.Q. of the parents, but he though it needed correction by the possibility of superior children being born to the same parents. He would like to see those figures put alongside in the same sort of table. It would help to adjust his views. The man who knew the figures might say that it followed automatically; he did not know. It had been said that it was bad to be born late in a family; he wondered if allowance had been made for the other finding of the statistical experts that the large family, on the whole, only came from people of poor quality, because if these two things were put together it seemed one would have to say that people who were sixth, seventh or eighth in the family were most likely to be people born of poor quality family and were already weighted adversely.

Then there was the question of social customs. There was no doubt that the probably more intelligent, certainly better-off families, had changed their habits and reduced their fertility. He was one of four, his father was one of seven, his father was one of a dozen, and his father was one of a dozen. Had the lower quality changed, or was there any evidence that they were changing their fertility habits? He had the impression that some were; it might be only the better ones of the so-called working classes who were beginning to reduce their families. One saw the better members of one's staff, for instance, having one, two or three children, and the not so good having six, five or four. Supposing there was some importance in the changing of social customs, was there any possibility that alteration of these customs would aid the alteration of the trend which the statisticians feared? If one studied the Births Column of *The Times* it would be found that people were having more children who at one time had one or none. All the young people out of the Services were determined to have children at the earliest possible moment, and he wondered whether there was a change in the feeling of taking the risk of having children in the classes which used not to take the risk.

Dr W. MAYER-GROSS did not wish to go into the matter of discussing optimism and pessimism in this respect, and he did not agree with Dr. Fraser Roberts that one could set these American experiences against the excellent work which had been done by a number of first-class workers in this country. He could not quite understand if Dr. Lewis thought that the intelligence test did express quite such a report, and one would expect with progressing civilization to get better results.

He wished to contribute something factual from a social survey in a rural area carried out in his department, and which would soon be terminated, and with regard to which he was very impressed by an observation which had been mentioned by Dr. Lewis. First of all, the figures of the dull and backward and the feebleminded were even higher than Dr. Lewis had found 15 years ago. He was also impressed by the fact that these were found in groups and patches in the different country districts, and also by the fact that obviously the migration of the energetic people to the towns and other districts deprived the country of the more intelligent stock. He thought this depopulation of the qualitative stock was an enormous danger which could not be denied, and against which some measure of remedy should be found. He thought psychiatrists working in rural areas should, by their knowledge, try to counteract this depopulation of the rural districts.

One last word about the comparison between Dr. Lewis's figures and the figures of the Scottish Education authorities; he felt they could not be compared. Dr. Lewis's figures on mental defectives were mainly based on certification, while the Scottish investigation was a general investigation of the population, including all children, and that gave a very different picture. From his own rural district he

found that Dr. Lewis's findings were confirmed and that the Scottish figures of 1935 were contradicted. He did not know why this was, but thought the reason was partly that children under a special grade of intelligence were left out of the survey.

Dr. A. A. W. PETRIE said that there were one or two points he had hoped would be mentioned on the problems of social customs. There had not been any clear discussion yet on the point of social custom, namely, of contraception versus the problem of fertility, and these two things were not the same, because the problem of fertility in different types, classes, nations and so on was a very important one, apart from the social custom habit of tending to have fewer children in a higher stage of development. The mental defective had probably been less influenced by that social custom than had any other class. He remembered at one of the inquiries,—he thought it was the Brock inquiry about 12 or 15 years ago—Lord Dawson gave evidence that contraception had reached the level of the day labourer, a statement that 15 years ago was more liable to contradiction than it was to-day. To-day it would probably be accepted as a fact. The more intelligent type of parent wished to give each child a better chance in the world. The mental defective group would not be influenced by such considerations, and one still came across the 12 and 14 family which was so common 50 or 60 years ago. In that type of family there was nearly always the defective or the near defective. He did not know anybody who could collect families of 14 or 15 in the highly educated classes, whereas many could talk about their grandparents and great-grandparents having had a considerably number of children because the social habits had changed, and in a more competitive and struggling world they tried to give their children a better chance in life.

Dr. Roberts stated that owing to like marrying like the incidence was being differently distributed, and the speaker thought that information might be conveyed to the highest levels because it was said that a classless society was going to be set forth in England, and obviously the genetic factors and the trends of human nature, as one hardly needed to be told, were rather against it. The biological urge tended to segregate different types from each other intellectually as well as in every other factor.

One had hoped, perhaps, although it was such a factual informative meeting that one should not ask for it, that some recommendations would come out of it, that the Chancellor of the Exchequer might ease the burdens on certain types and so on, but this was something that this country had seriously to consider, how far they could take these trends. Were these trends natural? Dr. Rodger referred to the cultural levels. Had not the higher cultural levels tended, in history, to be diminished and be replaced by cruder types? The more cultured elements tended to be recruited from below and that might prevent, of course, the advancement of men towards the millenium, and might tend always to maintain the same sort of level. That really might be one very distinct factor, but as a nation it had to be considered how the good stocks could be improved and the bad stocks diminished, and that was something which Lord Dawson was most emphatic about. He said that the natural processes by which these less viable stocks ordinarily died out under an artificial system were obviated, and they were protected and flourished until they choked the whole nation. Something had to be done to compensate for the artificial maintenance of stock which under the natural law of the jungle would cure itself by dying out, owing to its inefficiency and poor vitality. He had always thought that it was important to have a man who could advise those in higher circles on what should be more than obvious.

Dr. Blacker gave a slight hint of the statistics which would be available in the next 20 or 30 years. He hoped these statistics would be kept as simple as possible, but he admired Dr. Blacker's optimism when he said that the medical man would complete the case-sheet the next day. At the same time, if they were to benefit by having a well-planned service, obviously the statistical section would be more than important for answering the many questions on the statistical research lines which could be answered if there were various assumptions on the lines Dr. Blacker indicated.

Dr. CRAWFORD thought it might be interesting to have a little clinical note; on the deficiency side he had been told that there was a different type of defective to deal with, especially in the higher grades. He mentioned this because of what Dr. Lewis had said with regard to the cultural and environmental side being more

important. There was not much difference in the Binet I.Q. point, but there was a large swing in that type. There was the defective who belonged to the subcultural group, who formed quite a large part of the patients; they were delinquents and their I.Q. showed them to be defectives, yet he would say that they were completely different. Their number was increasing. Inside the institution there were two classes, one a subcultural group and the other defectives as they knew them.

Dr. K. K. DRURY asked if the statisticians could give the other end of the table and bring it back to 1800, 1700 and 1600, and say what the ratio of defectiveness was then compared to what it was now. If it went from 1·5 to 1·4 in 100 years, by the time the calculations reached Elizabethan times they must have been supermen, and that was not so. It would be most interesting to know what was the proportion of mental defectives in the year 1400.

Dr. T. A. MUNRO said that Dr. Blacker gave in detail the method of obtaining some really useful facts about psychosis and numbers of patients suffering from mental disorder and all the various factors relating thereto. It was very right that he should do so. After he began to know a little about dealing with figures he was very impressed by the ease with which one could collect really valuable facts, or facts which were capable of being interpreted by quite simple means. He felt, however, that the number of facts which one had to collect on any form must be small and exceedingly simple. It was only too easy to go the other way and pile up a large number of facts about whose accuracy one had doubts, and therefore one had doubts on the value of any interpretation. Dr. Blacker also mentioned the value of the facts which might be compiled on a punched card for research. The speaker agreed, but would suggest that it would be more valuable to collect a small amount of correct data in the same form throughout for a more intensive survey and to concentrate rather on two or three hospitals or areas in England, perhaps a town and rural area, and there set up a definite research unit. Besides having the forms and the cards, one had to have the man or the team of workers who were really interested in finding out these things, and who would take care that the cases were adequately surveyed and the information obtained was correct. He would not like even to bother to read a paper which discussed family histories if he knew that these family histories had been written down by a patient in an out-patient room, while waiting to see a doctor.

Mr. Caradoc Jones, Dr. Fraser Roberts and Dr. E. O. Lewis mentioned the important surveys they had made. It was clear how valuable these surveys had been, because they continued to be quoted; they lived because the work in them was carefully compiled and, as Mr. Caradoc Jones had shown, they contained a vast number of facts. These facts, if they were carefully recorded, were always open to interpretation, and generally more facts could be dug out of the work done later on.

To come to one definite point, Dr. Fraser Roberts mentioned that a possible factor in the fall of I.Q. was the large size of the family or alternatively the late maternal age, and possibly one might take a more optimistic view of the fall if people in the future had fewer children and these large families did not occur. This was the kind of fact which could be dug out quite easily from Dr. Penrose's survey of mental defectives at Colchester. One would expect to find that there were more mental defectives among the later children of the mother than the earlier, or, alternatively, one would expect to find that there was an association of low intelligence with an older mother's age. That information could, he was sure, be obtained quite simply by merely looking at the appendix of Dr. Penrose's survey. He did not wish to misquote his former chief, but he thought he did show that that effect did not occur in families. The mental deficiency in the sibships was scattered throughout all the siblings, with the one exception of mongolism. That was the value of a survey which was carefully, correctly done and well recorded. The survey which he did in mental deficiency awaited being done in a mental hospital—he would pass it on to Dr. Blacker and Dr. Maclay.

He was glad to hear Dr. E. O. Lewis speak about his work in town and rural areas, because it reminded him of the work he did when he was to some extent under Dr. Lewis's charge on the Committee controlling his own work on consanguinity. It was striking in rural areas in Suffolk and the fen country to see social and cultural factors very dynamically at work. He met one doctor who had been 30 years in practice in a rural village and he told him how 30 years ago there

was a lot of inbreeding; the boys and girls never left the village; now they went on the 'bus to the local town 20 miles away and met the people they would marry. He remembered going to a house in the fens and meeting a grandparent who had never been to Cambridge, never seen the sea, or been to London, and he met parents who had been as far as London, and he met children who had been taken on a school tour to Holland. There was a much larger mixing of the population. Although he would agree that these social and cultural factors were strong and real, he could not go as far as Dr. Ferguson Rodger in saying that they were of more importance than purely hereditary factors. Dr. Fraser Roberts's work and Dr. E. O. Lewis's work proved scientifically that in general brainy parents had brainy children and dull parents had dull children, and if dull parents had more children than brainy parents then it was inevitable surely that there would be in the next generation a larger number of dull children. That did presuppose that the social and cultural factors remained the same, and he was sure that it was these neglected factors which were proving very much in a changing and dynamic society.

The PRESIDENT said that this was a very fundamental problem, and he thought that it had been necessary to present the facts in the way in which they had been presented. Suggestions had been made of an approach towards this problem, which was not merely a problem of psychiatry, but a problem for our nation if it was to survive at an adequate level. They could not be complacent about the situation; psychiatrists had not taken sufficient part in putting these problems of hereditary constitution and environmental structure; he did not think they had ever taught their medical students these facts, and it was surprising to find the ignorance of medical people in general in regard to questions which were not only of national but of great international significance if they were going to help a people which were going to have great difficulties in the future to contend with. That was why he felt that it was essential to build up a positive eugenic programme as fully as possible, and to inform not only their fellow medical men but the public in regard to matters which were striking at the structure of society.

Dr. BLACKER, in reply to the discussion, thanked the President for his expression of the importance of the symposium, although each contributor had touched on very different aspects of the general theme of the population. Most of the questions had been directed to the other two speakers, but he had jotted down one or two points which had a bearing on the questions which had been asked.

With regard to Dr. Munro's statement on facts and their value he could not agree more, and he was the last person to burden the doctor with more form-filling, but by organizing the records department it was possible to collect the data which were available and collate them in a way which had not been done in this country. The absence of mental health data compared to what was produced by other countries was something which there was a wonderful opportunity of remedying now. The mental health records could be made the best in the world with the changes which were promised.

He would agree with Dr. Munro that some of the facts which might be put forward might be of dubious value, and he distinguished between the demographic and the medical data. He had far less doubts in his mind as to the statistical value of the demographic data than he had of the medical data. He never suggested for a moment that a patient should be asked to fill in details of his family history while waiting to see the doctor; he suggested that the patient should be asked to recall the number of live siblings of his own and how many children, if any, he had got. Those two facts between them would enable them to work out all sorts of correlations relative to the fertility of these different elements in the population. It was extremely simple, and involved practically no extra work.

Where the difficulties would arise would be on the question of diagnosis. There was sitting at the moment a world conference to try to standardize diagnosis, and it was hoped eventually to produce agreement on a standardized list of diagnoses as between the U.S.A., Canada and this country, and when that list was perfected it was hoped, in theory, that the data from Canada, the United States and this country would be available, but when one examined the list of proposed psychiatric diagnoses one felt gravely disturbed as to the possible value of such comparisons, because he found there were, roughly speaking, 25 items divided into three main headings: psychoses, psychoneuroses and psychopathic personality. Under the heading " psychoneuroses " there was neurasthenia and hypochondriasis, and unless there was general agreement as to what conditions were covered by such

terms—neither of which was ever used at the Maudsley Hospital—what would be the value of the figures when they were compared and the statistics were worked out? This was where there would be muddles, much less than on the demographic data, unless the Committee gave an indication of the kind of case to which these labels should be attached. There would be large areas in which there would not be any neurasthenia or hypochondriac cases. The activities of the Committee would depend on its capacity to formulate fairly clear meanings of the terms they were proposing to adopt, and then persuading people who thought they were extremely bad and valueless to use them, which would be difficult.

Several speakers had mentioned cultural levels. He felt a great deal of sympathy with those who spoke about the influence of cultural levels on intelligence tests. He had read two books recently which had set his mind to work on the subject, one was called *The Oregon Trail*, which consisted largely of an account of the wanderings of a tribe of Indians. The buffalo provided their food, accommodation and clothes, and they fought against the neighbouring tribes. The chief of a village was a magnificent human specimen, who had over 30 squaws of his own; there was nothing to prevent anyone assassinating him except that the whole family would have a vendetta against the killer. The chief was the most warlike, most vindictive man and, incidentally, the most prolific. Suppose one was to take a Binet I.Q. of a tribe of Indians; the result would seem to show that theyhad not very much intelligence, but the intelligence was different and the scale of tests would have to be different. The other book was Mr. Frank Lorimer's study of the population of Russia. The majority of the population of the U.S.S.R. was illiterate in the time of the Tzars; the literacy had now been raised to something like 70 to 80 per cent., and that would make a difference to the capacity of doing the test. If the Binet test was given to an unselected sample of children in a Russian village under the Tzar they would do a great deal worse than they would do to-day. The education that they had received would make a great deal of difference. One felt that the tests themselves would undoubtedly undergo modifications, and it was part of the plan of the Scottish Education Committee that regular tests should be carried out at intervals and that new ones should be introduced as time went on, so that it was necessary to feel that the technique of testing was capable of improvement. It was difficult to standardize the results of the tests, and be quite sure that the conditions were similar when making two investigations separated by a long interval.

Dr Petrie raised a fundamental question when he said that the remedies had not been discussed. He had intended to say something which would touch on that subject, but it was an immense subject. The cultural pattern was being altered at the moment in a significant way in certain countries. He was thinking of France, where, as a result of the introduction of enormous family allowances, fertility had shot up. A great many of the patterns prevalent in 1939 were now changing, and there was an exceptionally enlightened school of French demography which was studying these matters. The Royal Commission on Population which began sitting in 1943 had all these questions before it.

Dr. Fraser Roberts, Dr. Aubrey Lewis and the speaker gave evidence before the Commission and he was a member of their Biological Sub-Committee, and this matter was very much before their minds. The word "demography" and the population studies should cover not only quantitative considerations, but qualitative considerations. It was of interest that Sir Cyril Burt's Memorandum, to which many references had been made, was originally submitted by him as a Memorandum to the Royal Commission on Population.

The policy side of this matter was being extremely closely studied by the Royal Commission, and when the Report appeared—it was promised for this year—it would be found that recommendations on policy emerging from its findings would not be omitted and they would have something significant to say on the subject.

Mr. CARADOC JONES said that there was one point which was raised in regard to the high mortality rate among defectives, and it seemed that he gave the impression that the whole of it was due to poor stock. He did not mean to do that. Some of that high mortality was undoubtedly due to the less care which was taken by less intelligent parents of their children and the environment in which they lived. One speaker put his finger on the right explanation of the difference in size in family as between the less intelligent and the more intelligent. He thought it was to a large extent explained by the fact that the more far-seeing parents tended rather to

restrict the size of their family, being anxious to give them a good education and so on, and the less intelligent did not look to the future at all and so they did not limit the size of their families.

Dr. FRASER ROBERTS said that many interesting points had been raised in the discussion, some of which had already been replied to. It was impossible to deal with them all, but he would mention a few. First of all he would like to deal with the point of projecting the calculations into past years and whether the population was a race of supermen in Elizabethan times. It was certain that the trend in differential fertility could only have existed in its present force for a comparatively short time. It dated from the serious decline in the European birth rate which started in 1870. There was good evidence that there was something of the kind long before that but it was weaker, and it might be that the trend in previous centuries was more than counterbalanced by differential mortality.

Dr. Burke asked about the table showing the highly intelligent children born to people at these different I.Q. levels; it was exactly the same table turned round the other way. Dr. Ferguson Rodger mentioned the American work showing the cultural and environmental differences could affect the results of intelligence tests. There was nothing very new in that, Prof. Burt had done quite a lot of work on that subject and he showed that there were these effects. What he emphasized in his recent pamphlet was not that cultural levels did not affect mental tests, but that in good mental tests one did as far as possible equalize. The Ohio work had been so destructively criticised that it was not worth quoting. It was replete with statistical inaccuracies. The work was really highly unreliable.

Dr. Munro's answer to Dr. Ferguson Rodger put the whole thing in a nutshell; the plain fact was that if the more intelligent were having fewer children the less intelligent were having more, and if inheritance had anything to do with it at all then the units making for high intelligence were being lost. Nothing would get over the seriousness of the loss of these basic units.

He would add one remark to what Dr. Blacker and Dr. Munro said about records. He agreed that records should be simply a few facts well ascertained.

The PRESIDENT moved a hearty vote of thanks to Dr. Blacker, Mr. Caradoc Jones and Dr. Fraser Roberts for a very interesting discussion, which was accorded by applause.

HEAD INJURIES: A NEW TREATMENT FOR THE POST-CONCUSSIVE SYNDROME.

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GUNSHOT and shrapnel wounds of the head during the war have produced various disabilities not commonly seen in the injuries of peace-time.

The symptom complex which usually appears subsequent to head trauma has become very familiar during the past few years. The resemblance from case to case of certain sequelae to head injuries has been grouped together in syndromes, variously labelled post-concussive syndrome, post-traumatic personality change, post-traumatic neurosis and post-contusional state, all indicating an oft-recurring persistent disability following concussion of the brain.

Many different types of investigation have been carried out, and in each instance some light has been shed on some particular phase of the symptom complex.

PATHOLOGY.

Definite pathologic changes in this syndrome have not been fully established. While various investigators believe the disorder is primarily of an organic nature, other observers have advanced evidence of its being a pathophysiologic derangement. Neustatter (1) has demonstrated the difficulty in deciding whether the syndrome is physiogenic or psychogenic.

The definition of concussion as presented by Strauss and Savitsky (2) is broad enough to allow for many of the theories of its pathophysiology—"a series of events resulting from a blow to the head severe enough to cause disruption of intracranial equilibrium."

It has been suggested by several investigators that the effects of cerebral trauma may be cumulative. As far back as 1874 Koch and Filene (3) proved that animals could be killed by repeated small blows on the head without showing evidence of any structural damage to the brain.

Martland (4), in 1928, recognized a condition occurring among prize-fighters which he named "punch drunk," and which was attributed to the repeated head punishments they had suffered while in the ring. Later, Shaller, Tarnaki and Newman (5) showed the apparent increase of vulnerability of the cerebral vessels induced by the application of repeated blows.

More recently Denny Brown and Russell (6) demonstrated that paralysis of respiration of increasing duration and rise of blood pressure occurred with successive blows, and that concussion could be obtained readily by repetition of moderately severe blows.

Penfield (7) has advanced the theory that the development of dural adhesions is the basic cause of the symptoms, and has demonstrated in a number of cases thin adhesions in the subdural hemisphere. Histologically these lesions are composed of a thin layer of blood undergoing the process of organization and adherent to the arachnoid as well as the dura. On pressure being applied, by means of a curved instrument on the under-surface of the dura during the course of an operation under local anaesthesia, the patient complained of a head pain of the same character as the chronic headache of a post-concussive syndrome. In such cases, apparently, the exciting agent may be either constant traction or pressure on a sensitive area in the under-surface of the dura. Penfield also believes that during the actual trauma the brain is temporarily " knocked out " of position by the blow, and when the normal relationship is restored, traction adhesions are formed. These findings induced him to adopt lumbar air insufflation as treatment.

Zacks (8) has given adequate proof of degenerative changes in the cells themselves, which bring about an altered physiologic state. He believes it probable that there is a change in the irritability of the vasodilators and vasoconstrictors, with resultant areas of localized altered circulation.

Glaber (9) agrees with this theory, and adds that these changes are transient and may be actively reversible.

Courville (10) suggests that the mental changes often seen as part of this condition are primarily vaso-motor phenomena.

A striking liability of headache, localized to the site of previous scalp injury, to provocation by posture or physical effort, provides evidence that such provocation in the more diffuse types of headaches indicates underlying structural damage. Provocation by histamine, particularly when the headache has been unilateral, suggests that intracranial localized vascular or perivascular changes may occur (Brenner, Fieldman, Merritt and Denny Brown, 11).

Ruesch and Bowman (12) state that in head injuries the organism seems to respond more slowly and less extensively to stimulations requiring metabolic and circulatory adjustments. They consider it might be worth while to investigate further biochemical and circulatory aspects in post-traumatic conditions, thus reducing the number of cases whose symptoms have been explained on a " psychogenic basis."

Kozol (13) found little or no correlation between pre-traumatic personality and liability to development of post-traumatic mental symptoms.

A post-traumatic condition cannot be regarded as a definite purposive reaction to trauma of a very varying nature. " The change that has escaped notice is that the psychogenic stimuli which now produce symptoms would not have been effective before the injury " (Sargant and Slater, 14).

We are presenting additional proof in support of Malone's (15) evidence that such vascular pathophysiologic changes play an important if not dominant role in this symptom complex.

Diagnosis.

Psychiatric symptoms are common among the sequelae of head injuries. These symptoms vary in intensity and duration from case to case. At one extreme may be increased irritability and occasional headache. At the other extreme may be a fully developed syndrome. The post-concussive syndrome usually presents a triad of symptoms—headaches, dizziness and various emotional disturbances.

A series of 88 soldiers who had suffered head injuries with unconsciousness was investigated at Sutton Emergency Hospital. As some months, and in some cases years, had elapsed before the admission of such cases, in all instances defects were of such severity and duration as to render the patient incapable of existing satisfactorily in his previous environment, and the fact that in 44·3 per cent. of cases symptoms had existed for a year or more seemed to indicate a poor prognosis.

This group of individuals showed a superficial uniformity of symptoms. Headaches, dizziness, disturbances of feeling and behaviour with vasomotor and emotional instability, impaired efficiency and fatigue were the commonest complaints related to the disability, particularly to prolonged disability. Many were handicapped through memory defects, defects in intellectual capacity and ability to concentrate, or through personality changes, such as moodiness and irritability (Table I).

Of the total number examined, 6 had suffered two head injuries, 4 cases had had three, and 1 case four.

The time which had elapsed between the accident and the date of admission to hospital is shown in Table I. Twenty-five patients were admitted within six months of the accident, 27 from six to twelve months after, and 20 from one to two years after. In addition, 16 patients were admitted at periods of from two to seven years following trauma.

Fifty patients developed symptoms immediately following the accident, 17 from one to two months after, 4 within three months, 4 after an interval of from three to four months, and 2 within six months. In the remainder the onset was gradual.

Forty-eight patients had had previous hospital treatment for varying periods with little or no benefit.

Patterson, Raynall and Kremer (16) recently discussed various aspects of the development of post-traumatic personality disorders, and made it clear that disturbances of even mild degree may have serious consequences, therefore early hospital treatment is advocated.

Therapy.

The rehabilitation of such men who had undergone combined organic and psychic injury has provided a serious problem during the war, an organic injury rarely occurring without concomitant psychologic effects. Because of the fact that psychogenic factors frequently complicated the clinical picture, many of these patients were unfortunately labelled neurotic.

Treatment so far has been carried out on no approved lines, and there has

Case.	Age.	Date since injury.	Fracture.	Unconscious.	Post-traumatic amnesia.	Symptoms. Headaches.	Dizziness.	Emotional instability, lack of concentration, memory impairment, irritability.
1	40	3 yrs.	+	15 mins.	1 day	+	+	+++
2	23	4 mths.	+	4 hrs.	Days	+	+	++++
3	27	18 wks.	+	10 mins.	..	+	+	+++
4	38	4 yrs.	..	15 mins.	..	+	+	++
5	31	6 yrs.	..	30 mins.	3 days	+	+	+++
6	25	6 mths.	..	20 mins.	..	+	+	++
7	34	11 mths.	..	7 hrs.	..	+	+	++
8	35	1 yr.	+	1 hr.	1 day	+	+	+++
9	44	4 yrs. 6 mths.	+	2 days	..	+	+	+++
10	52	1 yr. 10 mths.	+	5 hrs.	Days	+	+	++++
11	34	10 wks.	..	45 mins.	Hours	+	+	++
12	22	9 mths.	..	5 hrs.	3 days	+	+	+++
13	27	8 mths.	..	7 hrs.	..	+	+	+++
14	25	8 mths.	..	15 mins.	Dazed	+	+	+++
15	20	10 wks.	..	2 hrs.	Hours	+	+	+++
16	38	6 mths.	+	2 hrs.	24 hours	+	+	+++
17	35	2 yrs. 6 mths.	..	12 hrs.	..	+	+	+++
18	27	21 wks.	..	5 mins.	Dazed	+	+	+++
19	24	1 yr.	..	10 mins.	..	+	+	++
20	22	3 mths.	..	20 mins.	2 weeks	+	+	++++
21	31	21 wks.	+	10 mins.	3 days	+	+	++
22	31	4 wks.	..	5 mins.	48 hours	+	+	++
23	24	1 yr. 7 mths.	+	1 hr.	Hazy for days	+	+	++
24	39	2 yrs.	..	10 mins.	..	+	+	++
25	25	2 yrs.	..	35 mins.	..	+	+	+++
26	23	1 yr.	..	30 mins.	..	+	+	++
27	21	6 mths.	+	2 hrs.	Dazed for time	+	+	+++
28	25	61 wks.	..	10 mins.	..	+	+	++
29	23	7 yrs.	+	3 hrs.	Hazy for days	+	+	+++
30	26	10 wks.	+	5 mins.	..	+	+	++
31	26	4 yrs.	+	15 mins.	2 days	+	+	++++

Examination.					
Ocular fundus.	Tinnitus.	Nystagmus.	Vision.	Number of injections	Result.
Normal	No	None	Normal	17	Gradual relief of symptoms with complete recovery. No recurrence 6 months after.
,,	Yes	Spontaneous rotary	,,	20	Rapid recovery with relief of all symptoms. Had 3 head injuries. No recurrence 3 months after.
,,	No	None	,,	16	Complete relief of all symptoms.
,,	,,	,,	,,	20	Rapid recovery with relief of all symptoms.
,,	,,	,,	,,	19	Gradual relief of all symptoms. No recurrence 8 months after.
,,	,,	,,	,,	14	Gradual improvement with complete recovery.
,,	,,	,,	,,	12	Complete relief of symptoms. No recurrence 3 months after.
,,	,,	Spontaneous lateral	Presbyopia	16	Rapid recovery with relief of all symptoms.
,,	,,	None	Normal	20	Gradual relief of all symptoms.
,,	Yes	Bilateral rotary spontaneous	,,	21	Gradual improvement with ultimate complete recovery.
,,	No	None	Hypermetropia	16	Relief of all symptoms except emotional instability.
,,	,,	,,	Normal	20	Gradual relief of all symptoms. No recurrence 4 months later.
,,	,,	,,	,,	18	Complete relief of all symptoms.
,,	Yes	,,	,,	15	Rapid recovery with relief of all symptoms.
,,	,,	,,	Refractive error	20	Relief of all symptoms except emotional instability.
,,	No	Lateral	Normal	17	Gradual relief of all symptoms, with complete recovery.
,,	,,	None	Presbyopia	14	Complete relief of all symptoms. No recurrence 7 months after.
,,	,,	,,	Normal	18	Gradual relief of all symptoms, with complete recovery.
,,	,,	,,	,,	14	Gradual improvement with ultimate complete recovery.
,,	,,	Bilateral rotary spontaneous	,,	16	Gradual relief of all symptoms, with complete recovery. No recurrence 6 months after.
,,	,,	None	,,	14	Rapid recovery with relief of all symptoms.
,,	Yes	,,	Refractive error	16	Complete relief of all symptoms.
,,	No	,,	Normal	18	Gradual improvement with eventual complete recovery.
,,	,,	,,	,,	14	Complete relief of symptoms. No recurrence 6 months after.
,,	Yes	Lateral	,,	17	Rapid recovery with relief of all symptoms.
,,	No	None	,,	17	Complete relief of symptoms. No recurrence 5 months later.
,,	,,	,,	,,	15	Gradual relief of symptoms, with complete recovery.
,,	,,	,,	Presbyopia	18	Rapid recovery with relief of all symptoms.
,,	Yes	Bilateral spontaneous rotary	Refractive error	20	Gradual improvement with eventual complete recovery. No recurrence 6 months after.
,,	No	None	Normal	16	Rapid recovery with relief of all symptoms.
,,	Yes	Spontaneous rotary	,,	18	Relief of all symptoms except emotional instability.

Case.	Age.	Date since injury.	Fracture.	Unconscious.	Post-traumatic amnesia.	Symptoms. Headaches.	Dizziness.	Emotional instability. lack of concentration, memory impairment, irritability.
32	33	4 mths.	..	10 mins.	Dazed for time	+	+	++
33	32	11 mths.	+	1 hr.	Hours	+	+	+++
34	40	3 mths.	..	3 hrs.	1 day	+	+	++
35	27	3 yrs. 10 mths.	+	5 days	Dazed for time	+	+	++
36	24	7 mths.	..	30 mins.	..	+	+	++
37	31	4 yrs.	..	15 mins.	..	+	+	++++
38	25	1 yr. 4 mths.	..	1 hr.	Dazed for time	+	+	++
39	28	1 yr. 5 mths.	..	35 mins.	Hours	+	+	++
40	26	5 mths.	+	10 mins.	1 week	+	+	+++
41	21	10 wks.	..	45 mins.	..	+	+	+
42	27	14 wks.	..	2 hrs.	Dazed for time	+	+	+++
43	20	19 wks.	..	4 hrs.	Ditto	+	+	++
44	23	7 mths.	..	10 mins.	..	+	+	+++
45	27	4 mths.	..	15 mins.	..	+	+	+++
46	21	9 mths.	..	20 mins.	..	+	+	+++
47	29	18 mths.	..	10 mins.	..	+	+	++
48	28	18 mths.	..	7 hrs.	..	+	+	+++
49	21	13 mths.	+	30 mins.	4 days	+	+	+++
50	26	11 mths.	+	20 mins.	24 hours	+	+	++++
51	32	7 mths.	+	6 hrs.	1 week	+	+	++++
52	27	9 mths.	+	8 mins.	24 hours	+	+	+++
53	26	54 wks.	+	3 days	..	+	+	++
54	31	7 mths.	+	30 mins.	10 days	+	+	+++
55	35	5 mths.	..	10 mins.	Dazed for time	+	+	++
56	38	4 yrs.	+	17 hrs.	..	+	+	+++
57	29	4 mths.	..	6 hrs.	6 weeks	+	+	++++
58	39	3 yrs. 4 mths.	+	1 day	..	+	+	++++
59	25	3 yrs. 1 mth.	..	20 mins.	Dazed for time	+	+	+++
60	23	6 yrs.	+	1 day	3 days	+	+	+++

Examination.					
Ocular fundus.	Tinnitus.	Nystagmus.	Vision.	Number of injections.	Result.
Normal	No	None	,,	10	Rapid recovery with relief of all symptoms.
,,	,,	,,	Refractive error	15	Rapid recovery with relief of all symptoms.
,,	Yes	,,	Normal	15	Complete relief of all symptoms.
,,	No	Spontaneous rotary	,,	21	Gradual improvement with ultimate complete recovery. No recurrence 6 months after.
,,	,,	None	,,	16	Complete relief of all symptoms.
,,	,,	Bilateral rotary spontaneous	,,	44	Gradual improvement with ultimate recovery except emotional instability.
,,	,,	None	,,	14	Rapid recovery with relief of all symptoms. No recurrence 3 months after.
,,	Yes	Lateral	,,	18	Gradual relief of symptoms with complete recovery. No recurrence 4 months after.
,,	,,	Spontaneous rotary	Presbyopia	15	Complete relief of all symptoms.
,,	No	None	Normal	15	Complete relief of all symptoms.
,,	Yes	Bilateral spontaneous rotary	Refractive error	14	Relief of all symptoms except emotional instability. Improvement maintained 6 months after.
,,	No	None	Normal	16	Rapid recovery with relief of all symptoms.
,,	,,	,,	,,	15	Gradual improvement with ultimate complete recovery.
,,	,,	None	Normal	14	Rapid recovery with relief of all symptoms.
,,	,,	,,	,,	14	Rapid recovery with relief of all symptoms.
,,	,,	Lateral	,,	12	Complete relief of all symptoms. No recurrence 7 months after.
,,	Yes	Spontaneous rotary	Refractive error	16	Gradual improvement with ultimate complete recovery. No recurrence of symptoms 4 months later.
,,	,,	Bilateral spontaneous rotary	Normal	18	Gradual relief of all symptoms with complete recovery.
,,	No	None	,,	20	Gradual relief of all symptoms except emotional instability.
,,	Yes	Spontaneous rotary	,,	19	Gradual relief of all symptoms except emotional instability.
,,	,,	Lateral	Hypermetropia	19	Gradual improvement with ultimate complete recovery. No recurrence of symptoms) 7 months later.
,,	No	None	Normal	17	Gradual relief of all symptoms with complete recovery.
,,	Yes	,,	,,	19	Gradual relief of all symptoms with complete recovery. No recurrence of symptoms 4 months after.
,,	No	,,	,,	14	Rapid recovery with relief of all symptoms.
,,	,,	Spontaneous rotary	,,	20	Gradual relief of all symptoms with complete recovery. No recurrence 8 months after.
,,	Yes	Lateral	Refractive error	18	Gradual improvement with relief of all symptoms except emotional instability.
,,	No	Bilateral spontaneous rotary	Normal	20	Gradual improvement with ultimate complete recovery. No recurrence of symptoms 6 months after.
,,	,,	None	Presbyopia	21	Gradual relief of symptoms with ultimate complete recovery.
,,	Yes	,,	Refractive error	23	Gradual relief of all symptoms. No recurrence 6 months after.

Case.	Age.	Date since injury.	Fracture.	Unconscious.	Post-traumatic amnesia.	Symptoms. Headaches.	Dizziness.	Emotional instability, lack of concentration, memory impairment, irritability.
61	21	2 mths.	..	30 mins.	..	+	+	+++
62	26	3 yrs.	..	8 hrs.	2 days	+	+	++++
63	24	1 yr. 9 mths.	..	2½ hrs.	1 day	+	+	+++
64	27	4 mths.	..	40 mins.	..	+	+	++
65	29	1 yr. 3 mths.	..	1½ hrs.	..	+	+	+++
66	30	5 yrs.	..	1 hr.	..	+	+	++++
67	39	1 yr. 1 mth.	..	2 hrs.	..	+	+	+++
68	25	1 yr. 6 mths.	+	8 hrs.	1 week	+	+	+++
69	29	9 mths.	..	20 mins.	..	+	+	++
70	32	7 mths.	+	3 days	3 months	+	+	++++
71	27	1 yr. 5 mths.	—	30 mins.	..	+	+	++
72	26	47 wks.	—	10 mins.	Dazed for time	+	+	++
73	31	19 wks.	—	1 hr.	..	+	+	++
74	37	14 wks.	+	7 hrs.	1 day	+	+	+++
75	22	7 mths.	—	10 mins.	..	+	+	++
76	42	2 yrs.	+	3 hrs.	Dazed for time	+	+	+++
77	35	3 yrs.	+	6 hrs.	1 week	+	+	+++
78	45	1 yr. 3 mths.	+	30 mins.	Hours	+	+	+++
79	27	9 mths.	..	2 hrs.	..	+	+	++
80	29	7 mths.	..	1¾ hrs.	..	+	+	+++
81	25	1 yr. 2 mths.	..	25 mins.	Dazed for time	+	+	++
82	31	11 mths.	..	30 mins.	..	+	+	++
83	28	1 yr. 4 mths.	..	2½ hrs.	Dazed for time	+	+	+++
84	23	5 mths.	..	1½ hrs.	..	+	+	++
85	29	31 wks.	..	45 mins.	..	+	+	++
86	30	11 mths.	+	3 hrs.	Dazed for time	+	+	+++
87	32	23 wks.	..	30 mins.	..	+	+	++
88	35	27 wks.	..	1½ hrs.	..	+	+	+++

Examination.				Number of injections.	Result.
Ocular fundus.	Tinnitus.	Nystagmus.	Vision.		
,,	No	,,	Normal	19	Gradual improvement with ultimate complete recovery.
,,	Yes	Spontaneous rotary	Myopia	24	Gradual relief of all symptoms except emotional instability. No recurrence of symptoms 5 months after.
,,	No	Lateral	Normal	15	Complete relief of all symptoms. No recurrence 7 months after.
,,	,,	None	,,	15	Rapid recovery with relief of all symptoms.
,,	,,	,,	,,	15	Rapid recovery with relief of all symptoms. No recurrence 6 months after.
,,	Yes	Spontaneous rotary	,,	22	Gradual relief of all symptoms except emotional instability. No recurrence of symptoms 6 months after.
,,	,,	Lateral	,,	18	Gradual improvement with ultimate complete recovery.
,,	No	Bilateral spontaneous rotary	Myopia	20	Gradual relief of all symptoms with ultimate complete recovery. No recurrence of symptoms 6 months after.
,,	,,	None	Normal	16	Rapid recovery with relief of all symptoms.
,,	Yes	,,	,,	24	Gradual relief of all symptoms except emotional instability. No recurrence 4 months after.
,,	No	,,	,,	18	Gradual improvement with ultimate complete recovery.
,,	,,	,,	,,	15	Rapid recovery with relief of all symptoms.
,,	,,	Spontaneous rotary	,,	18	Rapid recovery with relief of all symptoms.
,,	Yes	Bilateral spontaneous rotary	Refractive error	20	Gradual relief of all symptoms with ultimate complete recovery.
,,	No	None	Normal	19	Rapid recovery with relief of all symptoms. No recurrence of symptoms 6 months after.
,,	Yes	,,	,,	25	Gradual improvement with eventual complete recovery. No recurrence of symptoms 6 months after.
,,	,,	Spontaneous rotary	Refractive error	24	Gradual improvement with ultimate complete recovery. No recurrence of symptoms 4 months after.
,,	,,	Lateral	Normal	16	Complete relief of all symptoms. No recurrence of symptoms 3 months after.
,,	No	None	Presbyopia	15	Rapid recovery with relief of all symptoms.
,,	Yes	,,	Normal	14	Rapid recovery with relief of all symptoms. No recurrence of symptoms 4 months after.
,,	,,	Spontaneous rotary	,,	16	Gradual relief of all symptoms with ultimate complete recovery. No recurrence of symptoms 3 months after.
,,	No	Lateral	Myopia	16	Rapid recovery with relief of all symptoms.
,,	Yes	Bilateral spontaneous rotary	Refractive error	20	Gradual improvement with ultimate complete recovery. No recurrence of symptoms 3 months after.
,,	,,	None	Normal	15	Rapid recovery with relief of all symptoms.
,,	No	,,	,,	18	Gradual improvement with ultimate complete recovery. No recurrence of symptoms 3 months after.
,,	Yes	Spontaneous rotary	,,	20	Gradual improvement with relief of all symptoms. No recurrence 4 months after.
,,	No	None	,,	14	Rapid recovery with relief of all symptoms.
,,	,,	,,	,,	15	Rapid recovery with relief of all symptoms.

been uncertainty as to choice of therapeutic procedures. Penfield (17) in 1927 introduced the procedure of lumbar air insufflation, which was, and still is, employed by some clinicians. The purpose is to have the air break up the subdural adhesions. In cases which proved particularly obstinate, Penfield advised bilateral trephination with mechanical rupture of the offending membranes.

In a series of 9 controls the effectiveness of barbiturates on the syndrome could not be proved—narcosis with sodium amytal proving unsatisfactory. Many patients had been receiving daily doses of luminal for various periods prior to admission with no improvement.

Brahdy (18) tried the effect of ergotamine tartrate on a series of 6 cases without improvement.

One of the effects of injecting hypertonic saline into the circulation is a diminution in the volume of the brain—hence it has been advocated for the relief of headache in post-contusional and post-concussional states. Feiling (19) found that even 100 ml. of 30 per cent. solution could be given, but usually 50 ml. of 15 per cent. was effective. Twelve controls in the present series showed no satisfactory response to this form of treatment.

At the General Hospital, Johannesburg, oral administration of prostigmine hydrobromide, 15 mg. *t.d.s.*, was given for 6–8 weeks, together with intramuscular injection of 1 c.c. of a solution of prostigmine methyl-sulphate, 1 in 2,000 twice weekly for 6–8 weeks, combined with a restricted fluid intake. Prostigmin helps the action of acetylcholine, which is a powerful vaso-dilator, and thus abolishes vaso-constriction of meningeal and labyrinthine arteries, which vaso-constriction is presumably the cause of persistent post-traumatic headaches (Malone, 15).

In view of the long duration of symptoms in the majority of cases it was felt that an expedient was necessary which would promote quick readjustment and reduce stay in Hospital to a minimum. Believing that in the majority of cases the disorder was on the basis of a disturbed vascular physiologic change, we decided to use the preparation Afenil, with which we had previously obtained very encouraging results in the treatment of the catatonic form of schizophrenia (20).

Afenil, or calcium chloride urea, is a preparation of calcium for intravenous administration. It is a double combination of one molecule of chloride of calcium (31·6 per cent.) and four molecules of carbamide (68·4 per cent.), prepared in ampoules, each containing 10 c.c. of a 10 per cent. solution = 0·11 gm. calcium. Given intravenously, if the technique be scrupulously attended to it is free from pain and risk, but special warning must be given of the risk of necrosis if there is any leakage into the intramuscular or subcutaneous tissues. Intravenous injection is performed in the customary manner with the aid of a compressor bandage ; location of the needle in the lumen of the vein should be carefully ensured in order to prevent any of the injection fluid entering the perivascular tissue.

An instantaneous vaso-dilatation is produced, with access of heat to the head, accompanied by flushing, sensations of heat in the mouth and stomach, and slight cerebral pressure, the injection being carried out slowly. Variations

in blood pressure are of the slightest. Alterations in the urine were not seen, nor was there any noteworthy acceleration of the pulse beat during the injections. Given every second day the injections were always well tolerated. After each injection the patients lay down and relaxed completely for two to three hours.

All cases received a complete neurologic survey, including intelligence tests and psychiatric studies before and after treatment.

The following objective signs were taken in evaluating the amount of labyrinthine vertigo present: (1) Nystagmus after quick movements of the head; (2) spontaneous nystagmus with patient's head extended backward to the right and to the left; (3) ophthalmic examination.

Results of Treatment.

There was a subjective sensation of a lack of muscular tension with attendant relaxation shortly after the first injection. As a consequence of this lessened tension irritability decreased, fatigue disappeared and sleep became more normal. Conduct disturbances became much more modified, and, after a week or two of treatment, disappeared. By the fourth injection improvement was obvious and was maintained in all cases; the onset of headaches and giddiness had considerably diminished, and in many cases were reduced to rudiments, concentration improved and the patient's outlook altered appreciably. It was a noteworthy fact that patients who were at first distrustful or even antagonistic to the injections asked directly for a repetition because they said they found their effect quietening, beneficial and only pleasant.

By using this preparation a syndrome which had been established for varying lengths of time could be greatly diminished at an early stage of the treatment. On completion, this improvement was fully maintained in all cases; symptoms had disappeared, the outlook was bright and optimistic, morale and confidence were restored. Average duration of stay in hospital was 60·2 days, which is satisfactory in view of the severity of symptoms presented and the time which had elapsed in the majority of cases before treatment was started.

Appended are details of three typical cases. Each patient kept his own notes on progress:

Case 1.—Admitted 14.xi.44; discharged 19.i.45. Glider crash D day, 6.vi.44, with head injury and slight crash injury to spine.

Was unconscious for about eight hours. M.O. who first saw him saw C.S.F. coming from wound in L. temporo-parietal region. Had a faint recollection of being in a R.A.F. Station Hospital, and of afterwards being taken to Oxford. Complained of severe headaches, almost constant, L. temporal passing to occiput. Was very light-headed at times. Had frequent dizzy spells, everything swimming round him. Loss of concentration and loss of confidence. Head went "all queer if he went to a cinema or to a dance." Memory impaired. Was very irritable, moody and bad tempered.

Notes.

2nd injection: "The injections seem to make me restful and steady."

3rd injection: "Sleep good. Head clearer. Feel better."

5th injection: "Can enjoy things better. Feel much more easy with people and can now mix with the others and talk to them. Can concentrate a lot better."

7th injection: "Feeling 100 per cent. better. Finding much more pleasure in life. Can enjoy myself and feel I am going to recover. Temper much better."

12th injection: "Head and temper feel good. Am much more settled and can work hard all day now and get no dizzy spells at all. Am enjoying life."

13th injection: "Been home and now feel reasonable with everyone. I feel quite different."

CASE 2.—Admitted 31.x.44; discharged 12.i.45.

Complained of headaches, frontal, at times occipital, which came on many times daily, lasting 10–30 minutes; depression, irritability, dizzy attacks, especially on bending. Concentration impaired. Had lost memory on two occasions for short periods. History of two head injuries.

(1) January, 1942. Shell splinter hit L. occipital region; sustained cerebral contusion and fractured skull. Was unconscious until the following day, when he came to in hospital. Felt hazy and foggy—"things hard to recollect." In bed for five weeks. On getting up was unable to concentrate, felt irritable, had severe headaches and could not stand noises.

(2) March, 1943. R. malar bone damaged by shrapnel. Operation R. temporal area to repair same. Was unconscious on this occasion for five hours. Afterwards felt "all sense of what he was doing had been taken away from him." Had lapses of memory and forgot to carry out orders. On admission stated he had "lost interest in everything and had become resigned to headaches."

Notes.

"On admission I was feeling very depressed and suffering from severe headaches. I was very irritable and quarrelled all the time I was at home."

2nd injection: "After this I went to sleep and when I awoke I found that I felt better with my head easier."

4th injection: "I must admit that I am feeling more cheerful and am beginning to get my confidence back. Headaches have become much milder. Feel depression is going. I am not so jumpy."

6th injection: "I am feeling much fitter and quite lively and don't jump at every sound. I can concentrate now."

10th injection: "Am feeling much more confident and cheerful than I have done for a long time. There has been great improvement. Feeling much better all round."

12th injection: "When I go home I feel in a fine mood. Am feeling fitter than I have for a long time and much more happy. My memory is all right now."

CASE 3.—Admitted 13.vi.45; discharged 17.viii.45.

This patient was admitted from the general side of the hospital in a very serious mental condition. He was very agitated and depressed, had severe headaches, much irritability, bad temper and nocturnal restlessness. Felt suicidal at times, that all hope was lost, that nothing could be done for him. He was unable to concentrate or think clearly; memory was much impaired for recent events. Stated his mind often "went blank for a long time." Thoughts were confused and "often mixed up at times." Had impulsive attacks of bad temper, with a tendency to violence. History of three head injuries.

(1) France, July, 1944: Fell down a German man-trap. Unconscious 1½ hours. In hospital for a month, where he developed headaches.

(2) September, 1944: When driving ammunition lorry explosion occurred which blinded him. Lorry went over a ditch; he struck his head. Was unconscious for seven hours and very hazy for days afterwards. Was in hospital for three months. Head was "driving him mad all the time." Boarded B1 on 3.iv.45. Returned U.K.

(3) May 24, 1945: Following quarrel with a soldier was knocked out and left unconscious on road. Was unconscious for several hours. Very confused afterwards and subsequently admitted to Sutton. This man's improvement was dramatic.

Notes.

2nd injection: "Fewer headaches and more confidence seem to be the effect these two injection have had on me."

4th injection: "I feel much better and more settled. Dizziness is passing off and headaches seem to be under control. The injections do me a lot of good; it is not a drugged feeling. Am a lot less depressed and bad tempered."

6th injection: "I now have a full night's sleep. Spend the mornings in the workshop and can now go to the pictures. Before these injections I could not bear the thought of anything like that. Now everything seems different, and I can enjoy myself with no ill-effects, such as headaches. No sway between moods as there was at first. Have much more confidence and seem to be getting back to my original self."

10th injection: "These injections have certainly made me feel very much better. I can concentrate and think clearly and now feel equal to anyone."

Intelligence Tests.

Fifty-four of the cases (unselected) were given the 20-minute Progressive Matrices Test on admission and on completion of the treatment. Group mean scores and standard deviations for the two tests are as follows:

	First test.	Second test.
Mean scores	33·37	38·93
Mean percentile scores	(41·26)	(65·84)
Standard deviation	13·15	12·61

These figures show a substantial increase after treatment. By the following formula it is possible to calculate the significance of this increase without resource to controls:

$$\sigma_D = \sqrt{\sigma^2 M_1 + \sigma^2 M_2 - 2r_{12}\,\sigma M_1\,\sigma M_2} \quad . \quad . \quad . \quad (20)$$

The critical ratio obtained from this formula is 5·55/1·45 or 3·82, and the probability that the obtained difference is significant is almost 100 chances in 100, i.e. virtual certainty.

Confirmation is demonstrated by a comparison—by grade—with 107 control cases tested on admission and after discharge on the same test.*

	Expected	Control group. (107 cases.)		Treatment group. (54 cases.)	
	%	First test. %	Second test. %	First test. %	Second test. %
Gr. I	5	3	10	9	17
II	20	14	15	18	28
III	50	48	42	41	39
IV	20	25	25	30	16
V	5	10	8	2	0

	Control group. %	Treatment group. %
Two grades up	5·6	3·7
One grade up	25·2	37·1
Unchanged	53·4	55·5
Down one grade	14·9	3·7
Down two grades	0·9	0·0

* The cases used as control group were neurotics from a similar population. We are indebted to Mrs. H. T. Himmelweit of Mill Hill Emergency Hospital for the figures.

The treatment group also show less score deviation on retest—unlike the control group, which shows a slight increase. The coefficient of variation $\frac{100\sigma}{M}$ for the treatment group is 18 per cent. less on the second test than on the first test (32·43 against 39·38).

The improvement shown after the injections was evident not only in the enhanced speed and accuracy, but also in the men's demeanour, when they assembled for the retest: they were brighter and more cheerful.

Discussion.

The results obtained from the use of Afenil for the relief of the distressing symptoms of the post-concussive syndrome help to throw a new light on the aetiology of the disorder.

The administration of the preparation produces a powerful vasodilatation of the organism, which supports Malone's (15) theory that the syndrome in part has as its aetiologic basis an altered vasomotor activity. He put forward the hypothesis that in the relief of symptoms by prostigmine the ensuing vasodilatation acted on the labyrinthine and cranial blood vessels. Perlow (22) has found this dilatation to be primarily arterial rather than arteriolar or capillary.

Helfand (23) found in a series of 22 cases of the syndrome that many of the findings were of a functional (reversible) nature, and believes that they were primarily vasomotor in origin.

Zacks (8) has described degenerative changes in the nuclei of the cochlear and vestibular nerves, as well as an altered irritability of the vasodilators and vasoconstrictors, with resultant areas of localized altered circulation.

Wolff (24) concluded that intracranial pain is due to an alteration in the tonus of the involved arteries and of the meningeal arteries in particular. This goes to support the results obtained with Afenil. It is possible that such vasodilatation may result in the mechanical breaking-up of organic changes, such as adhesions.

Further to the vasodilatation produced one might ascribe to the calcium content of Afenil a checking influence on conditions of excitation of the nervous system. Calcium ions have a general sympathicotonic effect. The investigations of Jänsch on the eidetic constitution, and Peritz (25), who traces a part of the schizothymic dispositions of Bleuler and Kretschmer to spasmophile dynamics of the organism, suggests that calcium therapy acts by way of the epithelial bodies.

In reference to other calcium mobilization agents, notably those containing vitamins B and D, some of these latter medicaments were substituted with practically no result at all. Intravenous application is indicated in all cases.

The effect of Afenil on post-concussive states is unmistakeable, and its employment is to be recommended for its undoubtedly favourable effect upon the course of the cure. The results suggest that the symptoms of the post-concussive syndrome are probably produced through pathophysiologic

mechanisms involving an alteration in the vasomotor tonus with resultant muscular tension and vascular instability.

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ASYMMETRIES OF SENSORY FUNCTIONS (SPATIAL AND TEMPORAL DISCRIMINATION) IN NORMAL PERSONS.

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INTRODUCTION.

COMMENTING on the different symptoms produced by disturbances of the left hemisphere (aphasia, apraxia, etc.) and of the right (dreamy states, hallucinations, etc.), Hughlings Jackson on many occasions pointed out that there exists a "duality" of the brain; the anterior parts of the left hemisphere serving more controlled and objective* purposes, the posterior parts of the right more subjective† and the anterior parts of the right serving more automatic purposes. Consequently, quoting Bastian and Rosenthal to support him, he tendered the suggestion that "mental" symptoms might be indicative of a disturbance particularly of the posterior parts of the right hemisphere (in right-handed people).

The observations of later authors (Oppenheim, 1902; Cassirer, 1923), the discovery of anosognosia, the importance of a damaged right hemisphere in disorientation in place (e.g. recent papers of *Brain*, 1941; Paterson and Zangwill, 1944 and 1945), in time (Hoff and Pötzl, 1934 and 1937; Ehrenwald, 1931, 1932; Clenov and Eidinova, 1934; Paterson and Zangwill, 1945), in apraxia for dressing (Brain, 1941; Paterson and Zangwill, 1945), and in some mental syndromes of non-manic or non-depressive colouring (Fleischhacker, 1945), showed the ideas of Hughlings Jackson to be correct in principle so far as clinical-anatomical considerations based on deduction from pathological cases are concerned.

One has to be cautious in deducing from pathological conditions the "localization" of normal functions. We have, however, the right to assume, when damage to a part of the brain causes a disturbance of such and such a function, that the structure and physiology of this particular part must be of importance for the working of that function under normal conditions. The idea of hemispheric "dominance" is based on such reasoning. But we need not rely on deductions only. Hughlings Jackson referred in his paper on "The Nature of the Duality of the Brain" to observations of Gratiolet and Broca that the two hemispheres of the brain are asymmetrical, the left anterior and the right posterior parts being the larger respectively. In more recent years G. E. Smith (1927), Economo (1927) and his school have emphasized such asymmetries. Even microscopical differences between corresponding parts of the right and left halves of the brain have been described (Economo-Horn, 1930; Stengel, 1930; Betz and others, as quoted by Economo-Koskinas, 1925).

Marked asymmetries in form and size of lobes, gyri and also of deeper parts

* "Objective"—psychically corresponding to what is physically the reaction of the organism on the environment.

† "Subjective"—psychically corresponding to what is physically the effect of the environment on the organism (*Selected Writings*, Vol. I, p. 310, from *Brain*, **8**, 192, 1880).

of the brain (e.g. thalamus, striate bodies, cerebellum, oblongata) have been confirmed by the author's observations (unpublished).

As far as physiological differences go, electro-encephalographic asymmetries have been described by F. A. Gibbs (1942), Williams and Reynolt (1945) and particularly by Mrs. M. Gibb (1945) (as quoted by D. Hill). In some normals reflex disturbances can be produced under certain conditions and are found to occur more often on the left side (Fleischhacker, 1943).

The pathological and normal findings, together with the existence of handedness and eyedness, invite further studies in the field of cerebro-peripheral organization of laterality or asymmetry of function. Such investigations might also make a contribution to the problem of how central and peripheral conditions are correlated and interdependent.

In connection with tentative suggestions put forward in a previous paper (Fleischhacker, 1945) two sensory functions have been selected for the present investigations:

1. Spatial (tactile) discrimination of two points on the thumbs as connected with the more technical-practical experience of recognizing and handling individual objects (possibly better developed on the left hemisphere).

2. Aural discrimination of the speed of time signals as connected with functions forming the basis of experiences of a more distant and, at the same time, more subjective nature, not directly within our grasp (and possibly better developed on the right hemisphere). Vierordt's statement (1868) that the ear is the best sense for the "estimation" of time has recently been confirmed again by Goodfellow (1934).

Before describing the investigations carried out and results obtained it might be worth while to point out—

(A) That overt right-handedness is either innate (structural, anatomical), or acquired (functional), and superimposed on latent, innate, non-right-handedness. This latter is much more frequent than previously thought so that, while about 95 per cent. or more of the population are overtly right-handed, only 75 per cent.—and most likely less—are structurally right-handed or dextrolateral.

(B) That in the present investigation we shall examine functions more based on innate structure than on acquired abilities. Therefore it is to be expected that the persons examined will be—

(i) Such as are anatomical and functional right-handers (or dextrolaterals), and—

(ii) Such as are not. These then might be—

(*a*) Anatomical sinistrolaterals but functional right-handers, or

(*b*) Anatomical and functional sinistrolaterals, and also

(*c*) A mixed group of so-called ambidextrous or ambilateral persons.

1. Asymmetries of Spatial Discrimination.

Material and Technique.

Twenty-five persons have been subjected to over 3,500 testings. On 20 of them mainly aesthesiometric tests have been carried out; but four of these and five others have been subjected to other tests, which will be mentioned

later. Their ages ranged from 12 to 67, 14 were males and 11 females. Professionally they were nurses, laboratory technicians, office workers, medical students, doctors and a schoolgirl. Two aesthesiometers were used (Head's and Carroll's). The results were approximately the same.

With a few exceptions the tests were carried out on the skin over the wrists, the radial parts of the metacarpus and the radial parts of the first phalanx of the thumbs. It is necessary to test spots which are as "symmetrical" as possible on the right and on the left. In practice, considerable difficulties are encountered, as the hands are not quite symmetrical. Apart from the anatomical position of the spots examined, growth of hair, thickness of the skin, creases, etc., have to be considered. It is also of importance that the skin should be clean. Two kinds of error will occur when the two points of the aesthesiometer are applied close together:

(*a*) The two touches are felt as one.

(*b*) Paraesthesias and even illusions occur so that one touch is reported as two. Therefore results should be registered separately according to whether one or two touches have been administered. It has also been found useful to register "doubtfuls," and the testees have always been encouraged to give a "doubtful" and not to guess when they could not come to a decision. The experiments were carried out in the following way:

The testee was sitting at his ease with both hands placed on a table. The axis between the points of the aesthesiometer runs parallel to the axis of the limb tested. If both points were applied, they were applied at the same time, i.e. together and not one after the other. The length of time of the touch of the skin was one to two seconds. As a rule the wrists were tested first, then the metacarpus and thereafter the basal phalanx of the thumbs. In a few cases the wrists have not been tested and in two others the wrists only. In these last two cases the examination had been interrupted and, on resuming it the following day, it occurred that the testees had found out that differences between left and right were expected.

At first a few preliminary tests were given with the two ends of the instrument close or less close together in order to provide the testee with an idea of the examination. At the same time the examiner had a chance to find closely corresponding areas on the right and on the left. Then the testee was asked to close his eyes and the experiment proper started with a series of four tests, each on the right and on the left. In each such series two single and two double touches were applied while the distance of the two points remained the same but the order of touch within the different series was changed. It was found desirable to begin with such a distance of the two aesthesiometer points that all four answers were definitely positive on either side and this series of four tests was repeated. Then the two points were brought a little closer together and another series of four tests on each hand was given. This procedure was carried on until at least half of the answers in one series was wrong. This series was repeated at least once. On repetition, in a small number of cases, more right answers were given, and then the experiment went on until on both hands half of the answers were wrong. It sometimes proved useful to go a step back and to widen the distance again in order to get positive results.

It is known that the distance between the asethesiometer points, still allowing discrimination, varies considerably with the parts of the body and the individual tested. Accordingly, the number of tests carried out on different individuals in order to obtain reliable results varied considerably. On the average 150 to 200 tests were required for each person, but in one case only 86 and in another 360 had to be carried out.

Results.

In the following tables the results are given for wrists and thumbs separately (but those obtained on the metacarpus and basal phalanx of the thumbs have been added together, as there was no essential difference between the two). There was one group of right-handed and one group of non-right-handed persons.

Tests on Spatial Discrimination.

Table I.—*Results of Aesthesiometer Tests.*

A. *Right-handers.*

Name.	Wrists. R. +	R. −	R. ?	L. +	L. −	L. ?	Thumbs. R. +	R. −	R. ?	L. +	L. −	L. ?
Miss Mi—	5	10	5	15	3	2	80	18	2	73	25	2
Miss Sm—	11	6	3	16	4	0	120	33	7	118	41	1 (digs also with left)
Dr. (Miss) S—	10	7	3	14	6	0	69	10	1	52	23	5
Mr. La—	7	11	2	12	6	2	54	14	0	46	21	1
Mr. Bi—	13	6	1	11	6	3	65	13	5	60	22	2
Mr. Co—	17	10	5	23	4	5	30	8	2	17	6	7
Mrs. Ho—	17	5	10	24	6	2	60	8	4	55	8	9
Miss McM—	28	10	9	29	8	10	19	6	7	18	11	3 (injects also with left)
Mr. J—	12	7	1	4	4	12	28	2	6	18	8	10
Mrs. F—	..	..	..	..	..	..	42	18	0	27	33	0
Miss I—	..	..	..	..	..	..	48	15	9	38	26	8
Dr. F—	..	..	..	..	..	..	60	16	12	52	28	8
Miss F—	..	..	..	..	..	..	43	17	0	28	32	0
Miss C—	6	5	9	10	7	3	Test was interrupted. On resumption it was found that Miss C. had got information of which results were expected.					
Sa.	126	77	48	158	54	39	718	168	54	590	294	56

B. *Non-right-handers.*

Name.	Wrists. R. +	R. −	R. ?	L. +	L. −	L. ?	Thumbs. R. +	R. −	R. ?	L. +	L. −	L. ?
Mr. H—	7	2	7	8	2	6	17	13	2	14	11	7
Mr. G—	15	10	11	31	1	4	50	8	10	49	10	9
Miss Co—	23	4	1	16	9	3	55	22	3	61	19	0
Mr. W—	8	5	11	8	8	8	(Not continued for reasons as Table I, A, Miss C—.)					
Mr. C—	19	7	2	15	12	1	32	16	0	38	10	0
Mr. Ge—	13	6	1	11	6	3	21	13	2	20	12	4
Mr. Gr—	23	12	5	21	16	3	12	13	7	17	10	5
Sa.	106	46	40	108	54	30	187	95	24	199	72	25

Right = +; wrong = −; doubtful = ?.

In another small series of experiments on four persons the aesthesiometer was replaced by the somewhat cruder method of recognizing small figures like triangles, squares and circles on the forearms. The results were as follows:

TABLE II.—*Results of Differentiating Triangles, Circles and Squares "Written" on Forearm of Four Right-handed normal Persons.*

R.			L.		
+	−	?	+	−	?
47	17	16	39	24	17

In other experiments of a more sensory-motor nature, five persons were asked to close their eyes, to put thumb and forefinger of one hand into any position they liked and to imitate this with the other hand while their eyes remained closed. The results were as follows:

TABLE III.—*Results of Imitating the Posture of Fingers of one Hand with the Finger of the Other.* (*Five Right-handed normal Persons.*)

Imitation of right hand with left.		Imitation of left hand with right.	
+	−	+	−
29	64	48	45

Right = +; wrong = −.

In a last series a number of persons were asked to close their eyes, to put all the fingers of one hand into any position they liked, to try to get a visual idea of this position, and then to open their eyes and state whether this position corresponded to the one they had imagined. It was found usually that it comparatively rarely did. But two persons found it easier to get visual ideas derived from the position of the left hand than from the right hand, and on the whole, results from the left hand were better.

Discussion.

When one evaluates the results of the present investigation and compares differences obtained between the right and left, not only the positive, but still more the negative results should be considered. Actually, the negative results are of greater importance than the positive ones, as some of these might be wrong positives, for (see technique) not only might two touches be felt as one only, but also sometimes one touch is felt as two when the two points of the aesthesiometer are brought close together and the testee becomes a little tired.

Tables I to III show that in righthanded persons the functions tested are better with the right side, while it is the opposite in the non-right-handed group. The only exceptions are the results obtained over the wrists. Here the differences are less outspoken, there is even a possibility that they are in contradiction to the results achieved on the thumbs.

All persons tested said at first that they were right-handed. Only on closer questioning six of Group IB admitted that they performed a number of activities better with their left hand—such as digging, playing tennis, golf, cards

and so on. Two others belonging to IA were Miss McM—, who said she could give injections with the left hand, and Dr. S—, who said she could dig with her left hand. The persons mentioned in Tables II and III were apparently all right-handed. The subject of handedness will be discussed to some fuller extent later on.

It was already known to Fechner (1860) that the right and left hand have different sensibility.

That spatial discrimination on the skin is better on the " dominant " hand has been described long ago by Lombroso (1897), Féré (1896) and, above all, by van Bierlivet (1897). Bierlivet has investigated muscular sensibility, vision, hearing and spatial discrimination in 120 persons and altogether 8,600 investigations have been carried out on them. He came to the conclusion that in about 78 per cent. of the persons examined, the sensibility for vision, hearing and spatial discrimination was better by 11 per cent. on the right side, and in the other 22 per cent. on the left, although only 2 per cent. of them admitted that they were left-handed. These results agree roughly with the " positives " obtained on the right-handed group in the present investigation. The non-right-handed group is too small to allow of a more quantitative evaluation, being in all probability a mixture of left and both-handed persons. However, after having read Bierlivet's paper and found my results confirmed in principle, I have not pursued the subject of tactile discrimination any further.

But possibly the superiority of the right or " dominant " hand does not hold good for all sensory functions. According to Goldstein (1927), the threshold for pain is lower on the left side of the body, and Wile (1934, p. 111) quotes Dwight as saying that the right hemisphere distinguishes more readily between different degrees of temperature and weight. Bauer (1911) also thinks that the left hand is better in estimating weights. In connection with this I should like to refer briefly to experiments carried on internal visual images of posture. Superficially these experiments seem very similar to those on imitating posture from one hand to the other (Table III). They are, however, of a different nature, in that the task here was to form an internal visual image derived from a postural sense impression. This is not a " technical practical function " as all the others tested, but a more subjective one, " not directly within our grasp," although concerning the organ of grasp—the hand. If one may be allowed to comment on the results of about 100 tests carried out on five right-handed persons, two points emerge, the one more, the other less distinct. With regard to the former, each of these five persons was surprised how difficult it was to visualize internally the posture of their own hands and fingers, and how comparatively seldom internal and external visual images would satisfactorily agree with each other. This supports the view of those who think that the body scheme is not necessarily visual. With regard to the latter less distinct point, it appears that in the five persons tested a better internal visual image was formed from postural sensations arising from the left hand. At least two of these persons thought that it was easier for them to obtain a visual image from their left hand than from their right. That anosognosia is usually produced by lesions of the right parietal lobe does, to say the least, not contradict these results. But such experiments will have to be

carried out on a larger number of persons, right and left-handed, and of different sensory types before any conclusions can be drawn.

2. Asymmetries of Temporal Discrimination (Aural Discrimination of Time Intervals.)

Material.

In the following experiments temporal discrimination was stimulated and estimated aurally by comparing slightly different time intervals produced by the beats of a metronome. As the discrimination of very small variations of time intervals was extremely difficult if only one single interval was to be compared with another of different (or same) duration, identical time intervals have to be repeated several times in sets or sequences for comparison. These sequences of shorter or longer time intervals are experienced as "faster" or "slower." Over 1,000 tests have been carried out on 40 persons. There were 20 males and 20 females. Their ages were between 13 and 68 and their occupations were more or less the same as in the experiments on spatial discrimination.

Technique of Metronome Test.

The instrument used was an ordinary metronome, and irregularity in speed, if any, was less than 2 per cent. per minute. The instrument was checked repeatedly in this respect. The variations were from faster to slower and from slower to faster speeds. Usually the number of tests with the variation to a faster speed was slightly greater than the other. Most of the experiments were carried out with time-signals between 84 and 96 beats per minute. The differences given for comparison were four beats per minute. In a number of experiments, however, the speed was between 144 and 168 beats per minute with variations of eight beats per minute; the results did not differ from those obtained with the slower speed. With binaural tests, in such circumstances, correct differentiation is possible in 80 to 90 per cent. of the tests (Vierordt). It usually took about three seconds to vary the speed of the metronome from one setting to the other. Such an interval was also allowed to pass in a small series of other experiments in which the speed given for comparison was not changed. It is known from binaural tests that in such circumstances only 20 to 30 per cent. of correct answers (namely, "no change") can be expected. The experiments should be carried out in a quiet room, as outside noises are disturbing and interfere with results. The testee should be seated at his ease in order to be in the right poise of "relaxed concentration." He should firmly close one ear with his hand and turn the other towards the metronome placed five or six yards away. The eyes should be closed so that he cannot see the swing of the instrument's pendulum.

In the actual experiment a preliminary gross demonstration was given to the testee. The metronome was allowed to beat at a medium speed for eight or twelve times.* Then, for comparison, the speed of the beats was changed by about twelve/minute, and the testee was asked to state the change. Then

* This was the average number of signals it took most persons for "remembering the time." But there are variations from one individual to the other, and it is the best to ask the testee to make a sign when he has "got" it.

the instrument was allowed to beat again, and after eight to twelve beats the speed of the metronome was altered, but in the other direction and the testee was again asked to state whether and what difference he noticed. He was informed that in the actual tests the variations would be definitely smaller but that, nevertheless, most of his answers should be correct, the possible answers being " faster," " slower," " no change " or " doubtful."

Now a series of tests in pairs (first one speed and then another for comparison), usually consisting of ten such pairs, was presented to one ear and then an identical series to the other. After a few investigations it appeared that, in anatomically right-handed persons, temporal discrimination was better on the left, in agreement with the expectation. Consequently, in order to make discrimination more difficult for the left ear, as the testee often got a little tired and nervous towards the end of the experiments and the influence of practice could be discounted, the right ear was usually tested first. The arrangement is of no decisive importance, as can be seen from the results obtained on non-right-handed persons, most of whom stated at first they were right-handed, so that their better ear was tested first.

In order to avoid bias it was made sure that the testees knew nothing of the eventual aim of the investigation, or of the results obtained on others. In order to exclude bias on my side I asked before the experiment started whether the testee believed himself to be right or left-handed, being content with this reply until the metronome test was over. Only then were tests on handedness carried out. The knowledge of the testee's handedness or laterality is necessary for the understanding of the results.

Tests on Handedness.

An appropriate idea of a person's structural original, innate, anatomical (also subcortical ?) laterality has to be ascertained by tests rather than by questioning which hand is preferred for different activities. There is an exception, namely, the hand or arm used for carrying small things like books, handbags, small parcels, overcoats and so on ; this is usually the left in right-handed people, and my own observations are in agreement with those of Wile and Régnauld. A person with only acquired functional (mainly cortical ?) right-handedness will very often betray himself by using the right, or either, upper limb for such purposes. A reliable test for handedness is to watch the person's relaxed hands when he stands, or, better still, walks. The hand of structural handedness is slightly more closed in such circumstances than the other, even if this latter hand is the hand of functional handedness. Another test is a slight modification of one described by Loeb (1887) ; the person stands at his ease before a not too low table or desk. A point opposite the midline of his body is marked on the table and the testee is asked to touch lightly the edge of the table with the forefinger above and the thumb below on either side of the mark. He then closes his eyes and is requested to move both his hands together with the same medium speed aside, away from the marked point and always with the edge of the table between his fingers until he is asked to stop. The distance between his hands and the starting point is usualy longer on the side of structural handedness, although, according to Cremer, as quoted by

Results.

Tables IV–VI: Aural discrimination of time intervals.

TABLE IV.—*"Right-handers."*

Name.	Metronome. L. ear. +	−	Same.	?	R. ear. +	−	Same.	?	Hand more closed.	Loeb.	Aesthesiometer.	Better ear.	Small parcels carried.
Mrs. F—	27	3	11	1	19	11	8	4	r	r > l*	r > l	r	r (+ l)
Dr. F—	24	4	3	..	17	8	6	..	r	r > l	r > l	r	l
Miss F—	6	1	..	..	4	2	..	1	r	r > l	r > l	r	r (+ l)
Mr. Wil—	8	..	2	1	6	2	3	..	r	r > l	—†	r	l
Mr. Lv—	10	..	..	1	7	2	..	1	r	r > l	—	r	l
Mr. Lb—	9	..	..	1	7	1	..	2	r	r > l	r > l	r	l
Mr. Ki—	9	1	..	..	8	1	..	1	r	r > l?	—	r	l
Mrs. O—	8	1	1	..	6	..	4	..	r > l?	r > l	—	r	l
Miss I—	9	..	..	1	8	1	1	..	r	r > l	r > l	r = l	l
Miss By—	8	1	1	..	6	3	1	..	r	r > l	r > l	l	l
Miss Sh—	7	3	..	..	5	5	..	..	r	r > l	—	r = l?	l
Miss McM—	10	..	..	..	8	2	..	..	r = l?	l > r	—	l	l‡
Miss Sa—	7	1	..	2	5	2	..	3	r	r > l	r > l	l	l
Mr. Coo—	7	1	..	..	4	1	3	..	r	r > l	—	l	l
Mr. Ch—	4	..	3	..	5	2	..	..	r	r > l	r > l	r = l	r
Miss Wi—	9	1	..	..	8	1	1	..	r	r > l	—	r = l	l
Dr. H—	9	..	2	..	7	..	3	1	r	l > r	—	r	l
Miss Ke—	7	..	3	..	7	2	..	1	r	r > l	—	l	l
Mr. Gl—	8	..	1	..	7	1	1	..	r	r > l	—	l	r + l
Mrs. H—	6	4	..	..	5	5	..	..	—	—	r > l	r	—
Mr. L—§	13	2	..	..	12	2	..	1	r > l?	l > r	r > l	r	r
Miss Mi—	12	1	4	..	11	1	5	..	r	r = l	r > l	r = l	l
Mr. J—‖	6	2	2	..	5	1	2	2	—	—	r > l	r = l	?
Sa.	223	*26*	33	6	177	*56*	38	17					

* r > l = r better than l.
† — = test not carried out.
‡ Tube catarrh r.
§ Tried to beat time l.
‖ Broke right arm 12 years ago, thinks he might be ambidextrous.

Right = + ; wrong = − ; no difference = same ; doubtful = ?.

TABLE V.—"*Ambidextrous.*"

Name.	Metronome. L. ear. +	−	Same.	?	R. ear. +	−	Same	?	Hand more closed.	Loeb.	Aesthesiometer.	Better ear.	Small parcels carried.
Dr. M—‡	6	..	..	1	5	..	1	1	—†	r = l	r = l	r	—
Dr. G—	6	1	3	..	6	1	2	1	l	l > r	— †	l = r	l
Dr. W—	6	2	3	..	5	1	5	..	l	l = r	—	l = r	l + r
Mr. La—	5	..	..	4	5	..	..	4	l?	l > r	—	l = r	l + r
Miss P—§	8	..	2	1	8	..	..	3	r	l > r	r = l	l	r
Miss H—	7	2	1	..	7	1	2	..	r	l = r	l = r	r	l
Mr. P—‖	7	1	2	..	7	2	..	1	l = r	r > l*	—	r	r
Miss T—¶	7	1	..	2	8	..	..	2	l	r = l	r > l	r	l
Sa.	52	7	11	8	51	5	10	12					

* r > l = r better than l.
† — = test not carried out.
‡ Ambidexter; old otitis l.
§ Always ambidexter.
‖ Left hand stronger and larger.
¶ Somewhat tired when left ear tested.

Right = +; wrong = −; no difference = same; doubtful = ?.

TABLE VI.—"*Left-handers.*"

Name.	Metronome. L. ear. +	−	Same.	?	R. ear. +	−	Same	?	Hand more closed.	Loeb.	Aesthesiometer.	Better ear.	Small parcels carried.
Mr. P—	9	2	..	1	11	..	..	1	l	l > r	l > r	l	l
Miss F—	5	2	5	..	8	1	2	1	r?	l > r	l > r	l	r + l
Miss M—†	3	3	..	..	6	..	..	..	—*	—	l > r	l	—
Mr. W—	3	1	3	..	6	1	..	..	l	l > r	l > r	l	r
Mr. G—	6	2	1	1	8	..	1	1	l	l > r	l = r	l	r
Mr. M—	5	2	3	..	7	1	2	..	l	l > r	l > r	?	l
Mr. P—	9	1	..	..	10	..	..	..	l	l = r	l > r	l = r	l + r
Mr. K—	5	..	4	1	8	..	2	..	l	l = r	— *	l = r	l + r
Miss D—	6	1	2	1	8	..	2	..	r = l	l > r	—	l	l
	51	14	18	4	72	3	9	3					

* — = test not carried out.
† Left hand longer, stronger, finer finger-movements l > r.

Right = +; wrong = −; no difference = same; doubtful = ?.

Loeb, the outcome of this test may be influenced by the testee's occupation. This test is described in the tables as "Loeb."

The acuity of hearing was tested with a wrist-watch; and on a number of persons the aesthesiometer was used. According to the outcome of the tests together the testees have been tentatively subdivided into the three groups of dextrolaterals (Table IV), ambilaterals (Table V), and sinistrolaterals (Table VI).

In Table VII the errors (excluding "doubtfuls" and false "no changes") have been set out. The table has been subdivided into:

(*a*) Absolute errors, "faster" instead of "slower" and vice versa from all the tests together where such differences have been put down in detail (Table VII, A); and

(*b*) Non-absolute errors from 82 pairs of tests (most of them obtained on four persons), when the time was not changed, and the wrong answers were "faster" or "slower" instead of "no change."

TABLE VII.—*Errors; All calculated as if Right-handed.*

A. *Absolute errors* (answers "slower" instead of "faster," and vice versa).

	R. ear.		L. ear.	
	"Slower."	"Faster."	"Slower."	"Faster."
	41	*33*	24	*15*

B. *Non-absolute errors* ("faster" or "slower" instead of "no change.")*

	R. ear.		L. ear.	
	"Slower."	"Faster."	"Slower."	"Faster."
	31	24	*33*	14
Sa.	72	57	57	29

	R.	L.
* The other answers given in this test: +	22	23
(Right ("no change") = +	*5*	*12*
doubtful = ?		

Discussion.

Before discussing the results of this investigation the question of laterality has to be dealt with. It is certain that structural (anatomic) or innate non-dextrolaterality occurs more frequently than previously assumed. Bierlivet concludes that anatomical left-handedness was at least as high as 22 per cent.* Bauer's figures* show only 60 per cent. right-handedness, the rest being left-handed or ambidexter, but in his conclusions he does not differ much from Bierlivet. Tests carried out on eyedness (Johnston, 1941; Parson, 1924; Seltzer, 1934)† show that only 70 per cent. or even considerably less of the population is anatomically right-eyed. The figures obtained by Stern* and Haak* agree with these claims. It should be mentioned, however, that the figures vary even for the laterality of the same organ when different techniques

* In European continentals.
† In the U.S.A.

are applied (Wile, Johnston). Apart from this, some authors (Johnston, Seltzer) think that a person might be more or less strongly right or left lateral or even mixed lateral (Orton, 1927; Wile; Stern, 1933). It is therefore necessary to apply a battery of tests in order to get a true idea of a person's laterality (Seltzer). Considering that the number of persons* tested in the present investigation is very small, that different tests have been applied to different organs and that the tests in themselves were not of a very elaborate nature (this may account particularly for the comparatively large group of ambilaterals†), it will be seen that a comparison with the results obtained on the laterality of much larger populations is satisfactory.

The tables show that there was one group of persons who discriminated differences in time intervals given by the metronome better with the left ear and that this group was essentially right-handed. In another group discrimination was not much different with either ear: this group was essentially ambilateral. In the last group the results obtained were best with the right ear, this group consisted essentially of anatomically left-handed persons. In this last group the differences between right and left were particularly striking. This might be entirely incidental, as the group was very small. On the other hand, it was anatomically very markedly sinistro-lateral, and also experimental conditions were most favourable for the right ear, which was tested first, as nearly all testees said before the experiment started they were right-handed, and only later some of them admitted to having been left-handed when young or to be ambidextrous now.

The results are apparently primarily independent of the acuity of hearing as tested by the wrist-watch. On the contrary, aural discrimination of time may be better with the ear which hears less acutely. Again, this is not always the case, and more accurate examinations will have to be carried out in order to decide whether there is any correlation, positive or negative, and whether and to what degree differences are due to peripheral or central conditions. The observations of Young (1926) and Knudsen (1922, as quoted by Young) that the left ear is better in the discrimination of differences of pitch may be relevant in this respect.

It is known (e.g. Vierordt; Myers, 1931) when short time intervals are estimated that there is a slight tendency to over-estimate (confirmed by Table VII) and therefore a number of "slower" obtained as positive may have been only right guesses. So that again, when differences between the two ears are evaluated, the number of errors give a truer picture than the number of positive results alone.

It might be of importance in this respect to note that the number of such over-estimates was comparatively high with the "dominant" left ear (especially in the group of non-absolute errors), while the number of under-estimates ("faster" instead of "slower") was low in both groups. In bi-manual estimation of weights, and also in Loeb's experiments the so-called inferior arm has similar tendencies (of over-estimating) so that there might be a con-

* Of English, Irish, continental origin.

† But Stern in his tests on eyedness has found a fairly large number of ambilaterals, so has Beeley (as quoted by Seltzer) in his measurements of arms and, from Bauer's experiments, the number of possible ambilaterals is fairly considerable.

nection in this respect, and further investigations into this point should be of interest. It may also help to clear the question of as to whether the right hemisphere (in dextro-laterals) is only of more "quantitative" importance with regard to discrimination of aurally given time-signals, and consequently aural experience and estimation of time, or whether it has a sense of time which in circumstances, at least, might differ from that of the other hemisphere.

It seems to be surprising that there should be not only a laterality of temporal (aural) discrimination, but that just that system should be more efficient which is usually considered as laterally "inferior" (l. ear ⇌ r. hemisphere in right-handed persons). However, it will be remembered from examples given in the introduction that a number of disturbances of a more "mental" nature are produced by damage to the posterior parts of the right hemisphere, and that therefore for such functions the right hemisphere should be more "dominant." Paterson and Zangwill (1945) have recently also doubted the omnipotence of the left hemisphere with respect to dominance. Let us review what we know about the laterality of essentially sensory functions in normals.

There appears to be little doubt that acuity of seeing, hearing, and spatial discrimination is better on the "dominant" side. The same claim has been made for eyedness. The position here is, however, not quite clear. Eyedness, and according to G. E. Smith (1927) to a certain extent even acuity of seeing, is very dependent on the co-ordination of eye movements and in this respect belongs to the group of technical-practical functions. On the other hand, in the ordinary tests on eyedness the suppressed picture lies in the "dominant" visual field of binocular vision. It has still to be decided which function is to be considered as "dominant": that which allows the focused picture to be seen in the "non-dominant" field, or that which suppresses the other less well focused picture in the "dominant" visual field. Stern tried to solve this problem by stimulating corresponding points of the temporal parts of the retinae and came to the conclusion that in 15 per cent. of the 86 persons tested the right hemisphere, in 35 per cent. the left hemisphere and in 50 per cent. both hemispheres were "dominant" for seeing. But as far as I can see his technique was at least partially dependent on visual acuity, and I cannot find any reference that he has taken this factor into account.

The position is apparently equally undecided with regard to sensation of temperature. A diagram in v. Frey and Reiss's (1927) article shows that the points for "warm" are more numerous on the right side of the face. But according to Dwight (as quoted by Wile) the right cerebral hemisphere is more sensitive in differentiating between degrees of temperature.

Dwight and Bauer claim that the "non-dominant" system is better in estimating weights and, similarly, movements, as in Loeb's experiments. In a number of Fechner's experiments on himself (F— was obviously right-handed) the left hand or arm was better in comparative estimation of weights. But in other experiments with heavier weights the right hand or arm was better; here, however, fatigue may have come in. So the position is not quite clear either; although the possibility of a predominance of the "non-dominant" system cannot be completely rejected.

I would not mention the few experiments carried out on visual imagination

derived at from postural stimuli in which the " non-dominant " hand apparently gave rise to slightly better results, had I not come across a paper by Rowe and Washbourne (1908) on the " motor memory of the left hand." The authors found, to their surprise, that in 7 out of 8 persons tested the left hand was better. According to the authors, the explanation is simple—the better skilled right hand found it easier to perform the task and did it more automatically, but with the unskilled left hand more attention had to be focused on it—therefore the better results. Goldstein thinks that the level for pain is lower on the left. Some of Zigler, More and Wilson's (1934) experiments support this view.

The possibility cannot be excluded that the " non-dominant " hand might be " dominant " for some sensory functions. It is interesting that all such functions are either of a more subjective or mental nature (pain, visual imagination, motor memory) or connected with proprioceptive rather than exteroceptive nervous mechanisms (estimation of weights). There are also " motor " functions in which the left hand is " leading," e.g. defence in fight, carrying and holding small things, or the expressive movements of a conductor of an orchestra. These movements cannot be regarded only as complementary to the more technical-practical activities of the right hand, but are obviously of a more " subjective " character.

Thus the results of the present experiments on temporal discrimination are in agreement with the ideas outlined in the introduction, with the facts just mentioned, and also with recent clinical and pathological findings (Clenov and Eidinova, Cohen and Roechlin, Ehrenwald, Hoff and Poetzl, Paterson and Zangwill).*

It is not intended to make any further comment or speculation at this stage. But it might be well to remind the reader that the posterior part of the " non-dominant " hemisphere is larger, and possibly of a more complicated gross anatomical build than the corresponding part of the other hemisphere. One might, therefore, suggest that this larger part is more representative of the *very* complex temporal functions which are so often disturbed in psychotic conditions (Halberstadt, 1922; Lewis, 1932; Schilder, 1936).

Summary and Conclusions.

(1) Spatial discrimination has been examined in 25 normal persons. In 18 of them it was better on the right hand. The other 7 persons admitted left-handedness or ambidextrous tendencies.

* Their findings are confirmed by fairly frequent observations of my own. This is a short but typical example: E. C. U—, aged 39, aneurysm of aorta; aged 53, dysentery; aged 70, stroke—since then " confused and deluded." One year later (1939) admitted to Shenley. B.P. 220/120, tremor of left hand. No idea of time and place, she is in China or on board of a ship, the year is 1896, her age 60. Misidentifies persons, wanders about and gets lost. Thinks she is menstruating and frequently asks for sanitary towels. Otherwise no great intellectual loss; always cheerful and pleasant; no trouble. Aged 74: Becomes incontinent, speech slurred, slight right facial weakness? Two months later: Semi-comatose, broncho-pneumonia, tongue deviates to the left. Improves for a short while, but soon rapidly deteriorates and dies five weeks later. Post-mortem findings on brain: Softening of cortex, subcortex and deep white matter of right gyrus supramarginalis and angularis. Occipital lobe apparently not affected. Small cystic softening of upper edge of left putamen, several lacunae in right lenticular nucleus. The misidentification of persons and the feeling of menstruating, besides the spatial and temporal disorientation are of particular interest. Cohen and Rochlin's clinical case showed also disturbance of the " bodyself " together with temporal disorientation.

(2) Aural discrimination of time was tested separately on each ear, in 40 normal persons. There were three groups:

(*a*) Essentially anatomical dextero-laterals (23), with temporal discrimination better through the left ear.

(*b*) Essentially anatomically sinistro-laterals (9), with temporal discrimination better through the right ear.

(*c*) Most likely ambilaterals (8), with no outspoken differences between right and left.

(3) Clinical, pathological and physiological experiences show that the left hemisphere in right-handed persons cannot be considered any longer as "dominant" for *all* nervous functions, and if we speak of hemispheric dominance we have to specify the function concerned.

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* But apparently a misprint; not in *Phys. Rev.*—H. H. F.

CONTRA-INDICATIONS FOR LEUCOTOMY: WHOM NOT TO LEUCOTOMIZE.

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Now that more than six years have elapsed since the introduction of leucotomy in this country, it is becoming possible to assess more accurately its remoter effects. The increasing use that is being made of the operation bears witness to the beneficial results that have been obtained by it, but the justifiable enthusiasm occasioned by the dramatic improvements it has produced in some cases apparently resistant to all other present-day methods of treatment must be tempered by a sober consideration of all the sequelae of section of the prefrontal fibres. While it is undoubted that after it many cases are sufficiently recovered to resume a full and satisfactory social life, and an even larger number are either freed from intense misery or from hostility and aggressive impulses and enabled to take a more co-operative part in the sheltered life of a hospital community, there are a few whose behaviour following the operation is definitely less satisfactory than it was even at the height of their illness. Furthermore, even in the successful cases, certain undesirable traits have often been noted.

It is not proposed to deal in this paper with all the contra-indications for leucotomy, but to draw attention to a few cases, operated on at the Burden Neurological Institute, in whom the undesirable results are so pronounced that it is felt it would have been better had these patients not been operated on. It is hoped that this preliminary study will be followed by reports from other observers on the patients in whom the results are unsatisfactory.

An attempt is made, however, to discover if possible some common factor or factors in these cases which may be of general validity, and so capable of being used as a yard-stick whereby to judge of the advisability of leucotomy in any given patient. For this reason also these unsatisfactory cases are compared with some that are considered as being most successful, since it is thought that the contrast may help to throw into relief those pre-operative factors which most clearly distinguish the one type from the other.

Owing to the fact that the most outstanding changes which result from the operation are changes in personality, rather than in intellect, the reports on these patients must necessarily take the form of personal histories, but these have been made as brief as possible, and only include those features which are considered relevant to the point at issue.

Although most observers are agreed that the results obtained in the obsessional neuroses and depressive states are generally better than those in schizophrenia, it is noteworthy that the unsatisfactory cases reported here include

two neurotics, an anxiety and an obsessional case, and one schizophrenic. The undesirability of the post-operative personality seems much more definitely allied to the character of the patient prior to his illness than to the form of illness to which he succumbed. In these cases the patients' character undeniably contained unpleasant or anti-social traits, which after operation became even more evident.

It is reported of W. W—, who was leucotomized in September, 1943, aged 27, that she was always asocial, and although a member of a large family, being the second of 6 children, was different from the others. She was dependently attached to her very indulgent mother, but extremely jealous and determined to have her own way, intensely self-centred, and with many neurotic traits, such as fear of sleeping alone and nail-biting. She did not make friends at school, but is said to have enjoyed practical jokes of a mean kind. After she left school at 14 she frequently changed her jobs, and failed to make a success of any of them. She had no ambitions, but her main interest in life seems to have centred round sex. Even here, however, she appears markedly ego-centric, for although she preferred male company and indulged in sex play and masturbation, she evinced no real affection for her boy friends. Women she regards as rivals, and was avowedly jealous of one of her sisters whom she considered prettier than herself. In spite of her sexual libido she was so childishly and egocentrically attached to her mother, who provided her with the protection she desired against the harsh contacts with reality which mature responsibility inevitably brings, and which her timid and egocentric nature feared, that she always declared she would never marry unless her mother could live with her.

Her first severe obsessional symptoms began at the age of 18. At this time ideas came into her head about people committing suicide, gassing themselves, or cutting their throats, and whenever these ideas came she had to do whatever she was doing at the time over and over again. These ideas may have been sado-masochistic manifestations of her sex impulses. The pre-operative Rorschach test seems to give some confirmation to this view; throughout there was an excessive preoccupation with sex, e.g. she gave a similar response to cards III, IV and VI, viz. " the bottom part of the body, may be female "; and she said of all the cards that they resembled one another, indicating that they all suggested female anatomy. Her response to the emotional effect of card II was very interesting. " I think these are like two animals—cows. The red part looks like blood. I wondered if they were male and female; I don't know why; they both look the same. I think I said when I first saw them (she had seen the first two cards on a previous occasion) they might be being slaughtered, when I thought I saw blood." In the discussion the only reason she could give for thinking them male and female was the fact of there being two.

These sado-masochistic phantasies probably gave the patient considerable sensual pleasure; when interviewed prior to the operation she volunteered that she always liked to hear about other people's downfall. At the same time she was troubled by a sense of guilt, and it was this that led to her excessive worrying. " I worry because I've got a guilty conscience." " I think of all the wicked things I have thought about." The obsessional habits and the later obsessional rumination were probably defence mechanisms against and an expiation of these criminal phantasies.

The neurosis was so severe that she had entirely given up work at the age of 22 and was wholly dependent on her family, whom she burdened excessively with her miseries and her scruples. She was under medical attention for many years, and had received various forms of treatment before leucotomy in 1943.

After the more immediate post-operative effects of anergia and foolish euphoria had worn off, she seemed for a while slightly but definitely better. She ceased to talk about her worries, read more than she had done for years, slept better, and seemed more genuinely fond of her young man. She married in 1944, but unfortunately her husband, though intelligent, is also neurotic, and the marriage has not been a success. As her husband was conscripted in the Pioneer Corps, she continued to live with her parents. She openly despises him and thinks him lacking in " male

assertiveness," and has only a profound contempt for his interest in music and poetry and his "feelings for humanity." The patient herself now likes reading "romances," i.e. erotic love stories, and explicitly states that she has no interest whatsoever in humanity. It is worth noting here that in a recent Rorschach test, performed elsewhere, there were reported to be 11 animal movement responses, FM, and no human movement, M, indicating the existence of very strong sexual libido. Sexual relations with her husband are unsatisfactory, and she states that she is much more passionate than he. There is constant quarrelling and bickering, and she now openly enjoys saying cruel things and inflicting suffering on others.

She is extremely idle and does little in the house, and is still excessively meticulous and very slow. She takes no interest in anything outside her own needs and frustrations, is irritable, resents noise, intolerant of her young brother, jealous of her married sisters, and inconsiderate.

Recently she was admitted to a psychiatric hospital for further investigation. Here she was disliked by most of the patients and the staff, and though she complained of "being terrified" of everything and of "suffering agonies," there was no evidence of any depth of emotion. She admitted taking no interest in the other patients' progress, and appeared amazed that they should show sympathy with her. She was idle, and exhibited a few obsessional symptoms. During her stay there was, however, some slight improvement noted as the result of hospital routine and discipline.

In this case leucotomy has undoubtedly relieved the patient of her conflicts and of the emotional distress which these caused her, but appears to have done so by removing the "conscience" which was one of the elements in the conflict, leaving the field open to the aggressive sadistic impulses associated with her overwhelming erotic interests. She is entirely egoistic, and completely lacking in feelings for other people. The behavioural habits which she acquired during the years prior to the operation are now persisting relatively unaltered, though one of the motive forces, namely her conscience or a sense of guilt, is no longer operative. Her conduct is little changed and she is definitely more unpleasant and a more amoral person than she was formerly.

The second case, which it is also thought advisable to report fairly fully, is that of V. B—, a man now aged 48, who was one of the earliest patients treated by leucotomy at the B.N.I. in 1941.

He also gave a long history of nervous trouble, and was inclined to date it all from the first world war, during which period he was in the Army for 3 years and received two small gunshot wounds. He married soon after his discharge from the Army and has a family of 4 children. He was a self-absorbed, irritable, quick-tempered person, intolerant of noise, and with no real interest or hobbies. He never made friends, and was a hard, unsympathetic man who is said to have led his son a dog's life, and was occasionally violent to his wife. He had many jobs of the semi-skilled or labouring type, but was frequently off work with nervous upsets and was unemployed for 5 years. Nevertheless he was always clean and neat, did not use bad language, and was strict with his family, insisting that they observe the conventional proprieties.

In the second world war he was considerably upset by the air-raids, and broke down completely after he had been detailed to clean up a shelter in which many people had been killed by a daylight raid. He became unable to eat and sleep, and just wandered about the streets hardly knowing what he was doing; later became unable to concentrate and was always listening for sirens. His distress was mainly egocentric, and was caused by the apprehension of danger to himself, but it was accompanied by a sense of shame concerning his own cowardice, and he was upset by the relatively nonchalant attitude of his wife and children: "I felt ashamed because they were all so much better about the raids than I was."

After the operation he became relatively indifferent to the air-raids, but some time afterwards when working on an aerodrome near where bombing practice was being carried out, he found it upset him and had to give up the job; but he ceased to worry the moment he was away from the immediate threat of danger. He has

had several jobs, but seems to have been very casual about his attendance and probably also about the standard of his work, and it is probably for this reason that he is unemployed and has been for some time.

He has now become so difficult that the family are finding it impossible to live with him. He seems to have no feeling for anyone and is intensely selfish and intolerant. He is very lazy and rarely goes out, except for an occasional visit to a " pub " and his weekly attendance at the Labour Exchange. Flies into rages over trivialities and is sometimes violent. He wants everything for himself, and will not tolerate the slightest disturbance of his own comfort. Mimics and bullies the children, is very argumentative and uses filthy language. He tends to behave better in the presence of outsiders. His wife writes: " If any of the girls are ill, they are afraid to stay at home as he says they are shamming, and if I say I have an ache or pain he says he is sick of hearing about them, and when I fall or cut myself he simply laughs about it; in fact, it is the only time he laughs, when anyone is in distress or hurt."

He attends to his own toilet and is fairly particular about his external appearance, but he is by no means as clean as he was, and his daughter thinks he has not had a bath since the operation.

The patient himself tells quite a different story, and is perfectly self-satisfied; says he gets along very comfortably with the family, feels fairly well, and is not in the least disturbed by having no job.

The description of the " man " in the Raven projection test gives his " self-portrait," and is therefore quoted in full as it is felt to be a very revealing document. The test was done on August 14, 1946.

" The Man.

" Is he definitely drawing? He might be writing—if so he will say ' Dear Sir ' to start his letter with.

" He doesn't know exactly what the man might be interested in—he thinks he might be a workman of some sort and that he's definitely not a clerk or a business man. He's interested in football or cricket—a sporting man, not very old, not more than about 30 I should think. When he stops what he is doing he will think, ' I hope that will be the last of that—I hope that will settle things definitely.'

" His real work is as an ordinary factory worker. (V. B— found it hard to imagine what he likes about his work.) He is on the tidy side and might be in an engineering works.

" (What does he dislike?). Well, of course no one actually likes work—to tell the truth, no one actually likes their work—it's hypocrisy to say the ordinary workman likes being cooped up in a factory for 8–8½ hours a day. I certainly think he's no different to the ordinary workman.

" If he's under supervision the foreman or ' passer ' of some description will see his work, and if it wasn't right, well, he'd be told. The foreman will think whether he's done anything wrong before, and if he has, then he will give him the sack—dismiss his services; but if he hasn't done anything wrong before, they may overlook it—quite possibly it was a slip on his part.

" He would say, if it was a first slip on the part of a very good workman, ' Well, it's wrong—don't let it occur again.' But if it had happened before, would say, ' We've warned you before, and we can't warn you again.'

" He will think, ' Well, I suppose if it's the first occasion I shall have to be more careful, but if it's the second or third occasion then I shall have to get another job, and what I shall tell them I don't know. I shall have to pull myself together and not make so many mistakes in life.'

" He likes the sort of people—well, I should imagine the common-or-garden workman such as myself; interested in sport, and perhaps the sort who go to pictures—I don't go myself—football, cricket, boxing—what the majority of men go in for.

" He prefers a man's company—male company he would prefer.

" He dislikes—well, it's hard to say. From the look of him I think he would dislike religious people—not the sort of people who just go every week to church, but those who have religious mania—duty bound to go once a week. He's not a girl's man—of course we know most men get married, and many certainly not before it's time for them to.

" What annoys him or makes him angry ? Well, I should say he's a man who doesn't like being interrupted. Many like being interrupted as a chance of stopping work, but I think he is a man who likes to get on with his work.

" What does he do when he's angry ? Oh well, it's hard to say. I've met some very queer people—I've met some very violent people and had to deal with them —but he might forget it by the next day.

" He is frightened by any sudden noise—like a motor-cycle back-firing, or something like that.

" When he is tired anything might worry him. I consider that anything would disturb him when he should be resting—he would consider that it wasn't right for that to happen when he wanted to rest. He would brood for a little while, and then go off on his own for some little while—possibly for a long walk—and then come home and sleep it off.

" He saw something funny—what ? Well, I don't know what you would consider funny, but, er. . . . some funny things can happen, such as a . . . you might be going along the street and you might see a cat nearly run over. Well, if the cat was only nearly run over, and scrambled out of the way in time, I should consider that very funny, and I should imagine that he would consider it very funny.

" He enjoys seeing a good football match more than anything else, or alternatively a good cricket match.

" *Dreams.* Oh well, practically all of us want more in life than what we've actually got in these worldly goods, in other words, money. I should imagine that he would naturally dream that he wanted more money, and if he got what he dreamt I should imagine it was more money.

" Well, I should think myself, I should imagine that he would put that £1,000 in the Bank or invest it in some business or other and carry on with his own work normally, and let the interest accrue.

" When a man of his description has been dreaming, he usually wakes—er—in a very torpid condition. I know by my own experience, and usually I know that when I wake I am very sluggish, when I wake from a dream of any description, whether it's good or bad—and I should think he was the same.

" Well, yes, I should think that he was satisfied to a certain extent in that he's got a good job, and I think he is satisfied in doing his job, but I certainly think he has got ambitions to get a bit higher in life if he can.

" Well, I don't think he has got any particular aim in life, only just doing his own work, and it's quite possible he does things, such as—er, investment on a football pool, or horse racing, or anything like that. That's his one ambition in life, I think—is to make money that way.

" Well, I certainly admire him by what I think of him, because I think he's rather inclined to be broad-minded, and addicted to sport generally.

" Well, I don't know that there is anything I dislike about him. I can't see that there is anything the matter with him that I could dislike. Well, I think I've given as good a description of him as anyone could.

" Well, I should imagine he was like myself—I should think we're near enough the same person as regards likes and dislikes.

" Well, I certainly think I like the same things generally. I live the same sort of life that he would live as regards sport and work, and I think it's—er, well, we're near enough the same person."

The portrait is undoubtedly that of a materialistic egoist ; there is no mention of nor consideration for any other person. His description of something funny confirms his wife's statement, since the only example he gives is that of a cat being nearly run over.

The other case, A. C—, now aged 37, was an unmarried woman who, having been fairly strictly brought up by her grandmother, had for many years earned her living as a barmaid and prostitute. She then lived for 7 years with a man, having one illegitimate son by him. Her illness was precipitated by this man's desertion of her. After admission to hospital she was difficult, hostile, sullen, and negativistic, but she continued to evince some affection for and interest in her son, and

would respond slightly to kindness, and it was obvious that at least some of her behaviour was motivated by feelings of shame and self-reproach. She imagined people said abusive things about her, which made her lose her temper and caused her to shout back at them.

After the operation she became much more hostile, and refused to co-operate at all, saying that she hated women, and that all she wanted was a man and that she had always wanted men. She bitterly resented the enforced abstinence of hospital life and was truculent and aggressive, and finally relapsed into mutism. She no longer evinced any interest in her son.

In a recent paper, detailed histories were given of 10 other patients treated by leucotomy at the B.N.I., and while all these can be said to have benefited from the operation, nevertheless in some of them the accentuation of certain undesirable traits of character can be seen, though the character considered as a whole shows many improvements which offset and counterbalance these.

If we now turn to the study of the most successful cases, it is also evident that the character of the person prior to his illness is of more outstanding importance than the clinical type of illness. I shall only briefly quote two cases to illustrate this:

M. W—, now aged 56, was operated on in August, 1941. He was the son of a railway official, who later became a miner in order to earn bigger money for his wife and five children. The patient himself rose to a position of considerable responsibility as a departmental manager in a large industrial concern. He was energetic, conscientious, capable, and actively interested in religion of the verbose emotional type. He was nervous, self-conscious, self-critical, and inclined to worry. His nervousness increased after the outbreak of war in 1939 and he began to suffer from abnormal physical sensations, particularly in his groin. He expected the Germans to begin large-scale bombing immediately, and whether or no this led him to consider his own preparedness for death and judgment, it is certain that he became preoccupied with certain minor sexual misdemeanours of his youth, and unjustifiably attributed his new and disturbing physical sensations to syphilis. He began to suffer from severe insomnia and loss of appetite, and became profoundly depressed and actively suicidal.

His recovery after the operation was slow, and several months elapsed before he was fit to be discharged and again before he was fit to resume work, in 1943. With his consent we subsequently contacted his employers, who are perfectly satisfied with him, and whose only criticism is that he seemed to show a little jealousy of the man who deputized for him during his illness.

His wife is very pleased, and finds him better than he has ever been—calmer, less excitable, less worrying, less self-conscious, but still active, alert and quite as considerate and affectionate as formerly.

L. H. W—, now aged 40, was the son of poor parents who rose by his own ability to be a bank clerk. He had one brother and one sister. He was brought up in a very religious atmosphere, with very strict views about sex. Although he discarded the religious beliefs of his parents, he remained very scrupulous and conscientious, self-conscious, reserved, anxious to be friendly but not always succeeding, undemonstrative, and with considerable sex-repression. He lived with his parents and contributed largely to the family budget, and his humble origin and rather unusual appearance gave rise to feelings of inferiority. Finally he began to suffer from severe insomnia and became increasingly preoccupied with and depressed by his anxieties, and on one occasion attempted suicide by taking 28 medinal tablets.

Since his operation in 1943 he has returned to the bank, and he married, in the summer of 1945, a girl who had known him for 11 or 12 years. She seems perfectly satisfied with him; says he has more confidence, is on a more even keel, and is more sociable though needs a little pushing from her. He is kind, but perhaps a little more selfish than he used to be and not quite so tactful, and doesn't care so much about the effect on people. Whereas before, owing to the poverty of his childhood he was unduly careful with money, he is now more generous. He wants to keep his marriage as happy as possible, and has many interests; likes pottering

about the house, enjoys cigarettes and his " pint," reads his literary " favourites " regularly, enjoys swimming, and is interested in nature, birds, astronomy and photography. Still likes to study and do things properly. Has no interest in religion, is quite content with the earth as it is and doesn't bother with the hereafter; thinks that when we die it is the end.

His wife feels that the results of the operation have been entirely good, and has not noticed any defects which she can attribute to it.

It is apparent that in spite of difficulties due to environment and temperament these two men had both achieved considerable success, and were playing a useful and responisble part in the social community and were liked and respected by those who knew them. In both there was also considerable conscientiousness and anxiety about their ability to live up to their self-imposed standards, and they were unduly self-conscious and troubled by unnecessary scruples. The removal of this scrupulous conscientiousness relieved them of the disabling symptoms produced by it, and so effected considerable improvement. The total personality, however, was basically well adjusted both to the environment and the social community, as evidenced by their earlier success; they had no outstanding anti-social or immoral impulses, and their post-operative behaviour therefore accords well with the conventional demands of the society in which they live.

Discussion.

If the three failures are studied together, certain features emerge. All showed egoism and lack of social adjustment. They had a poor work record, and had none of them achieved any real success, nor had they given much evidence of any real altruistic affection. It is true that W. W— was very attached to her mother, but in a childish, dependent way; that V. B— was married and had three children, but he seems to have shown them little affection, and his remark in the post-operative Raven projection tests seems very self-revealing—" He's not a girl's man; of course most men get married, and many certainly not before it's time for them to." A. C—, although socially the least respectable, nevertheless does seem to have had some real affection for her son, and probably also for the man with whom she cohabited for 7 years.

All three had evolved their own pattern of behaviour. This was least satisfactory in the case of W. W—, who had gradually become completely dependent on her family, whom she burdened excessively with her interminable talk about her misery and her worries, and with her obsessive rites. V. B— and A. C—, on the other hand, were coping rather more successfully with life until they were overwhelmed by a relatively major catastrophe—air-raids in the one case and desertion in the other. In each case the catastrophe completely disrupted their habitual mode of life, and both became more or less psychotic. V. B.— became confused, unable to concentrate, sleepless and depressed, while A. C.— became hostile, negativistic and aurally hallucinated. During their illness new ways of reacting, i.e. new habits were formed, which had little in common with their former habits.

After the operation W. W— and V. B— were soon able to return to their former envionment, and resume their former way of living. In many respects,

therefore, their behaviour is unchanged, the only outstanding feature being the marked increase in their egoism and lack of consideration for others.

A. C— never became sufficiently well adjusted to be considered suitable for discharge from hospital, and her present environment therefore is the same as it was during her illness, and tends to perpetuate the same kind of behaviour, a similar stimulus evoking a similar response, and she has had no opportunity to resume the habits of her pre-psychotic phase. Furthermore, the enforced sexual abstinence due to her detention in hospital aroused considerable emotion which motivated her post-operative behaviour, making her seem more hostile and unco-operative than before. It is interesting to speculate what might have happened had it been possible to allow this patient to satisfy her erotic cravings, and return to her former life of prostitution. It is arguable that under these circumstances she might have resumed many of her pre-psychotic habits, and become, if not a desirable member of society, at least able to maintain and readjust herself in the community as a prostitute.

In making a final assessment of the effects of leucotomy the problem of re-education is of paramount importance, Clinical observation and animal experiment have shown that the old topographical idea of the cerebral cortex is erroneous, and must be replaced by a more holistic view, since it has been found that if one cortical area is damaged, some of its functions may subsequently be more or less efficiently performed by some other area.

Thus the increasing utilization of vision and touch may eliminate many of the disabilities due to loss of hearing, or of vision, touch, and temperature those due to loss of sight. There is also evidence, at any rate with efferent nerves and fibres, that the function which is lost may even be recovered, and not merely compensated for by substitution.

It is therefore probable that the functions which are disturbed by section of the prefrontal fibres may later be restored to some extent by developing the latent potentialities of the rest of the cortex.

It is undoubtedly true that we are all creatures of habit, and that we become increasingly so with age. It is, of course, possible for a well-established habit to be broken, and be replaced by a new type of response, and this breaking of a habit may be brought about by the presence of external circumstances, or by an inner conviction or desire. The substitution of good habits for bad ones demands the recognition of purpose and values, and is felt as a moral obligation. It requires so much effort to break a well-established habit that it cannot be done unless the motivation for so doing is adequate.

Much of the abnormal behaviour in neurosis and psychosis is conditioned by autistic thinking and is self-determined. There is some evidence that after leucotomy the patients become more extraverted, are more susceptible to external influences, and more objective and materialistic in their outlook. If this be true, then any desired change in the patients' behaviour must to an increasing extent be conditioned from without, and opportunities must be provided for the re-establishment of previous good habits, and strenuous effort made to replace bad habits by some satisfactory ones. Furthermore, the question of adequate motivation must be seriously considered, and where there is evidence of an increased egoism, it may be necessary to base one's

re-educational programme almost entirely on motives of self-interest, relying on the judicious use of rewards. If many good habits had previously been formed, the sooner the patient can be returned to his normal surroundings the better, for the objects and events of his environment will tend to re-awaken his previous mode of behaviour. It is bad, however, to allow any patient to drift along in an environment in which he has formed unsatisfactory habits, for these will simply be perpetuated; this may apply equally to his own home, or to a hospital ward. As far as possible, old interests should be revived and new ones introduced, and a regular disciplined routine adopted in order that stable habits of a satisfactory kind may be formed.

Summary.

The occasional occurrence of undesirable traits has been recorded in the post-operative characters of certain patients treated by prefrontal leucotomy.

In this paper are given reports on three cases in whom the personality after the operation is on the whole less satisfactory than it was before, and these are compared with successful cases.

The conclusion is reached that the basic character and outstanding traits of the total personality are of greater importance for assessing the probable results of the operation than the particular type of mental disorder from which the patient is suffering.

BRIEF RETROGRADE AMNESIA.

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THIS study of retrograde amnesia of brief duration is based upon information furnished by 117 persons who had undergone, according to their statements, one or more terrifying incidents. All were men on full military duty, with the exception of three civilians, included as being of particular interest. In many investigations the information has been obtained from patients in whom motives other than accuracy could have taken a part in their descriptions. A patient may invent, distort or exaggerate his amnesia for psychological, or material and pecuniary, aggrandisement. In this series 99 of the cases were voluntary applicants for officer-training.

Each subject was aware that he was being interviewed by a psychiatrist, but in spite of the importance to the candidates of appearing normal, 47 gave a history of amnesia. This is, no doubt, a minimal figure, as some would not refer to any matter they considered abnormal or detrimental to their applications. A tendency to minimize effects of terrifying incidents would be probable.

In this article the term "retrograde amnesia" will be used in the sense described by Guttmann (1944)—that is, when a sufficient length of time has elapsed for the function of recall to have "settled down again." This may be after a period of some months to many years since the incidents occurred. Russell (1935) stated that the memory of distant events usually returns before that of those more recent and that, in the post-concussional confusion period, incidents may be recalled which are forgotten after the return of full consciousness. The process appears similar, psychologically, to that which occurs under semi-anaesthesia or mild hypnotics, when repression is reduced, but may be re-accentuated when the patient has emerged from the semi-conscious state, unless he is compelled to face the subject-material previously repressed. Case 1 demonstrates the necessity of allowing sufficient time to elapse for the amnesia to be reduced to its minimum without treatment (Rudolf, 1944).

CASE 1.—Bomb exploded about 7 yards distant. For a few days after this event, the sound of the explosion, the pause while he thought "must get down," the blast on the back and the concrete falling around was all that could be recalled. Amnesia for from one-half to one minute previous to explosion. Gradually, over about 10 days, and at first indistinctly, the whole of the amnesic gap was filled in without any conscious active process by self or others.

In this paper, brief amnesia preceding an injury and amnesia associated with a terrifying incident without concomitant physical trauma will be discussed. Hysterical amnesia with a prolonged duration will be excluded.

The knowledge of amnesia depends upon the account given by the patient.

Consequently, paramnesia or retrospective falsification might possibly occur, especially as considerable periods elapsed before the subjects were interviewed. Nevertheless, previous authors, such as Somerville (1931) and Russell (1932), believe that the account given by the subject is usually accurate, although Somerville describes an exceptional, personal incident in which the patient believed, for at least 17 years, that Somerville had knocked him down, whereas another cyclist had done so. The subject on recovering from unconsciousness saw Somerville standing beside him, and associated Somerville, the first person seen after regaining consciousness, with the last event before being knocked down.

Russell (1932) reported that of 96 cases of head injury showing retrograde amnesia, in no case was memory of the blow recollected if unconsciousness had occurred. In the present series 34 cases reported unconsciousness, but not necessarily with head injuries. Of these 34, eight recollected, without receiving psychotherapy, the blow that immediately preceded the loss of consciousness.

If a subject gives a coherent, continuous and reasonable account, and if he gains nothing by denying it, a history of unconsciousness in association with an incident will probably be reliable. However, the so-called unconsciousness may, in reality, be an amnesia, the subject having been fully conscious at the time of the incident. The unconsciousness may have been a dazed feeling, which was interpreted as unconsciousness. The subject may have been informed that he had been concussed and assumed that unconsciousness had developed. Perhaps, when dazed, he may have been given drugs or an injection which sent him, immediately, to sleep (Case 2). Consequently, a statement by a patient that he has been unconscious does not necessarily imply that he has been concussed.

CASE 2.—Sergeant recalled being led to first-aid post and being in a lorry. Recalled going in ambulance to a church and being in a ship. Under hypnoanalysis, recalled going to a second aid post, where he was given bromide. If analysis had not been carried out, the administration of the bromide would have been unknown, and all amnesia subsequent to this N.C.O. being in the lorry would have been considered to have been psychological. In reality it was, possibly, partly chemical in origin (Rudolf, 1944).

To obtain reliable information about the presence of unconsciousness, trained witnesses would be required, but accurate decisions of the duration of unconsciousness may be impossible to make. Consciousness may return intermittently; it may be broken by periods of sleep or unconsciousness. The subject may have carried on his activities, apparently normally, for minutes or hours after a severe blow before losing consciousness (Case 3).

CASE 3.—Recalls being struck by hockey stick, following which was conscious for about 1½ hours. Then unconscious for a day.

In view of the difficulties inherent in the assessment of unconsciousness, the statements made by subjects quoted in this article should not be, necessarily, regarded as reliable. As statements with regard to amnesia are the conscious beliefs of the subjects, such statements can be accepted, especially, as in the cases described here, a tendency to hide rather than to expose amnesia would be more likely.

Psychopathy.

According to Schaller (1939), the presence of amnesia for the injury is one of the diagnostic points between post-traumatic concussion state and post-traumatic psychoneurotic state, amnesia being present in the first.

Table I shows the percentage of psychopathic symptoms and signs found in the present series. All the cases were interviewed by the same psychiatrist for the purpose of judging their suitability for appointments, so that approximately equal investigations were made in each case. The table shows that equal proportions of those who recalled their injuries and of those who showed amnesia for the injury gave evidence of psychopathy.

Table I.—*Psychopathic Signs in Cases who had Received Physical Injury.*

	Recalling injury.	Amnesia.	Total.
With psychopathic signs	18 (58·1%)	13 (41·9%)	31 (33·0%)
Without psychopathic signs	37 (58·8%)	26 (41·3%)	63 (67·1%)
	55	39	94

Table I shows that one-third showed psychopathic signs. That this proportion is not confined to cases who have received injury is demonstrated by Table II, in which 250 men who had not passed through terrifying experiences, and who were interviewed for the same reasons and by the same psychiatrist as those of Table I, gave a similar proportion.

Table II.—*Cases not Involved in Terrifying Experiences.*

With psychopathic signs	83 (33·2%)
Without psychopathic signs	167 (66·8%)
	250

Tables I and II suggest that men with psychopathic signs do not appear to be more liable to pass through alarming incidents due, for example, to their own emotions, to accident-proneness or to exaggeration of events, in reality trivial, than do others without these signs. The tables give no indication of the true proportion of psychopathy amongst the adult male population of this country, as selection of the men had been made, firstly for the Army and secondly for promotion. A further selection had taken place, for many men had been referred by combatant officers because they were considered "queer" or unusual.

The criteria of psychopathy were taken to be evidence of abnormal emotional conditions, even though these were not of sufficient intensity to affect appreciably the efficiency of the sufferer. Evidence of psychopathic symptoms at a early age only, e.g. childhood fears of the dark, were not used as criteria, although those who had suffered from marked childhood fears were still, possibly, affected emotionally by these earlier disturbances.

Cases.

The cases described briefly below have been selected as being representative of different aspects of the subject, They can be divided into:

A. Full recall of injury with, or without, unconsciousness.
B. Amnesia for injury with, or without, unconsciousness.
C. Amnesia antecedent to injury.
D. Amnesia without injury.
E. Repeated terrifying incidents.
F. Indefinite retrograde amnesia.
G. Recoverable memory.
H. Non-recovered memory.
I. Fear without injury.
J. Post-traumatic unconsciousness.

A. *Full Recall of Injury.*

Case 4.—Struck by lorry. Recalls head hitting vehicle. Unconscious.

Case 5.—Bicycle wheel struck curb. Recalls being thrown off and nose striking pavement. Unconscious.

Case 6.—Car struck a mine. Hit on chin by Bren gun. Recalls movement of car and blow on chin. Unconscious.

Case 7.—Recalls seeing flying bomb approaching, running from it and hearing its explosion. Unconscious.

Case 8.—Recalls sound of explosion, being carried along through the air and hitting wall of hut, which collapsed. Not unconscious.

Case 9.—Heard explosion, saw flash, felt his bicycle slide from under him and recalls falling on to ground. Not unconscious.

Case 10.—Recalls being lifted off bicycle by blast and hitting the ground. Not unconscious. Cannot recall hearing the sound of the explosion that produced the blast. This does not necessarily mean that an amnesia for the explosion occurred. Cases 11 and 12 demonstrate this point.

Case 11.—Recalls walking, carrying pail of water in each hand, when heard sound of the bomb falling. Felt push in the back from the blast and fell to the ground. As recalled sound of the bomb falling and feeling the blast, repression of the intermediate event, namely, the explosion, is improbable. Both the sound of the bomb approaching and the anticipation of death or injury as he was being pushed to the ground would be alarming. Not unconscious.

Case 12.—Recalls standing, seeing flash of explosion, feeling the blast, being carried about one yard and sitting down on the ground. Not unconscious. Here, also, repression of the sound of the explosion, when both the flash and the blast were remembered, is improbable.

B. *Amnesia for Injury.*

The cases immediately following demonstrate that amnesia is not related to the type of accident.

Case 13.—Recalls crashing of falling building and of his being in the air, but not of falling and striking the ground.

Case 14.—Recalls whistle of falling bomb and picking himself up about 4 yards away from his first situation. Amnesia for the sound of the explosion, for travelling through the air and for striking the ground. Not unconscious. If this subject had been travelling at an acceleration of from 300 to 400 g, the acceleration which is required to produce concussion without being struck by blast or other agent (de Haven, 1942), he would have been destroyed on striking the ground.

Case 15.—Recalls saddle slipping and his coming off his horse, but amnesia for flying through the air and striking iron fence about 3 yards distant. Unconscious.

CASE 16.—Recalls, when on motor-cycle, seeing cyclist ahead, thinking must turn to right, putting on breaks and shutting off petrol about 15 yards from the cyclist. Amnesia for striking cyclist. Unconscious.

CASE 17.—Was passenger in car struck by another car. Amnesia for about one mile before reaching scene of accident. Unconscious.

CASE 18.—Drove motor-cycle into lorry. Amnesia for about 1½ miles preceding accident. Unconscious.

CASE 19.—Recalls seeing knee coming towards him about 6 inches distant, when playing Rugby football, but amnesia for the blow. Unconscious.

CASE 20.—Recalls beginning of dive to tackle at Rugby football, but amnesia for finish of dive and for kick on head. Unconscious.

CASE 21.—Recalls walking across road and placing foot on opposite kerb. Cannot recall seeing bicycle approach and feeling it strike him. Unconscious.

CASE 22.—Recalls walking on edge of swimming-bath, but amnesia for foot slipping, head striking floor and falling into the water. Unconscious.

CASE 23.—When walking along breakwater fell on to shingle below. Amnesia for walking on breakwater and for falling. Unconscious.

C. *Amnesia Antecedent to Injury.*

CASE 24.—Woman knocked down. Amnesia for posting letter on a country 'bus until in her house on opposite side of road. Hypno-analysis carried out in sessions spread over several days. Memory regained for crossing road after 'bus had begun to move, for seeing cyclist coming round towards her from front of 'bus, for seeing his hat fall off and his front wheel skid towards 'bus, for taking step towards 'bus, for being struck in back, finding herself on the ground lying on face and towards right shoulder, hearing sound of bicycle and man falling on her and feeling back of her head struck. The sensation of feeling the head struck was recalled one visit before that in which she recalled the feeling of her back being struck, and two visits before the memory of falling on the ground was regained. Apparently the most repressed part of the amnesic period was not in direct connection with the injury, i.e. the blow on the head. If the retrograde amnesia had been due to the physical injury, the most difficult part of the memory to recover would have been that immediately preceding the injury. The most difficult part, i.e. the last to be regained, was the passage through the air while the woman was falling to the ground.

Once safely on the ground, the fear of serious injury or death was less great than when falling to the ground, the falling being of greater emotional significance than the injury to the head.

CASE 25.—Man could jump easily over rope or solid log 3 ft. in height, but unable to make himself jump over solid wall of equal height. Wished to be trained as paratrooper, but when ordered to jump wall about 2 ft. 6 in. in height and about 1 ft. 6 in. in width, ran up to it, put his foot on it, but was unable to jump over it. About half-a-dozen unsuccessful attempts. Consequently unable to become paratrooper.

At 14 years of age, when jumping over wall 2 or 3 ft. in height caught foot on it, fell forward and broke wrist. Recalled jumping and hitting ground, but amnesia for striking wall with foot, although informed by observers had done so. Not unconscious.

Presumably, the moment of greatest fear was as the foot struck the wall and so previous to the possibility of greater injury due on striking the ground.

D. *Amnesia Without Injury.*

The brief period of amnesia preceding an injury is often thought to be due to organic disturbance. The fact that it is possible to recover the memory up to, and including, the moment of physical impact, even many years after the incident, points to a psychological rather than to a physical cause. Amnesia similar to that preceding injury may occur without any physical trauma, as is shown by the following cases:

CASE 26.—Amnesia, often known as "black-out" amongst paratroops, for first and second jumps when training. It commenced, as is usual, as jump began and, on first occasion, terminated as the parachute made the usual sound when coming out of its haversack. The amnesia, therefore, ceased before the occurrence of the jerk due to the 'chute opening, but as soon as the man knew safety was assured. In many cases the amnesia ceases when the tug of the 'chute opening is felt.

CASE 27.—An experienced paratroop major, with 27 jumps to his credit, stated that "black-outs" occurred in each of his first few jumps until the 'chute opened. The lengths of the periods of amnesia became progressively less until they ceased at the tenth jump, when, so he said, he "had gained complete confidence in the equipment." No further amnesia, although, as is usual with all paratroops, suffered from marked fear until the light in the aircraft was turned on.

CASE 28.—An instructor who had jumped from aircraft between 30 and 40 times in controlled jumps, i.e. automatic opening of 'chute, carried out a free jump, i.e. in which he himself opened the 'chute by pulling the rip-cord. From the moment of jumping at 3,000 ft. until he pulled the rip-cord at about 600 ft., he was unable to recall his sensations. Amnesia, therefore, occurred when this officer was unable to rely on an automatic process for his own safety but was compelled to rely on himself. He pulled the rip-cord considerably later than did three others who jumped with him.

The amnesia is not likely to be due to falling through the air or to somersaulting, as amnesia is not only not constant, but comparatively rare amongst paratroops. Case 29 demonstrates that memory can be retained when upside-down. Paratroopers and acrobats are aware when they are somersaulting.

CASE 29.—Baled out at 26,000 ft., but did not pull rip-cord until below cloud at 20,000 ft. During this fall recalls seeing feet higher than head. Saw one knee boot coming off, bent to it and pulled it on. Felt as if in easy chair with feet raised. When pulled rip-cord must have been travelling at about 120 m.p.h. (*Brit. Med. J.*, 1945). The maximum velocity that can be tolerated, without discomfort, providing jaw movements or swallowing are carried out to clear the ears, is stated to be 114 m.p.h. (Matthews, 1945.)

E. *Repeated Terrifying Incidents.*

Although the fear of imminent injury or death is nearly universal, its intensity varies from person to person, and in the same individual from incident to incident. Of 18 subjects who had undergone more than one alarming experience, 10 recalled the whole of their multiple experiences, including the moment of impact; 7 showed amnesia for one experience only, and 1 individual amnesia for more than one. In the seven, the amnesia was for the first incident in each case, and not for the second.

Of four cases with three experiences each, one recalled all details in all three experiences, one showed amnesia for the first and third experience, the third for the second experience only, and the fourth for the third experience only.

The following cases are illustrative:

CASE 30.—*First experience:* Holding hose-branch, when heard bomb explode and was blown sideways.

Second experience: Lying down, two days later, when heard bomb falling and was rolled over by blast.

Third experience: On following day, standing, when heard explosion of land-mine and was blown about 5 ft. and over.

No amnesia for any incidents.

CASE 31.—*First experience:* Passenger in car when it was struck by a second car. Recalls car being pushed across road, but amnesia for its striking a wall and for his head being struck. Unconscious.

Second experience: Recalls seeing flash of explosion, feeling blast hit him, being carried along about 12 ft. and being thrown over.

Third experience : Walking when found himself lying down. Amnesia for cause of this action.

CASE 32.—*First experience :* Recalls standing, being blown over, and rolling over and over until fell into trench.

Second experience : Recalls sound of explosion when in truck. Amnesia until found himself getting up from grass. Probably unconscious for short period.

Third experience : Recalls sound of other, more distant, bombs falling and exploding, but not the sound of the nearest bomb exploding, but only of its fall. (See Cases 11 and 12.)

CASE 33.—*First experience :* When cycling, in dazzling sunlight, rode into van. Recalls striking van and falling on to road. Not unconscious.

Second experience : Recalls, when cycling, motor-cycle approaching about 10 yards away. His front wheel was struck by motor-cycle, but amnesia for impact. Unconscious.

Third experience : Recalls engine of flying bomb stopping, bomb exploding, ceiling shaking and coming down on to him. Not unconscious.

CASE 34.—*First experience :* Recalls stone coming towards him, attempting to dodge it and it striking him on the bridge of his nose. Unconscious.

Second experience : Recalls sound of explosion and being pushed to ground. Not unconscious.

CASE 35.—*First experience :* Recalls shell exploding, going flat and being wounded in neck.

Second experience : Recalls explosion of shell on wall of trench and his going flat. Not unconscious.

CASE 36.—*First experience :* Recalls flash of explosion, travelling through the air and falling down on to path. Not unconscious.

Second experience : Recalls sudden orange glow and being pushed on to ground. When sitting on the ground, heard the explosion. Not unconscious.

CASE 37.—*First experience :* Recalled sound of explosion and feeling the blast.

Second experience : Knocked out when boxing. Recalls the blow.

CASE 38.—*First experience :* Recalls explosion of a flask in a laboratory and of burning methylated spirit being thrown on to his face and hands.

Second experience : Recalls explosion of bomb and his falling on to ground.

CASE 39.—*First experience :* When cycling, his front wheel struck by car from the left. Recalls nothing after about 100 yards before scene of accident. Unconscious.

Second experience : Recalls sound of explosion, smoke, flying bricks and the blast blowing him over.

CASE 40.—*First experience :* Recalls being lifted off ground and flying through the air, but amnesia for striking wall, furniture and floor. Unconscious.

Second experience : Recalls explosion of bomb, travelling through the air and coming down on to the ground.

CASE 41.—*First experience :* When climbing wall, grasped stone flower-bowl, which broke. Amnesia for falling, striking ground and raising himself on hands and knees. Unable to recall flower-bowl falling on his chest or the cause of a bruise on back.

Second experience : Recalls hearing bomb falling, feeling blast strike him as he was dismounting from his bicycle, and hearing the explosion. Not unconscious.

CASE 42.—*First experience :* Recalls falling, but not striking a boot with his right temple. Unconscious.

Second experience : Recalls that, when crouching down, heard explosion and went over on to floor. Not unconscious.

CASE 43.—*First experience :* Saddle of cycle fell off. Recalls coming off bicycle, feet hitting ground, falling towards ground, but amnesia for head striking ground although chin injured.

Second experience : Recalls bomb exploding and windows and ceiling falling.

F. *Indefinite Retrograde Amnesia.*

In some cases, such as the following, where the subject was in bed and, perhaps, sleeping, doubt exists as to whether retrograde amnesia occurred. Sleep may have been sufficiently deep for repression to be unnecessary. That

sleep may not be affected by an explosion, although other effects are disturbing, is shown by an experience in which the author awoke feeling the bed vibrating. A few minutes later an explosion was heard followed by vibration of the bed equal in extent and duration to the first. Presumably, as equal vibration occurred on both occasions, the sounds reaching him would have been equal.

CASE 44.—Asleep in bed. Woke up on the floor without recollection of an explosion or of being lifted out of bed.

CASES 45 and 46 demonstrate the awareness of the situation. Both cases recall sounds of the explosions, being lifted out of their beds and dropped on to the floor.

G. *Recoverable Memory.*

Usually with treatment, as for example, hypnosis, full memory can be regained up to, and including, the moment of impact, as shown by Cases 47 and 48, described as exemplifying widely different types of trauma:

CASE 47.—Tram-driver showed amnesia from a passenger entering his tram, about 50 yards before the tram-car crashed into a 'bus, until he woke in hospital. Under hypnosis, memory regained up to the caving-in of the metal front of tram striking him in the chest and knocking his head on door behind him.

CASE 48.—Clergyman possessed amnesia for room in house in which he had lived for 10 years. Under hypnosis, regained memory of room, and of a friend of his father losing his temper, rising, coming towards him, placing his hands on his throat and nearly strangling him, about 30 years previously.

H. *Non-recovered Memory.*

In some cases the brief period of amnesia immediately preceding the impact, whether or not unconsciousness occurs, appears to possess particular significance. In these cases the final fraction of a second may not be filled in, as exemplified by Cases 49 and 50:

CASE 49.—Amnesia for getting into lorry until in hospital. Under hypnosis, memory regained for entering lorry, sitting on a box, lorry turning a corner, box swaying, going over side of lorry, falling head-first towards road until eyes level with wheel-hub. The final part of the fall of one or two feet and striking the ground was not recovered.

CASE 50.—Adjutant showed amnesia for stopping one of his lorries and riding in it until awoke in hospital. Under hypnosis, memory recovered for riding in lorry, standing looking over roof of cab, lorry striking stationary car, his leaving the lorry and travelling through the air upwards. Falling and striking the ground was not recovered.

Similar incomplete results were obtained by Sargant and Slater (1941) in neurotics, who dated their amnesic disturbances from concussion or from being blown over. These authors considered that these very brief periods of amnesia remaining after treatment were presumably organic in nature.

This view is supported by the evidence from Cases 51 and 52, in which no possibility of the knowledge of an impending accident existed. In both cases the blow causing concussion fell on the back of the head whilst the soldier was performing work unassociated with danger. Neither man could have been aware of the approaching object. In one case no retrograde amnesia occurred; in the other all events up to, but excluding, the blow were recollected.

CASE 51.—As clearing undergrowth was struck on back of head by a tree felled by another man. Was unaware that tree would strike him. Recalls blow; no retrograde amnesia; concussed.

CASE 52.—As bent down, plank struck him on back of head. Concussed and cannot recall blow. Was unaware plank was falling, and man working on scaffolding above him was unaware plank had fallen. No other man in neighbourhood who could have warned him of the danger.

In neither case did retrograde amnesia, other than for a fraction of a second, occur.

1. *Fear Without Injury.*

Feelings of fear were well described by—

CASE 53.—Captain who had made 13 parachute jumps and who was accustomed to running in flat races in which physical injury was improbable. Stated that feelings of fear, e.g. in stomach, were identical whilst waiting to start in a race and waiting to jump from aircraft. In the first, the condition was of possible psychological trauma, i.e. loss of prestige, whilst in the second it was of possible physical trauma, i.e. death.

The possibility that the whole, or a part, of the fear while waiting to jump was due to a possible loss of prestige due to showing fear or refusing to jump is unlikely for two reasons. First, it is common knowledge among paratroopers that fear is always felt before jumping, although it may stop when the light goes on. The regularity of this fear was reported by a man who had made 40 jumps. Second, fear of refusing to jump cannot be of great intensity when a man has jumped many times and has complete confidence in his equipment. In addition, he knows that if he hesitates and the R.A.F. man does not push him out of the aircraft, the man behind him in the stick will do so. In consequence, he is unlikely to fear that he will not leave the plane.

Amnesia can, of course, be due to guilt. This cause is unlikely in paratroops, as the men are carrying out their acknowledged duty.

An instructor, who had carried out between 60 and 70 jumps, found that the men, although always feeling fear, do not invariably consciously attach their fear to the possibility of becoming a "Roman Candle." Some may fix their fear upon going through the door of the aircraft and others on the landing. On operations the men are usually more anxious about the operations than the jump, although when on non-operational jumps the same men would be consciously afraid of the jump itself.

Although these "black-outs" are normally unconscious protective devices, one officer stated that he was terrified so greatly during his first two or three jumps that he compelled himself to make his mind blank. This officer did not appear to be a coward, since later he volunteered for, and was engaged in, special individual work in Greece of a highly dangerous nature.

The "black-outs" of parachute jumping are causally dissimilar to those occurring in air-crew when an aircraft goes into a tight turn. The last occur constantly, being related to the magnitude and duration of g, and not to the subject having confidence in his aircraft. The tight turn, by increasing g considerably, increases the weight of the body-tissues. The writer has no information as to whether the retrograde amnesia and disorientation found after unconsciousness due to complete "black-out" in air-crew are physical or psychological in origin.

J. *Post-traumatic Unconsciousness.*

The length of the post-traumatic unconsciousness is commonly used as a gauge to the severity of the physical injury. If the pre-traumatic amnesia were also produced by the physical injury, a relationship between the length of the retrograde amnesia and the post-traumatic unconsciousness might be expected. As far as the subjects' statements are reliable, Table III shows that no direct relationship exists. The divergences are so great, e.g. retrograde amnesia of one or two seconds with post-traumatic unconsciousness of 15 minutes in one case and of 24 hours in another, that some significance may, perhaps, be attached to them. Russell (1932) believes that the patient's "subsequent memory of when he woke up provides a not inaccurate indication of when consciousness returned," so that "the duration of unconsciousness can be estimated with fair accuracy even when the patient is seen for the first time long after the accident."

TABLE III.—*Length of Retrograde Amnesia and of Post-traumatic Unconsciousness.*

A=Duration of retrograde amnesia.
B=Duration of post-traumatic unconsciousness.

Number of cases.	A.	Number of cases.	B.
13	Under 1 sec.	2	Few secs.
		1	2 mins.
		2	Few ,,
		2	10 ,,
		1	15 ,,
		1	1 hr.
		1	2 hrs.
		1	Few ,,
		1	7 ,,
		1	3 days.
2	1 sec.	1	4 hrs.
		1	6 ,,
4	1–2 secs.	1	15 mins.
		1	3 hrs.
		1	8 ,,
		1	1 day
1	5 secs.	1	15 mins.
1	2 mins.	1	6 hrs.
1	Few mins.	1	1 min.
1	20 mins.	1	2 days

DISCUSSION.

Mayer-Gross (1943) examined the brief retrograde amnesia occurring in patients undergoing electric convulsive therapy. As he found that, in more than 100 experiments in over 40 psychologically abnormal persons, amnesia occurred for subjects with, apparently, no emotional value, he considered that retrograde amnesia could not be due to guilt or the unpleasantness of the situation.

The view that retrograde amnesia is due to cerebral injury destroying the traces, or engrams, of the immediately preceding impressions cannot be accurate in paratroopers, since no cerebral injury occurs.

Mayer-Gross (1943) advances the view that retro-active inhibition may occur. In this inhibition the latest memory traces, which are still in process of consolidation, are prevented by the cerebral disturbance from being properly formed and organized. Mental or physical effort immediately following learning disturbs recollection. Neither cerebral disturbance nor effort takes place during a controlled parachute jump. The 'chute opens without the man taking any action, and the sensation of floating down to the earth is pleasant and, frequently, so exhilarating that the man sings as he descends, even below the level of 18,000 to 22,000 ft., at which euphoria due to decrease of oxygen may occur (Matthews, 1945).

Since, with appropriate methods, memory can be recalled, retro-active inhibition cannot have prevented the latest memory traces from being formed, or, if formed, they cannot have been destroyed.

The dread of electric convulsive therapy which, although less than that of chemical convulsive therapy, may cause the patient to refuse further treatments, may possibly produce the retrograde amnesia examined by Mayer-Gross. The fact that the subjects forgot non-emotional objects shown to them during the period immediately preceding the treatment is to be expected, for all objects, whether with or without emotional value, are consciously forgotten during a period of complete amnesia.

Whether or no the retrograde amnesia associated with electric convulsive therapy is causally similar to that preceding terrifying incidents, that of the parachute jump appears similar in origin to the retrograde amnesia associated with physical injury.

Parfitt and Gall (1944) stress mental preoccupation as a cause of prolonged amnesia. In brief retrograde amnesia of a psychological type a strong preoccupation with the fear of death is, presumably, present, although consciously there may be no knowledge of this. During hypnosis, the abreaction may be exceedingly marked as the terrifying incidents are brought into consciousness. In addition to the major events, minor sensations, unconnected with the danger, e.g. colour of the surroundings, may be described. If the mind had been entirely preoccupied with the intense fear, matters not directly connected with the cause of the fear would have been ignored.

Once repression has been initiated by fear, a time-mechanism rather than a subject-mechanism is in force. The beginning of the repression is preceded by conscious thought, either pleasant or unpleasant, but its end appears to be determined by an unconscious process appreciating that danger is past.

Conclusions.

From a study of 117 cases the following conclusions were reached :

1. Brief retrograde amnesia may occur—

   (*a*) Preceding injury with or without unconsciousness.

   (*b*) Preceding anticipated, but not actual, injury.

2. Duration of retrograde amnesia is not related to the duration of post-traumatic unconsciousness, as given by the patient.

3. Period of greatest repression may be immediately before physical trauma or may be a fraction of a second before the trauma occurs.

4. Of cases undergoing injury, equal proportions of those recalling injuries and of those with retrograde amnesia gave evidence of psychopathy, as assessed by the same observer.

5. Either similar or dissimilar reactions may occur in an individual undergoing more than one terrifying experience.

6. Retrograde amnesia is not due, necessarily, to cerebral injury destroying traces of impressions, to retro-active inhibition, to mental preoccupation or to organic causes. The hypothesis is supported that retrograde amnesia connected with actual or possible physical injury is, in large numbers of cases, due to repression caused by fear, with the exception of a period of less than a second in duration, which may be due to organic disturbance as from a blow to the head.

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CLINICAL PROBLEMS OF REPATRIATES.*

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In recent months most of us have seen patients who have been in the Services and who now present features of psychiatric illness. Many of them are in the ordinary run of our experience, and we have no difficulties—other than the usual ones—of understanding the origins and pattern of their present distress. By and large, the ordinary clinical breakdowns occurring in the Services were of a kind familiar to us before the war, while during the war we became familiar with most of the disturbances of behaviour and feeling produced by specific stresses of service life. Many patients with difficulties of these two kinds were discharged the Services in the past, and others have since been demobilized. The large and compelling problem of their treatment and effective rehabilitation should not blind us to another newer problem—that of ex-servicemen who made satisfactory adjustments to civilian life before the war, and to service life during the war, but who are now in severe difficulties under the stresses presented to them by their return to civilian life. In a manner unexpected by the majority, they have become ill-at-ease in familiar surroundings, phobic, depressed or irritable, asocial, confused, retarded, aggressive, antisocial or restless. There is a mass of evidence to show that in addition to the clinical symptoms which lead some of them to seek help from medical men, their damaged attitudes disrupt other aspects of their lives—social, domestic or industrial—in serious and subtle ways.

It would be easy to exaggerate the extent and the depth of these disturbances, and it would be tempting to shut our eyes and to argue the problem in terms of intrapsychic conflict, but it would be folly to assume that it is a problem too small for consideration, easy to understand, one to be dismissed as a natural consequence of demobilization which time will heal. Tens of thousands of men are or have been involved in psychological difficulties of this kind, and investigations have shown that far from there being a "natural" cure after a few months of civilian life, the passage of time may only harden the trouble and compel the individual to live with his social potential severely blunted; to pursue life as it were with one cylinder missing.

Description of the psychological difficulties of ex-servicemen is made difficult by the very wide range in kind and severity of their reactions; they vary from acute schizophrenia to a more common inability to enjoy the taste of life. Some ex-servicemen have felt no difficulty at all in becoming civilians again; some of the men in great but secret distress would be furious if their problems were openly broached; and it is certain that a considerable number

* A paper read at the Northern and Midland Division of the Royal Medico-Psychological Association on 10 October, 1946, at Rubery Hill Hospital, Birmingham.

will never consult a doctor because of fear of impending insanity. So both the size of the problem and the exact shape of the curve of its intensity are difficult to assess. Some relevant facts are known, of course. Surveys of ex-prisoners of war suggest that 60–70 per cent. have experienced greater or lesser distress and difficulty in industrial, domestic or social fields. Many hundreds of these men have been treated in psychiatric hospitals, not for illness which appeared during imprisonment, but for psychiatric disturbances consequent upon and arising only after repatriation. Many thousands of prisoner repatriates accepted the offer of help at the Civil Resettlement Units, which were designed after a study of the problem by psychiatrists and psychologists working in the Army. Scores of men are known who cancelled their acceptance of the offer because in their distress they could not face the prospect of discussing their problems with anybody at all.

Prisoner repatriates have been studied intensively and there is agreement by those who made this study that the basic problems they present are different *in no essential* from the problems presented by servicemen in general who have returned to home life after years in the Services. Civil Resettlement Units could not be created, however, for other than prisoners of war. Their numbers were too large, and in any case they do not arouse the same mixture of curiosity and compassion as was aroused by prisoner-repatriates. There is little public feeling now for the man leaving the Services. He may once have been treated by the public with propitiatory fêtes and rites, like a sacred sacrificial animal, but naturally, now that the war is over, he is an anachronism, and any difficulties he may have in becoming a civilian he must handle as best he can, with few social agencies to help him. An estimate of the numbers who have not made a good adjustment must be a guess—a sample survey of non-prisoner repatriates suggests that a quarter are as unsettled as the most unsettled prisoners of war—certainly the majority will never come for medical diagnosis, and they must be regarded as a sociological as well as a medical problem, an incubus on the mental health of the nation. Without pressing for too close an identification of the prisoners of war with other repatriates, it would be wise to take seriously the figures reached from the study of the former problem. We may be sure at least that the numbers we see in our consulting-rooms represent a few men self-selected from the mass which either hides its troubles or endeavours to cope with them in other ways.

Before we can discuss the feelings these men have and the different syndromes into which these may fashion themselves, we must recognize that repatriation itself is a stress at once peculiar, subtle and unexpected. A glance at myth and history will show us, however, that it is not a new phenomenon. Let me quote one case-history from literature :

When Ulysses was away on overseas service he resisted the wiles of foreign women and thought often of his homeland, the beautiful Ithaca, and of his wife who lived there. Penelope was fighting a different, nearly a losing, battle against the temptations of her aspirant suitors, and when her service husband demobilized himself he was just in time to prevent the complete break-up of his home. When he returned from his combined operations he found that things were far from well. Much had changed. His own son did not recognize

him, and his own servants regarded him as a stranger in his own land; and it is interesting to note the hesitancy and caution with which he handled the situation facing him. He sought no effusive welcome, but disguised himself as a shepherd, and going to a trusted farm hand who knew him as a child, re-established a relationship there. Only when he was sure that the old man retained his affection for his master did he say who he was, and begin the painful process of rehabilitation. He approached his house in a mixture of anger, curiosity and doubt, and was laughed at by his wife's suitors and mocked by his own maids. He was eager to be loved by his wife, not as a hero, but for his own sake, and he entered his home beset by rage, suspicion and uncertainty.

The case-history goes on to say how his irritation at the immoral women in his home community grew and expressed itself, and how he took his revenge on those civilians who had been eating up his birthright, how he was reunited with his war-weary wife and his worried old father, and how he re-orientated himself in honour and affection. This psychiatric social history ends there, and Homer does not go on to tell us of any subsequent difficulties of industrial or domestic adjustment needing after-care. We must imagine these for ourselves. We know that Penelope and Ulysses were fairly stable individuals, but I cannot imagine that their home was without domestic scenes until their mutual emotional readjustment was complete. At all events, on the evening of V.J.-Day I seemed to hear a continuation of the story. I heard a woman behind me in the crowd gossiping about a more recently demobilized commando —"Two and a half years! Back only a fortnight and she doesn't know what to do with him. He sits in the back room by himself. Won't speak to anybody, won't go out, won't read. Won't do nothing. She doesn't know what to do. There'll be trouble there."

A second case-history is that of a man seen earlier this year. In 1939 at the age of 18½ he joined the Army, and in 1940 went to the Middle East with an armoured unit. Three times in the next three years his unit got to the salt flats of El Ageila, and twice it was driven back. During this time his home and his father and mother were destroyed by bombs. He lived, mainly in the sand and sun, a life full of thrills but little day-to-day interest, with the compensations of tight comradeship and freedom from responsibility for the major decisions of the day. During these three years he had two leaves in Cairo and spent £200 in two weeks in hotels, cabarets and brothels. He returned to his own land last year and immediately fell into difficulties. Though a young man of 25 he had never been in an English pub, and panicked on the two occasions he had tried to ask for a drink. He felt awkward because he did not know what behaviour was normal in any social situation and felt that he was a foreigner, liable to be looked at and laughed at. Any public places—a café, a railway station, a dance hall, a bus—brought up problems of behaviour and common convention which made him feel inferior and ignorant. How to behave as a visitor in somebody else's home puzzled and worried him, and he was afraid of young women, diffident and uncertain how to address them, unsure of the proper approach, and unable to decide whether women were Madonnas or harlots. It was difficult for him to think that they might just be human beings like himself. So, unsure of himself, somewhat

lost and bewildered, and unable to feel settled and at home in his own city, his sleep was disturbed and he became morose, angry with civilization, bitter about the lack of comradeship in civilian life, quiet, asocial and depressed. He wanted to rejoin the Army or join the Palestine Police Force or to emigrate, but felt too ill because of recurrent nightmares even to take up simple work. When he was seen he had spent all his gratuity in a vain search for enjoyment, and had come to the end of his tether.

The third case-history concerns a prisoner of war, a regular soldier, now 26 years old. He had been brought up in a slum home, from which he escaped into the Army in an endeavour to lead a decent, clean, orderly life. He enjoyed the discipline, the regularity of pay and food, and began to respect himself. He seriously hoped to reform his widowed mother, who disgraced him even before his slum neighbours by drinking too much. The war broke out when he was abroad. His great pride in his unit for its subsequent fighting record suffered a terrible blow when he and it were captured at Tobruk. He was then subjected to the dirt and disorganization of Italian prison camps and had to fight for his food with other men who, too, had once known civilized manners. When placed with Indians in Salonika he endeavoured to uphold his own high standards of behaviour and refused to take part in the scramble for garbage, feeling contaminated by and guilty about the primitive savagery of the struggle for existence. When he was transferred to Germany he joined in the ordered intensely democratic life of a German prison camp and settled usefully, but lived for the day when he would be released—Britain would be fine; the people there were decent and homely and clean; there was freedom in Britain, and comradeship and honesty. In his need for affection he often dreamed of his mother, whom he saw as a clean, thrifty Scotswoman, and made all kinds of excuses to himself about why she had never written to him. He had fantasies about his home-coming, felt sure it would resolve all his hopings, and planned to attend night school and become a wireless engineer.

On repatriation he went back to his home street and found a stranger in his home. His mother had moved, and he found her living in one dirty slum room. He was shortly the centre of a drunken civilian cheering party that he tried vainly to enjoy. He had to sleep on a mattress on the floor for a week or two and began to get angry at life; his fantasies had been destroyed and life faced him as it was—difficult, dirty and ill-organized, demanding further efforts of him. It was easy to exchange trivial commonplaces with people, but nobody understood how he felt. He resented sympathy, and felt fury at the bomb stories that defensive civilians thrust upon him. He could not understand how people could hold such empty values and knew that they could never understand his own. In despair he picked up several street women, and there, too, found disgust and despair at the emptiness of the relationship. He spent his gratuity in drink, went to London and slept in air-raid shelters, had violent feelings of destructiveness, and murderous wishes towards policemen—"Smug and happy as if nothing had happened." He was admitted to hospital, violent, suspicious, bitter about Britain, and scornful about any offers of help—"I've seen your sort before; you're trying to get my story so that you can laugh at me." He said he was a slum rat—"Let's have no

pretending—send me back to the filth where I belong." He ground his teeth and clenched his fists constantly and hit viciously at doors and walls. A week later he was classified as schizophrenic.

These cases are perhaps too violent to be typical, and a fourth case-history is needed. A man of modest intelligence, well adjusted when he was a labourer before the war, was placed in the Pioneer Corps during the war years, and although he missed his wife at first, settled down to good work of a routine nature. He had comradeship and had no worries about money, food or a job. He got on well with his officers and his fellows and felt proud of his uniform. When he returned to civilian life he felt himself a stranger and was badly puzzled by regulations about food and clothing and shortages, and felt inferior in the presence of people who understood these things and handled them casually. Things were too much for him to understand, and he felt foolish and shy before the complexity of life. He kept to the house, could no longer take his wife to the cinema, and resented the fact that his wife was now managing his affairs, and was trying to get him a job, although he recognized that it was necessary for somebody to do this in the face of his own incapacity and lack of initiative. He developed headaches and indigestion and went to his doctor, but was too ashamed to confess his own puzzlement at the civilian world and quietly accepted the medicine which was given him, although he felt it would do him no good. "If only he had asked me what the real trouble was I might have told him, so I just told him about my stomach."

Many more case-histories than these few are needed to indicate the wide range of clinical reactions to unsettlement. The mildest forms of industrial unsettlement may, however, be present in our own doorsteps, in those employees who have returned from the Services and cannot settle easily into their once familiar regime, who want to apply for other jobs, who are restless and dissatisfied with their careers, who drink more than they did, or who are quieter and less at ease than they were. The most severe disturbances at the social and domestic levels are revealed in the public courts, in the separation orders, in the charges of attempted suicide or murder, or child neglect, and in the Juvenile Courts, where children from a disturbed domestic scene show the social forms of their distress.

There is a general belief that widespread unsettlement is an inevitable consequence of war itself, and that it occurs as a result of human aggression unleashed in wartime, and that the spontaneous individual feelings of peace and co-operation are bound to lag behind the official declaration of V-day. The fear has been expressed that men trained in warfare do not forget their training, in spite of the fact that servicemen are not trained to kill each other, but rather to live together even under privations in loyalty and comradeship. (It is true, of course, that numerous individual clinical problems of aggressiveness and despair are the result of the exhibition of aggression in wartime. One meets violently irritable ex-servicemen with nightmares which began after bloody episodes, and quiet men hiding their mourning for dead comrades from themselves and the world, but these are truly problems of service life, not problems of ex-service stresses.) A glance at one or two other phenomena will show us that the same troubles with which we have so far concerned

ourselves can arise without war, and are implicit rather in any sudden transfer of an individual from one cultural framework to another with which he is unfamiliar or out of touch. They seem to arise whenever people are uprooted from a familiar social environment.

A paper written in 1940 drew attention to a disturbance of emotion severe enough to be called " evacuation psychosis." It arose in old men and women evacuated from their homes to bomb-free areas in the country, and was characterized by depression, apathy and confusion.

In 1944 Lord Rennell, Director of U.N.R.R.A. in Italy, concluded that the greatest handicap in resettling the Italian refugees from the battlefields was neither hunger, malnutrition nor physical disease, but a peculiar distress at being uprooted, which showed itself in irresponsibility, dependency, resentment and apathy. This resulted in carelessness about infestation and personal hygiene, and a serious lowering of the standard of their personal morals and habits of hygiene. Their lack of respect for the latrine was by no means characteristic of them as Italians, but rather as newly displaced persons.

A similar phenomenon was observed in Britain in 1940 when the correspondence columns of our newspapers aired widespread complaints from those who had given hospitality to evacuated children, and found them to befoul carpets and stairways, to be careless of property, rebellious, rude and delinquent. Not realizing that these disorders of behaviour were reactions to the distress of domestic disruption, some correspondents assumed that it was a normal state of affairs among working-class British children and expressed their indignation at the failure of compulsory education, and revived the old remark that the only visible effects of the Education Acts on Britain was that the writing on lavatory walls was now two feet lower than of yore.

Before the war began some of us were familiar with similar phenomena in another setting. Well-meaning city planners condemned the filthy and dilapidated houses of slum dwellers and installed them in clean, well-laid-out housing estates far from the homely, closely integrated communities they once knew. This planned social disruption produced among some of the people so displaced a loneliness and confused distress and a dissatisfaction with their new strange society that expressed itself in poor standards of conduct. Stupid destructive and careless behaviour was reported in the new homes, and the occasional appearance of coals in the bath produced an interest and shocked indignation hitherto reserved only for brides and blood in the bath, or actresses in baths of asses' milk, or chorus girls in baths of champagne.

We may recall, too, the behaviour of some of the Jewish refugees in this country before they had found an accepted place in our society. Their demanding dependency on benevolent organizations, their social immorality, their hungry self-seeking, their touchiness and their lack of gratitude, provided yet another* example of the behaviour disturbances consequent on the transfer of human beings from one social milieu to another, and of the kind of problem that may irritate authorities who procure and manage such changes on a

* " By the rivers of Babylon, there we sat down, yea, we wept, when we remembered Zion . . . and them that wasted us required of us mirth. . . How shall we sing the Lord's song in a strange land ? "

mechanical basis and in all good faith, but in ignorance of the psychological facts of life.

Sociological studies of the integration of foreign national groups and coloured communities into second generation societies throw a good deal of light upon the difficulties presented to society by immigrants and strangers, but it is sufficient if the examples given help us to understand that the psychological problems arising in ex-servicemen to-day are not specific to our generation or circumstances, and that they are in line with similar problems which face human beings from time to time—whenever they are required to grow satisfying social bonds in a new social milieu.

Many a returning serviceman knew that he had new viewpoints and ideas, and some were and are eager to practise their expression in civilian life, but few had any but a superficial understanding of the emotional strengths and weaknesses that service life has given them. Most men knew that they had a lot to learn, but few were prepared for problems of emotional adjustment in their very homes, and their own workplaces, and among their own familiar communities. In fantasy their civilian life was to be as they left it, with no closing of the emotional ranks when they fell out, and they felt themselves to be basically unchanged. The great barriers of unshared experience that grew up in the war years between them and their familiars in civilian life were and could only be half-realized. The blessing of freedom carries many burdens, and the feeling of these burdens had been forgotten.

The emotional deprivations of service life meant that many men, hungry for home, turned to phantasy and saw civil life through rose-coloured spectacles. Comfort, freedom, tolerance, affection, independence lay there. It was forgotten all too often that wives are not always obedient, loving, good-tempered and dressed in their best clothes, and it was not realized that a warm fire, an armchair, a book (and no bullying sergeants) become boring after three or four hours. Friends are forgetful and may have grown new interests and other ties, and old familiar places are oddly unexciting and unsatisfying. It is both puzzling and disconcerting that the feeling of belonging at home which has been so often wanted can be so elusive, and that the old familiar places should feel so new. The feeling of strangeness, the growing fear of not now being able to grasp the prizes of old feelings and situations, the anxiety that after all it can never be the same are forceful disappointments. A fear of meeting friends in case of failure, an inability to sense atmosphere in old places, and a feeling of emotional isolation from the relatively lawless and selfish civilian life is a terrible tragedy after years of longing. The difficulties are often about intangible and incommunicable deep human values, and the inability of others, wives and friends, to share a subtle but important viewpoint makes for distress and growing anger and a belief that they have forgotten what life is about. Men in such a state are restless, bitter and irritable at home, and feeling cut off from the very sources of understanding affection go for long solitary walks or remain silent and morose for long periods. Alcohol is a commonly sought relief, and may help a man to talk to strangers without uneasiness, but sober mixing with crowds and inactivity at home are alike intolerable.

Coincident with this uneasiness the practical details of a new life must be settled. Work must be found and kept. Who will have him? What is he fitted for? The competition of his fellows is something new again after the common tasks and comradeship and assured pay of the services. Unknown workmates are felt to be potential enemies. Those who prospered in war and have secure homes may be hated.

If these feelings are aired any failure on the part of his family to understand them may meet with fury and a hopeless despair at ever being understood. Family rows may become frequent, and the ex-serviceman has a common habit, distressing to his relatives, of slamming the front door and going off in a rage to walk it off.

It would be wrong even in a rapid survey like this to pretend that the ex-servicemen's home had no wartime problems. Wives, too, were lonely, and grew an independence and freedom of thought that may be unwelcome to their returned husbands, but which they are not always prepared to relinquish. In turn they may have longed for the return of their husbands, and be eager to lay upon these unfitted men the burdens carried alone for so long. A wife may have new tastes, new enthusiasms, unfamiliar viewpoints, and in turn may be hurt and angry that she, too, is not understood and accepted in the old way. Arguments, rows, violence in the home, hopeless impotent rage may follow the thwarting of the repatriate and his wife in their need to regain the homely understanding they so often cherished and yearned for in the past. These outbursts of anger are followed invariably by shocked repentance, and then the whole cycle may begin again on a basis of bitter despair at ever regaining emotional security.

It is not surprising that the uncertainty of being loved and acceptable reflects itself fairly commonly in absolute or relative impotence. This may be transient, and where the wife's attitude is one of tolerance and affection a good prognosis can be given. But the emotional splits between man and wife are often too embarrassing to both for help to be sought, and many decent people suffer the distresses of rows, violence and sexual estrangement in shame and unhappiness.

Emotional unsettlement reflects itself in industry in various ways. The newly assumed domestic responsibility and the high cost of living may make for an unreasoning pursuit of high wages. Hostility and rivalry, jealousy and antagonism for workmates may all be expressed in this way. Common industrial signs of unsettlement vary from withdrawal from communal life of the factory to indiscipline, arguments with foremen, and failure to participate in the leisure activity of workmates. A restlessness, an inability to feel settled and unreasoning dissatisfaction with wages make some men go, anxious and hostile, from one job to another, while others develop feelings of exhaustion at work, and show their distress in common conversion symptoms.

The common feelings of irritability, hostility, bitterness and failure to feel at ease in old surroundings pursue many repatriates in their social lives also. Some men will get up and leave their house if a stranger comes in. Many will go to great lengths to avoid meeting acquaintances and use the back door only, or go out only at night, but the need to be understood may lead some to

public-houses, there to drink in solitary gloom, wishing for the courage to talk to others. The failure to make effective human relationships may be seen further in broken engagements, failure to maintain old friendships, refusal to renew memberships of clubs and societies, or in the ganging-up of ex-comrades.

It is common to hear from these men of the fear of going into public places, an embarrassment at going to church, the cinema, the dog-track, and of difficulty in joking and feeling at ease in company. Among unmarried servicemen contacts with women of their own kind, friendship, affection and marriage may have been a deferred delight, a phantasy elaborated during service life whenever the unsatisfied needs for tender relationship were felt.. Now, sheer ignorance of womankind may make for awkwardness and shyness and fear of the very people who were worshipped from afar. Violent feelings may be noted—a belief that women should conform to his fantasies of perfection in understanding and friendliness in their recognition of his needs, in public conduct and in private conversation. The fact that women are ordinary human beings, now wise, now foolish, often tactless, often without intuition, may be felt by him to be a wicked infuriating failure on their part. Again, the feeling of being cheated of a thing he felt sure he was to get may give rise to angry desire to destroy all womenkind as monsters, cocottes, harlots, drunkards, foolish empty-headed hard-boiled gold diggers. So his approach may vary from inability to speak in their presence and a shy avoidance of women in general to a despairing attempt to achieve ultimate relationships with prostitutes and brash attempts at affectionless seduction, with violence if his advances are spurned. Many men who have got as far as escorting a girl home from a dance are in terror when it comes to say good-bye. What is the proper thing to do ? Can he kiss her ? If he tries and fails he may feel again anger and foolishness. If he succeeds he may be no better off. Has he to go further ? Will she think him slow if he does not ? What is the correct thing to do ?

In general, the distress at being a stranger in his own land and at failing to settle gives rise to a feeling of angry emptiness, and the situation is felt to be worse because the security of service life and the support of comrades are no longer present. He must deal with his anger and his emptiness by himself. Withdrawal of interest from the world as a protection against further hurts may lead to actionless apathy, but all the mental mechanisms used by mankind as protections against intolerable anguish may be seen in the worst cases. Paranoid beliefs about the rottenness of civilians, women, friends, employers, politicians may produce minor disturbances of behaviour, or may flower into psychotic states. Bursts of uncontrollable aggression at near relatives, people, or at a world felt to have failed him after his years of effort may lead some men to the police-court.

Depression of varying depth with feelings of failure and uselessness or with bitter paranoid colouring is perhaps the commonest resultant of severe resettlement difficulties, with suicide as a possibility.

Anxiety states too are common, especially with phobic developments of closed spaces, of cinemas, of crowds ; or accompanied by somatic complaints—

breathlessness, headache, fatigue, indigestion. Hysterical conversions occur also, as might be expected, but in my experience they are not common.

Case-histories of unsettlement are typical. Relatives will almost monotonously give the same story: "He was all right the first few days; he was so glad to get home, but he seems changed. He used to be so cheerful. Now I don't know what to do with him. Nothing I do seems right for him. He's a different man." Almost invariably moodiness, outbursts of temper on small provocation, refusal to meet friends, narrowing of social interests and blunted industrial confidence, desire for solitude, restless inability to settle and a new tendency to take long walks precede the grosser clinical states.

This is not the occasion to discuss the treatment and handling of these men, but two warnings are relevant. Many of them have in the past come face to face with loneliness, death, destruction and horror. Their experiences will often have given them a conviction that they know more about life than civilians. The contrasting confidence of civilians often therefore irritates them, and leads them to feel that they can never be understood. The civilians are felt to be wrong and queer. On this account advice to a man to make an effort to pull himself together will meet with quiet hopeless contempt for his adviser.

Secondly, sympathy shocks and hurts, for it sets them apart as "different." Almost universally they have compelling needs to feel integrated again with their own people, and in any case do not feel it is they who have changed. They need understanding and recognition of their distress on an adult basis, as a settlement problem, and all but the very sick are angry or frightened at the idea that they may have a neurotic illness.

Their problems are largely those attendant on a change of social setting, problems of ego development and modification, and of social re-expansion. We would be wise to recognize that our pre-war and wartime experiences do not wholly befit us to understand or treat them. Only a determination to grasp the emotional problems inherent in change of community will enable us to bring therapeutic interest and understanding to this wide and important social problem.

DIVERSIONAL THERAPY AT BROADMOOR CRIMINAL LUNATIC ASYLUM.

By J. S. KNOX, M.R.C.S., L.R.C.P., D.P.M.,

Deputy Medical Superintendent, Broadmoor Criminal Lunatic Asylum.

SOME 640 men and 170 women patients are detained in Broadmoor. The following account of the diversional therapy applied to their different types of mental disorder may be of interest.

The effect on our closed community is to brighten the monotonous lives of the patients. The games and similar activities stimulate interest, initiative, and a readiness to accept responsibility.

The Medical Superintendent and the Chaplain are assisted in this work by a committee of patients annually elected to represent the views of their respective blocks. This central committee appoints sub-committees to control each undertaking.

Different types of entertainment are required in order to give as many patients as possible an interest in this form of therapy. Outdoor games such as cricket, bowls, football, throwball, softball, croquet, quoits and lawn tennis are provided. In addition there are annual sports and a flower show. Indoors, table-tennis, the annual concert party, the choral society, lectures, dances, the cinema and whist-drives provide entertainment in the Central Hall. A monthly magazine is issued. Cards, draughts and chess are played at all times in the wards, and individual hobbies are promoted as far as is possible.

Some of the above attract patients who are skilled at ball games, some require intellectual ability, and others appeal to individuals who are not particularly good at anything. Some recreations are useful because they draw large audiences of patients. Others again appeal to the outside public, and thus provide important extra-mural contacts enabling neighbouring teams to visit the hospital, and audiences, often containing patients' relatives, to attend the various concerts.

Cricket at Broadmoor has been under the successful control of the Chaplain and his predecessors for the past 70 years. The attractive bowl-shaped ground is partly surrounded by an orchard, and partly by a tree and flower-covered hill. Between 70 and 90 patients of different types attend weekly and watch the matches. On the field they have a picnic tea, and the occasion provides opportunities for men from different parts of the hospital to meet and talk to one another. The first team has at least 4 patients playing, and the umpire, groundsman and other officials of the game are also patients. Besides these week-end matches, which are against good club sides, there are internal games

played mid-week in which, during the season, about 50 patients take an active part. Many are convalescent patients or mild manic-depressives and schizophrenics, with some feeble-minded persons. Few have ever played the game before, but some are able to learn and become creditable and enthusiastic performers. Very few excel at batting, but a number are accurate and skilful bowlers and good fieldsmen. In peace time a proportion of our matches are played away, which gives the patients taking part a desirable change of scene.

There are four rinks for playing *Bowls*. They are kept in excellent order by patient-labour, and the game is, like cricket, played in the summer months. The greens are situated on a high terrace backed by the buildings, and overlooking a view of some 30 miles of open country. About 25 patients are considered good enough to play in the games arranged with neighbouring teams. Their ages vary from 20 to 65, and among them are convalescent patients, manic-depressives, paranoiacs, and feeble-minded persons. At various times 100 patients take part in the internal matches and competitions which are played during every fine summer afternoon or evening. Among the staff are a dozen keen and good bowls players. They coach the patients, and successful results against local opponents are recorded. The game is organized by the patients' bowling sub-committee, which is responsible for selecting the teams and arranging the internal competitions. Prizes are awarded, and the competitors are handicapped so that every player has an opportunity to gain a prize. There is no monopoly among the better players.

Association Football is played from October to the end of January. Fifty patients join in the games, and large numbers attend and watch. As the standard of play is low, the first team is generally strengthened by the addition of two or three male nurses, and teams of secondary school boys or from the lower divisions of local leagues provide the opposition. As these games have to be played at home we are unable to enter competitive football.

Throwball was invented and developed here in the days when football was considered too dangerous a game for our patients. It is played with an Association football, but the patients run with it in their hands and try to throw it into a small goal. Handling an opponent is not permitted—a condition which makes it possible for the middle-aged men to play. It is a good fast game played on a small grass pitch 80 yards long by 40 yards wide for a period of 40 minutes. This enables two matches to take place during a spring afternoon, when this game is played. It attracts a large and enthusiastic following.

Softball is an American game founded upon the principles of baseball. It is exciting, fast and sufficiently simple to be understood and enjoyed by many of the refractory patients. It is organized by a specially selected patient, who is in charge of all the games held in the refractory blocks. He arranges matches in the exercise grounds, and also on Sundays in the summer on the cricket field. Out of 130 refractory patients some 20 take part—among them are paranoids, manics, melancholics, low grade feeble-minded, and those with organic brain disease. About 30 other persons are able to attend and enjoy the comparative freedom of the cricket ground.

Croquet is played by the women patients throughout the summer months, and competitions are arranged by their own committee.

Outdoor Quoits is very popular among the men, and many show great skill at this game.

Lawn Tennis is played upon the one hard court provided by the Institution. It is unorganized, and dependent upon individual effort for its life. It has its enthusiasts, however, and not many summer evenings pass when it is not in use.

The *Annual Sports* are carefully organized. Every patient is handicapped in accordance with his previous " form " in such a way that he must make a special effort if he wishes to win. All ages and tastes are catered for, and the more orthodox events such as the 100 yards are mixed with others such as basket balancing, slow bicycling, etc. A quoit competition tests the skill of the older men. Cigarette prizes reward the successful competitors in the side-shows, and the day ends with nearly everyone obtaining a prize of some sort. The whole event is organized by the patients' committee, and the course officials and stewards are also patients. Only the starter and judges are selected from the staff.

Our district is a rural one, and gardeners are good and many in number. One hundred male and 18 female patients have plots of ground of their own. On these they produce fruit, flowers and vegetables. These they either eat, sell, or give away, and many of them grow for exhibition in our annual flower show which is held in the Central Hall, where good staging arrangements are provided, and displays are of quite a high standard. At the same time painting, modelling, sewing, fancy work and knitting are exhibited, as well as a large stall with goods to sell for charitable purposes. Side-shows in the charge of patients are provided, and all day long patients, and in the evening, many of the local public view the exhibits and purchase many of the articles. The profits are sent to a prescribed charity which is, on occasion, the Benevolent Fund that helps the indigent patients.

Of the indoor diversions *Table Tennis* is very popular and is arranged in " Clubs," each of which draws its membership from a prescribed part of the Institution. During the whole of the winter " leagues " and individual matches take place on three or more evenings a week. Once a month games are arranged between the best patients' team and visitors from neighbouring towns, and the standard of play is sufficiently high to attract a large number of patients as spectators. The umpire is selected from the staff and the scorer and ball-boys from the patients. As this game requires both nimbleness of mind and of body the numbers who are efficient is limited. The best players are mostly convalescent patients, mild manic-depressives and some paranoiacs. During the dark evenings it gives entertainment to about 70 men and 30 women.

The *Concert Party* called the " Broadhumorists " consists of about 25 selected male and female patients. Others serve as dressers, scene-shifters and the like. On two evenings a week in the winter months a stage-play written by a patient is rehearsed. These meetings are looked upon as social occasions and have therapeutic value, and considerable perfection is thereby attained without staleness. The production takes place in March and April, with three performances to different classes of patients and twelve to the public. Over 3,000 people attend. The dresses are made in the Institution's shops and are

a special and very attractive feature. The scenery is painted in the upholsterer's shop by a patient under the skilled supervision of the Master. He and his patients control all back-stage operations. The music is directed by a male nurse who is a musician, and the Institution's band forms the orchestra. The Medical Superintendent personally controls the production. It is mainly the convalescent and manic-depressive patients who take part in this form of entertainment, and is valuable because it helps to reduce the local prejudice against mental illness in general and Broadmoor in particular. It also has found us friends in many fields who have been able to help us in a variety of ways. Thirdly, it has enabled the patients to collect over £300 annually for charity. In addition to the above a smaller party visits some of the surrounding villages and gives a specially rehearsed concert during the winter months.

The *Choral Society* is a particularly worth-while entertainment. It is organized by a musical member of the staff, and caters for many patients who seem to have little other interest. The number of performers is 50, the women providing the more skilled half. Many of the patients are frank psychotics, and often depressed, deluded, irritable and difficult in daily life, but are responsive and obedient to the conductor and sing correctly and well. They rehearse in the Central Hall on two evenings a week during the summer months and give four performances to the patients and to local audiences. Among these patients are some who are capable musicians and have good voices. The standard of their performance is, for an amateur production, quite good.

An *Evening Lecture* is arranged once a month in the winter and is given by an experienced lecturer on travel, scientific, political, or other subject of general interest. About 300 patients attend, and interesting discussions generally take place. There is a good deal of musical talent in the district, and musicians, concert parties and choral societies also give freely of their services to the patients. These performances are much appreciated.

Evening Dances are held four times a year on a somewhat elaborate scale. The Hall is decorated skilfully by the Matron and her assistants. The women wear their best frocks and many appear in evening dress, while the men put on their best suits. Eighty male parole patients attend, with a rather smaller number of women patients. The Medical Superintendent and the Medical Staff with their wives are present and dancing goes on from six to eleven, with two intervals for refreshments.

The *Cinema* is shown once a week during the autumn, winter and spring. On Friday evenings there are two houses, at each of which 200 of the better patients attend. On Thursdays performances are given in the refractory wards and 130 of this class of patient are present, so that nearly three-quarters of the population of Broadmoor goes to the films. The projector in use is a 16 mm. Gebescope, and the films are non-inflammable. Educational and feature films alternate, and both are very popular.

Four major *Whist Drives* are arranged for players of both sexes during the winter months. Smaller drives are also organized for the separate blocks.

"*The Broadmoor Chronicle*" appears once a month. A patient is Editor, and the editorial committee consists entirely of patient members who are interested in this kind of work. The whole life of the hospital is covered as far as

possible with critical and factual articles. There is a monthly "leader," with competitions, descriptions of entertainment and sport, jokes on topical and local subjects, cartoons depicting Broadmoor's eccentricities and peculiarities, poems, and advertisements from local tradesmen. Production costs are covered by the sale of copies to patients, their friends, and members of the staff. The magazine is popular, as it enables the patients to express their many and differing points of view to the administration.

These activities have considerable therapeutic value. They are indirectly paid for by the patients from the institution canteen without calling for assistance from public funds.

Finally, I would add that these observations are published by permission of the Home Office, but do not necessarily represent official views.

THE DIFFERENTIAL DIAGNOSIS OF A CONSCIOUS TEMPORARY GENERALIZED MOTOR PARALYSIS.

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THE conscious involuntary immobility of which recognition has been described elsewhere (Rudolf, 1946*a*) appears to be a cataleptic or trance-like state. The psychological aspects have also been described (Rudolf, 1946*b*).

Usually, except when undergoing an attack for the first time, no alarm or anxiety is felt as the subject realizes that the attack will persist for a brief period and that he will not remain paralysed. Occasionally fear is felt in every attack, as in the case of a female nurse who had suffered from three attacks, in each of which marked anxiety was felt. This anxiety could, however, have been due to hallucinatory experiences as she thought on each occasion that the Sister was coming and the patients were calling to her. Although the nurse was unable to move, sleep may have occurred and the condition have been sleep hallucinosis.

Although sleep hallucinosis is commonly found occurring in narcoleptics, hypnagogic hallucinations, that is, hallucinations appreciated as the individual is falling asleep, occur in the normal person. A nurse relaxed in a chair and closed her eyes. She thought she heard her name called and that someone leant over her, but she was unable to see anything. Suddenly she was able to see and to move normally.

States of sustained immobility involving the whole voluntary musculature may be due to causes such as—

(*a*) Voluntary concentration.
(*b*) Fear.
(*c*) Day-dreaming.
(*d*) Vaso-vagal attacks.
(*e*) Schizophrenia.
(*f*) Post-encephalitic Parkinsonism.
(*g*) Hysteria.
(*h*) Epilepsy.
(*i*) Sleep.
(*j*) Sleep paralysis.
(*k*) Cataplexy.
(*l*) Narcolepsy.
(*m*) Coma.
(*n*) Concussion.
(*o*) Shock.

(*a*) *Voluntary concentration.*—The immobility can be terminated whenever the subject desires. Immobility of this nature occurs whilst bird-watching, listening to a sermon, lecture or play, or in a soldier standing at attention.

(*b*) *Fear.*—Extreme fear may cause immobility: the subject is "rooted to the spot." The immobility is short-lived and awareness of the surroundings exists. An example is the case of the captain of a frigate who stood motionless on the bridge unable to give the order to reverse or stop the engines although his ship was travelling, bow-first, straight at the quay.

The essential difference between the immobility of fear and that of catalepsy is that, in the latter, fear does not exist unless the subject is frightened of the immobility itself. The attack begins without the presence of fear.

(*c*) *Day-dreaming.*—Whilst day-dreaming, an individual often appears to be in a cataleptic condition but his thoughts are far removed from his surroundings, of which he is oblivious. Usually he has control and can bring his mind back to his environment, and, in consequence, is able to move at any time he wishes.

An example of intense day-dreaming was described by Kinnier Wilson, who reported that the eyes became fixed on some object, the object became indistinct, and only by a strenuous effort could the subject cut short the attack. At times he felt unable to move any muscles, yet thought, "Oh! yes, I can move if I like." No strong emotion was present.

Although day-dreaming is usually accompanied by immobility, as well exemplified by Rodin's "The Thinker," movement may continue during it. For instance, men at printing machines were noticed to maintain the movement of their arms and hands automatically, although the movement was not required. These men later asked what had been said to them during the period in which they had been, apparently, completely unaware of having been addressed, although another man, who continued movement and failed to answer, was quite without knowledge that anyone had spoken to him. Men may continue to feed the machines normally, but may miss errors in pictures or type on as many as 100 consecutive sheets. One printer who suffered from a mild type of day-dreaming in which he felt dazed, omitted, on one occasion, to notice a mistake until it had appeared on about 500 sheets. Another man, who felt dazed in a similar way, stated that he was able to move and to see normally during the attacks. Such conditions border on the diagnosis of hysteria.

These conditions in printers appear similar to some occurring in radar operators who have been observed to continue to turn the goniometer, looking at the screen but not keeping on the target. One man was noticed to continue to turn, with the target on the tube, although consciously he had not seen the target. When spoken to, he immediately realized the presence of the target and continued normally.

Another type of case is exemplified by a radar operator who turned the wheel more and more slowly and finally stopped, although he was not asleep and the target was moving on the screen.

These examples of day-dreaming accompanied by automatic movement are dissimilar to the type of case in which the subject feels he is moving automatically, as if the movements of the limbs were unrelated to the mind. In

one such case hypno-analysis revealed that the sensation was due to fear, with amnesia, for seeing 25 years previously the automatons or robots in the film "Metropolis."

(*d*) *Vaso-vagal attacks.*—In addition to the immobility, numerous other symptoms are felt. Full consciousness is usually retained, a feeling of impending death is often present, and the heart's action may be abnormal in rate or rhythm. The colour changes, dyspnoea may appear, and sensations, sometimes indescribable, may begin the attack. The attack may last up to half-an-hour in length, but the sufferer may be tremulous and weak for several hours.

(*e*) *Schizophrenia.*—The schizophrenic may remain motionless and is usually aware of occurrences around him. For instance, Lazell reported that certain sentences of lectures which he gave to mute and stuporose cases were remembered by the patients months after they had recovered. Although the possibility exists that brief attacks of immobility occurring in schizophrenics could be due to catalepsy, a striking point of the temporary tonic motor paralysis discussed in this article is its occurrence in persons leading a normal, apparently healthy life.

(*f*) *Post-encephalitic states.*—Cases of this condition may remain motionless and are fully aware of events around, but, as in schizophrenia, the sufferers are not apparently normal, healthy individuals able to perform normal work.

(*g*) *Hysteria.*—Fugues, whether short or long, are usually purposive. They may occur in order to protect the conscious from unpleasant events, expected, occurring, or imaginary, but amnesia, whole or partial, is present for the period of the fugue. In the temporary tonic motor paralysis described here, full memory is retained for the events heard or seen during the attack.

(*h*) *Epilepsy.*—The *petit mal* attack may resemble, to the onlooker, a brief cataleptic episode. The sufferer remains motionless with a blank expressionless stare and may change colour. This last does not occur in catalepsy. To the subject, the attacks of the two conditions are vastly different. The subject of *petit mal* is wholly or partially unaware of his surroundings during the attack, and may be unaware that an attack has occurred. The subject of the tonic motor paralysis discussed here is fully aware of the presence of the immobility, and of the events occurring around him during the condition. The rare inhibitory epilepsy is confined to a portion of the body such as one half or one limb.

(*i*) *Sleep.*—In sleep the musculature is usually flaccid, although in some positions, such as in sleep when riding, the muscle tone of the trunk is maintained, The tone of the neck muscles is always diminished, and that of the eyelids reduced, if not absent. In the brief cataleptic condition now being discussed, the tone of the orbicularis oculis is maintained so that the eyes are open and gazing into the distance in a fixed stare. The subject is aware of his surroundings so far as hearing and vision are concerned, although only objects in the direct line of sight are included. In sleep, the subject is usually unaware of his environment unless some strong internal or external stimulus influences the dream-content. An instance is that of a nurse who was sitting in a chair when she imagined vividly a certain patient getting out of bed. She called out to stop him doing so, and woke up to find him sitting up in bed about to get out to come to her to find out what was worrying her.

(*j*) *Sleep paralysis.*—This paralysis can be predormitial or postdormitial. In the first, localized or generalized paralysis, of which the subject is aware, occurs before sleep; in the second, after awakening from sleep.

Predormitial paralysis can, if accompanied by fear, waken the subject fully, so that attacks of this condition could resemble those of the temporary tonic motor paralysis here being dealt with, if the latter were accompanied by fear. But fear seldom accompanies the condition if the subject is unaware of its harmlessness. No anxiety is felt once the sufferer is accustomed to its occurrence.

Postdormitial paralysis is exemplified by the instance of a nurse who fell asleep in her chair, letting her book fall. She heard the door open, saw the Superintendent come in and walk away again, but was completely unable to move. All movements returned simultaneously. Attacks of the cataleptic states discussed in this article occur when the subject has been known not to have been asleep and, perhaps, has been standing. Instances are of an officer standing on watch on the bridge of a cruiser, and of a nurse, standing turning over the pages of a report book.

Both pre- and postdormitial paralysis show durations of seconds or minutes. The second may be abruptly terminated by the subject being touched.

(*k*) *Cataplexy.*—In this condition the sufferer hears all that occurs but, as all voluntary muscles are flaccid including the orbicularis oculis, does not see his environment. The attacks are usually produced by strong emotion, either pleasurable or the reverse. The subject sinks down and appears to be asleep.

(*l*) *Narcolepsy.*—The attack of narcolepsy produces all the appearances of sleep, and the subject is usually completely unaware of his surroundings during the attack. The attack may be brief, or may last a few hours.

(*m*) *Coma.*—The immobility of coma, whatever the cause, is generalized, the muscles are flaccid and other signs of organic trouble are usually present.

TABLE I.—*Attacks of Immobility.*

	Muscles flaccid.		Muscles tonic.	Appearance of sleep.	Awareness of surroundings.
Voluntary*	−		+	−	+
Fear	−		+	−	+
Catalepsy	−		+	−	+
Vaso-vagal†	−		+	−	+
Schizophrenia	−		+	−	+
Post-encephalitic	−		+	−	+
Day-dreaming	−		+	−	−
Hysteria (fugue)	+	or	+	+−	+‡
Petit mal	+	or	+	+−	−
Sleep	+		−	+	−
Sleep paralysis	?		?	−	−
Cataplexy	+		−	+	Aural only
Narcolepsy	+		−	+	−
Coma	+		−	+−	− or partial
Concussion	+		−	+	−
Shock	+		−	−	+−

\+ = Present; − = Absent; +− = Variable; ? = Doubtful.

* Can be terminated voluntarily.
† Numerous accompanying symptoms.
‡ Not fully, after attack terminated.

Complete unconsciousness may be present, or some incidents taking place during the comatose state may be remembered.

(*n*) *Concussion.*—Again, the generalized immobility is of a flaccid nature, and complete unawareness of the surroundings is present. The unconsciousness may persist from one second to many hours.

(*o*) *Shock.*—The muscles are flaccid, awareness of the surroundings is present, except in severe cases, and the usual physical signs of the condition are found.

Summary.

Sixteen causes of generalized immobility of the voluntary musculature have been discussed in order to provide comparisons with the temporary tonic generalized motor paralysis previously described.

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THE PSYCHIATRIC SOCIAL WORKER IN THE COMMUNITY.*

By E. M. GOLDBERG.

INTRODUCTION.

As you probably know, in January, 1944, the Provisional National Council for Mental Health were asked by the Board of Control to provide a Social After-Care Service for men and women discharged from Service Psychiatric Hospitals. For the purposes of this work an experienced psychiatric social worker, known as Regional After-Care Officer, was appointed to each of the Civil Defence Regions to undertake and organize this service. The psychiatric social workers visited the Psychiatric Service Hospitals in their areas, obtaining a full history and recommendations from the psychiatrist referring the case, and interviewing each patient to discuss his needs and plans. These reports were then sent to the Regional After-Care Officer in the patient's home area and formed the basis of our work.

Soon cases began pouring in, not only from Service Hospitals but from other agencies interested in the resettlement of the psychiatrically disabled Ex-Service man, such as Disablement Resettlement Officers, Ministry of Pensions doctors, Red Cross workers and so on. By the end of 1946 some 10,000 cases had been dealt with under this scheme.

Throughout we have been faced with an acute shortage of trained personnel and in most regions it was only possible to have the services of one or two full-time psychiatric social workers, so that most of the Regional After-Care Officer's assistants were trained social workers without the Mental Health Certificate. These general case workers receive a great deal of tuition and supervision from the psychiatric social worker. This dilution is raising great controversy, but it must be stated that some of the social workers have done remarkably patient casework of a high standard and that the scheme would have broken down without their help. As I will show later, emphasis on the general casework side is much greater than in orthodox clinic or hospital psychiatric social work, so that there is a place for the general case worker, under the guidance of a psychiatric social worker, in such a community service.

It is the first time that a community service on a national basis has been provided for a selected group of psychiatrically disabled persons and it has offered the psychiatric social worker enormous scope in applying her skill in the wider social field.

After three years of hectic activity, I felt the need to assess the value of this new service and its possibilities for the future, and began a study of successes and failures in our work.

* A paper read at the Social Psychiatry Section of the Royal Medico-Psychological Association at 11, Chandos Street, on 21 February, 1947.

Method of Research.

I have been studying roughly 12 cases from each Region—chosen by the Regional After-Care Officers—six cases in which they felt that After Care had a positive contribution to make and where our work led to a general improvement, and six cases in which our work, intensive though it may have been, did not lead to any substantial change or resettlement. I hoped that by investigating the outstanding positive and negative manifestations of our work we might be able to elucidate essential trends. As I will show presently, definite trends in our work stand out quite clearly in spite of so many different personalities doing the case work with different types of training and background, and in spite of wide variations as to the type of population, provision of treatment facilities, standard of Social Agencies and so forth.

Outline of Paper.

First of all I should like to discuss some of the outstanding characteristics of the success cases, both with regard to the type of patient and his disability and our methods of work, illustrating each group with one representative case. I will then analyze the outstanding failures in a similar way. From there I shall pass on to the social worker's essential role in this type of community care, touching on the difficult subject of the difference in the approach of social workers and psychiatic social workers. Finally, I am going to try to define in what way this type of psychiatric work in the community differs from the more orthodox psychiatric social work in the framework of a hospital or clinic, what its particular significance and contribution is for the present and for the future.

Successes.

It is a common characteristic of all the success cases that the patients are co-operative; that is to say, they feel the need for help and have sufficient intelligence and emotional drive to want to get well and to establish a fruitful contact with the After-Care Officer. Often they are people whose basic personality and intelligence are reasonably good and whose disabilities are reactive rather than constitutional. But amongst the success cases there are also a number of very "poor fish," people of low intelligence, of almost constitutionally anxious temperament. They have, however, possibilities of emotional growth in them, enabling them to reach the worker and enabling the worker to establish a real contact with them. This contact proves the first bridge or link with the community and its demands and with infinite care these rather poorly endowed personalities can be helped to make an adjustment, as one After-Care Officer put it "within their shaky limits."

Four specific groups stand out clearly in every Region as capable of benefitting by After Care in the sense described above. They are:

(1) Fairly acute anxiety states in persons of good intelligence and basic personality, often associated with a difficult reality situation.

(2) Affective disorders, often almost indistinguishable from the chronic type of anxiety, in the rather limited individual who cannot

cope with stress and complexities and who needs the tolerant approach and patient encouragement, which will give him confidence to tackle life more successfully.

(3) The recovering schizophrenic, who needs rehabilitation in the widest sense of the word, from encouraging and stimulating contacts with reality in everyday home life, to re-learning the wider social skills in the community.

(4) Some cases of post-traumatic disabilities, who need skilled help to make a completely new adjustment on a new and often more limited level.

THE ACUTE REACTIVE ANXIETY STATE (Case example).

This man, aged 35, was referred for After Care by a Neurosis Centre in 1944, and has been an active case for two years now. He had always been a neurotic personality with depressive trends, but had a fair occupational and social adjustment prior to the War and many compensating positive qualities. He had an excellent record in the Army and developed a reactive anxiety state after acute experiences in the Norwegian campaign. His early home background was extremely unstable and unhappy. He married a mother-substitute type and has two children. At the time of referral he was separated from his wife and his domestic difficulties were severe. He was out of work and suffering from bouts of violent depression. An excellent contact was established and the patient proved to have considerable intelligence and insight. His marital difficulties were discussed freely and he was also able to release his guilt about some new attachment which has possibilities of emotional satisfaction. The man lives in a mining area, but is unable to carry on in heavy industry. It was found that he worked with great pleasure and skill on his allotment, which yielded remarkable results. After very careful consideration and consultation with D.R.Os. and psychiatrist it was felt that the best form of resettlement for this man would be to enable him to employ himself full time on his allotment, which could easily be extended into a smallholding. This would give him real satisfaction and also enable him to work at his own pace. As the agricultural resettlement grants were not in force then, a £50 loan was obtained from the Red Cross and the patient was helped to extend his activities. At the same time much practical help was given in sorting out various other difficulties with the Ministry of Pensions and Ministry of Labour regarding allowances for his wife. The patient was working under extremely difficult circumstances as the grant was not really big enough to live on. Constant encouragement and opportunities for discussing difficulties were given by the After-Care Worker. Recently it has been possible to secure the agricultural resettlement grant of £150. The patient has been able to repay the £50 to the Red Cross, has extended the smallholding further and is at last beginning to see a certain margin of profit. His nervous condition has improved greatly, and he has had no major attacks of anxiety or depression. As you will see from this account this man had treatment at a Neurosis Centre, but it is clear that no amount of psychiatric treatment alone would have helped him to a tolerable adjustment as the domestic and employment difficulties would have acted as continuous disturbers of the peace. The After-Care Officer was in a position to take into account this patient's varied needs. She brought him psychological relief through the talks about his marital and personal difficulties, by discovering the occupation that gave him every satisfaction, she enabled him to make this his life job. She relieved him of some of the domestic anxiety by acting as an interpreter to the Ministry of Pensions, the Assistance Board and various other Social Agencies. The P.S.W. was able to deal with the whole of the problem in its social setting. Through her co-ordinating function the other Social Agencies involved were helped to understand the complexity of this man's problems. The patient himself would not have been able to carry on through periods of severe financial and domestic stress if it had not been for the feeling of support and security which he derived from the After-Care Officer's understanding.

GENERAL.

It may be objected that this case relates to a patient who could and should have been helped by psychotherapy and that the social worker trespassed. It will have to be remembered, however, that psychotherapy is only available for very few people and that anxiety conditions which are closely bound up with difficulties in the reality situation often yield much more quickly to the combined approach of psychological understanding and practical help. It is obvious that by means of her training the Psychatric Social Worker will be able to recognize when the condition becomes so severe as to demand psychiatric treatment. I have no time to quote a number of similar cases where the actual treatment part has been carried on at a Clinic, but where the After-Care Officer has played a vital part by attending to the material difficulties and needs of the patient, thus ensuring co-ordination.

AFFECTIVE DISORDERS AND CHRONIC ANXIETY STATES.

A man of about 38 was referred by a Neurosis Centre, where he was being treated after his discharge from the Merchant Navy, with a diagnosis of anxiety with depressive features. He had a cheerless and slummy home background, had seen severe enemy action, his wife had left him and he was living with his aged mother. He was able to take work as a labourer on his discharge, but became increasingly depressed, particularly as his new girl friend was cooling off. He again applied for treatment and had another spell at the Neurosis Centre, but his depression became so severe that he was considered a suicidal risk and transferred to a Mental Hospital as a voluntary patient. He did not stay there but came home, tried to work as a labourer, but remained irritable, depressed and suspicious. He could not adjust to life at home, which was undoubtedly partly due to the dreary and cheerless environment created by his very old and ineffectual mother and his slovenly and uninterested sister. The After-Care Officer obtained material aid and finally arranged for him to go back as a voluntary patient to the local Mental Hospital. He only stayed a few weeks and expressed his ardent desire to go back to sea. After intensive negotiations it was possible to arrange this. The After-Care Officer provided clothing for him and literally nursed him on to the ship. This was in May, 1946, and up till now he has been making regular trips to Germany, Portugal and Spain. He writes regularly to the After-Care Officer and asks her for help with innumerable practical difficulties.

You will notice that this man was in three different hospitals and that treatment failed to bring about any improvement, but that when he was given intensive personal attention and support it was possible to encourage him in such a way that he was able to go back to his old job at sea. Although he is still rather inclined to be depressed, he is probably as well as he has ever been. The After-Care Officer was, in this case, the only source of support and encouragement to a depressed and lonely soul, living in a cheerless, affectionless environment. His dependence on the worker was very great indeed at one stage and she was having to work very hard to fulfil his ever-growing demands, but he now seems able to stand a little more on his own feet.

GENERAL.

I should like you to observe that the unsparing intensive work on this and similar patients, who looked chronic and hopeless to begin with, was carried out by Social Workers, in contrast to the anxiety group which was handled

almost entirely by P.S.Ws. I feel that this is rather significant. The first group of patients needed a considerable amount of psychiatric assessment and the work of the P.S.W. amounted to something like superficial psychotherapy. In the second group of affective disorders, what was demanded of the worker was not so much interpretation of acute conflicts, but something which I should like to call "maternal care"—a form of positive support, material and psychological, making great demands on the Worker's willingness to give of herself unsparingly and this the less psychiatrically trained person seems well able to do. It strikes me that this group of depressed misfits in the community are people who have not had sufficient maternal love and instead of striking out aggressively like some of the psychopaths they have become depressed and ineffectual. Through the generous help of the Social Worker, who recognizes their deficiencies and who makes untiring efforts until positive feelings are stirred, the patient is able to move forward, at first utterly dependent on his new mother figure, but gradually emancipating himself as he is able to reach out for other satisfactions.

The Recovering Schizophrenic.

A boy of 19, with 18 months' service in the Army, was referred by a Military Hospital in May, 1945, the diagnosis being hebephrenic schizophrenia. The boy was the only son of a very over-protective mother. He was of superior intelligence, matriculated and was called up from school. He worked as a laboratory assistant in the R.A.M.C. When he was first visited he was still withdrawn and probably deluded and quite inaccessible. His mother felt that he was hopeless and by her attitude she was doing everything she could to keep him ill. The After-Care Officer visited regularly, won the confidence of the mother and was able to modify to a certain extent her attitude of over protection. She was encouraged to believe that the boy would improve and when there were signs that he was able to get into touch with reality she was taught how to encourage him and make the most of his recovery. In this way the boy was encouraged gradually to undertake more and more in the way of tasks at home and social activities outside, and when he was ready for work the After-Care Officer was able to find the one job he wanted to do, that of a junior chemist. He started this job about 10 months after his discharge from Hospital and he has gone from strength to strength since, as he is now also able to engage in social activities outside his work and his home. This boy probably made a spontaneous recovery from his severe schizophrenic illness, but I personally have no doubt that he would not have made anything like such a complete recovery had it not been for the help the After-Care Officer was able to give; first to his mother and secondly to him. This case shows what can be achieved by working through the environment first and changing the relatives' attitudes and by active help in the re-education of the recovering psychotic. There was a relationship of complete trust and confidence between the family and the After-Care Officer, who, with very good insight, made the right move at the right time, encouraging a gradual widening of interests and activities commensurate with the patient's capacities.

General.

The function of the After-Care Officer in this case did not so much involve the very intensive personal help the other group of patients required and was not so much dependent on transference and the relationship therapy, but was one of creating a social ladder, as it were, on which the patient was able to climb step by step towards social integration. It is a form of environmental help aimed at the patient, the possibilities of which have not, I think, been realized

fully. Here, I feel, lies a great field for experiment in psychiatric rehabilitation. I am inclined to think that many psychotics, after successful treatment, have a good chance of social integration if, at the optimum moment the right type of approach is made; if, in other words, the Psychiatric Social Worker is able to lay her finger on the one positive and real thing the patient is capable of achieving and that stirs his interest and imagination. I am afraid that we are still too stereotyped and unimaginative in our approach. Another essential point that emerges is the immense importance of following up quickly after discharge from Hospital, so that what I call the optimum moment is not missed. In civilian work we should be able to commence rehabilitation during the last stages of hospital treatment, and I have visions of rehabilitation centres following on occupational centres in the hospital and gradually leading towards everyday working conditions.

Cerebral Tumour Patient.

This patient is a married man, aged 37, who was referred in 1944 by a R.A.F. Station Hospital. He was said, at that time, to be anxious, depressed and retarded. He had a stable employment record, had reached the top class at his school and was apparently a stable personality. On the first home visit it was found that he was unable to carry out the simplest action on his own. He was immediately referred for psychiatric examination, admitted urgently to an E.M.S. Hospital and a tumour of the brain was found and operated on. He stayed in Hospital for 3 months and on his discharge he was expressionless, very slow, paralyzed completely down one side. He was attending as an out-patient the occupational therapy department of the Neurosis Centre. He was not receiving a pension and the financial situation in the home was very strained and required the After-Care Officer's attention. His speech was also impaired, and speech therapy had to be arranged, as well as elaborate arrangements for escorts. At that time the patient was very depressed and despondent and his wife, a rather neurotic type, was desperate, disgruntled and not encouraging patient at all. When the Neurosis Centre closed down, the last hope went as there was no occupational therapy available. The After-Care Officer was undaunted and after contacting many different agencies he was able to get a weaving loom for patient. He found an occupational therapist at the local Mental Hospital willing to go to patient's home and teach him once a week, and finally S.S.A.F.A. was willing to bear the out-of-pocket expenses of the occupational therapist. The loom was installed, the occupational therapist started to visit him weekly and the patient at last became active and hopeful. Finally, in order to provide a variety of interest, rug materials were obtained for him. The occupational therapist thinks highly of this man's ability and believes it is possible that he will eventually be able to do light work. Along with these practical developments went the After-Care Officer's close relationship with this patient's family. By providing outlets for the patient, relieving the intolerable financial strain and by general encouragement, he was able to lift a cloud of depression that had descended on the whole household, and outside people remarked how much more positive the wife's attitude was; instead of discouraging patient, she was now helping him and the last impression of the case was a write up describing patient sitting in a room with the sun pouring in, weaving happily.

This case, then, shows the Social Worker once more as a co-ordinator, seeing the patient's problems in his family setting. Occupational therapy alone would not have brought about improvement in the whole family outlook. Through the Social Worker's constant help, this man, severely disabled though he is, was enabled to use his limited capacity to the maximum, and both he and his wife have been helped towards a positive outlook.

Post-Traumatic Patients.

The main issue with the post-traumatic type of case is to help the patient to make a new and positive adjustment on a level often much lower than he had previously achieved, to guide the patient and his family towards the acceptance of the disability, at the same time providing positive satisfaction within the patient's range. The task of the P.S.W. is often a very complex one here, as she will have to enlist the help of many social and therapeutic agencies. She must be constantly aware of the possibility of the patient developing hysterical symptoms and other pathological reactions on top of his organic disability, if life is too difficult for him to face. No amount of training or occupational therapy or material help will bring about real readaptation if the fundamental problem of psychological readjustment remains untouched.

This brings us to the end of our analysis of the successes.

Failures.

They stand out remarkably clearly and fall into much more definite and uniform groups:

(1) The allegedly uncertifiable unrecovered chronic psychotic, who, by virtue of his illness, is incapable of insight or of responding to our help.

(2) The psychopathic personality, which I should like to divide into

(*a*) the delinquent psychopath,

(*b*) the unmanageable girl psychopath,

(*c*) the chronic alcoholic, and

(*d*) the paranoid type of psychopath, often subnormal in intelligence, who is frequently found in a derelict social setting.

The Unrecovered Psychotic.

A single man of 30 was referred by a Military Hospital in 1944 with a diagnosis of schizophrenia, having made only a limited improvement and receiving a 100 per cent. pension. There was no previous history of mental illness, but he had an erratic employment record. The mother was immensely over-protective, and her severe deafness made it difficult to have much contact with her. The After-Care Officer kept in regular touch with this patient, visiting at intervals of a month or six weeks. He remained withdrawn and probably deluded. Attempts were made to interest him in work or occupations at home with no result. He was referred to the Ministry of Pensions three times with a view to further treatment and each time he was sent home again with a note saying that he only required panel doctor supervision, although latterly he had become increasingly more restless and deluded. The Panel Doctor was satisfied with the Ministry of Pensions verdict and no one moved until the patient proceeded to murder his father and severely injure his old mother. He was then committed to Broadmoor Asylum. Here, then, we have a patient who is considered a harmless lunatic, although he was actively deluded and deteriorating steadily. The price the community paid for the freedom of the individual was two lives, as the mother is incurably shattered by her experience, though not physically dead. The Social Worker's ability to help constructively was limited and could not amount to more than referring patient for treatment to the appropriate agencies and to giving all the help she could to a very over-protective, but kindly mother.

General.

It is evident that the function of the After-Care Officer in the case of the psychotic requiring treatment is to secure treatment, help relatives to cope with the patient and to co-operate with treatment. The serious situation prevailing all over the country is that the psychotic without insight will not consent to voluntary treatment and that some doctors and relieving officers are unwilling to resort to certification unless the patient is really a raving lunatic. This rigid limitation of the use of certifying machinery is alleged to protect the freedom of the individual. I wonder how long it will be until it is realized that the price we pay for the alleged liberty of an ill person, who would be much better in a hospital, is the life and happiness of otherwise normal and happy people. There is ample evidence that in all the Regions, After-Care Officers have left no stone unturned to get deteriorating psychotics into Hospital, but time and again they have met reluctance to certify and untold misery has resulted for the immediate environment of the patient, quite apart from the fact that the patient himself was not helped in any way. The reason for our failure in this type of case lies in the prevailing antiquated machinery of the Lunacy Laws, which, I hope, will be overhauled before long in the light of recent advances in the treatment of mental illnesses.

The Delinquent Psychopath.

This man, married, aged about 30, was referred to us in 1944 by the Ministry of Labour as he had great difficulty in settling down to a job. He had been discharged from a Neurosis Hospital with a diagnosis of psychopathic personality with severe neurotic traits. His history revealed great emotional difficulties in early childhood, centring round a terrifying and over-powering mother. He went to a Grammar School, entered a Theological College against his will and finally joined the Indian Army. Whilst in India he married a half-caste twice his age, and married an English girl bigamously later on. After his prison sentence he had various commercial jobs. He was imprisoned on one occasion for impersonating an Army Officer. In 1939 he joined up again, was often absent without leave and was unable to keep his promotions. After his discharge from the Forces he had approximately eight jobs before being referred for After Care, and the reason for his dismissal from most of them was delinquent and/or arrogant behaviour. When he was seen first he was in the most severe financial and domestic difficulties, aware of his deep-seated problems, but blaming his circumstances for his repeated failures. An attempt was made to secure psychological treatment for him, but he did not keep the appointments. Finally, after intense emotional scenes, he left home and arrived penniless at the After-Care Office. He was then in a very co-operative mood and opened up considerably about his early difficulties, and there seemed to be a gleam of hope that one would be able to help him. He was fixed up in a hostel and, after great efforts, the After-Care Officer, in close co-operation with the D.R.O., succeeded in getting him a job as a valet in a Canadian Army Officer's Camp. This was a job after the man's own heart and he departed full of hope for the future. After a fortnight he was apprehended for stealing from the Officers and served a six months' prison sentence. A year or two later he was in further trouble with the Police after a shop-breaking charge, which took place after a severe domestic upheaval. Here, as in other cases, this patient's deep-seated difficulties go back to a series of emotional disturbances and conflicts in his early home life. He was intelligent and on the surface willing to co-operate, but his unconscious drives were far too strong, and even when some of the reality stresses were removed and he was given a completely new chance away from home, he was quite unable to lead a normal life; he also faces a life of prison sentences.

General.

Why are we so utterly unable to help these anti-social psychopaths, of whom many are above average intelligence, in spite of the fact that we have insight and sympathy with their problems? The fundamental reason probably is that their problems are so deep-seated and the pattern of delinquency so established that we are unable to break through to them. The establishment of any fruitful contact is made all the more difficult by their tendency to wander about the countryside. It seems fairly clear that this type of psychopath needs long-term treatment. One psychiatrist suggested that they would need some type of institutional treatment, which was a blend of a hospital and a prison, but even with long-term intensive psychotherapy one wonders whether any results will be achieved. I think it is important to bear in mind that in all these cases manifestations of disturbances and pathological attitudes were observed in childhood. Perhaps the only answer to this great problem is that by ample child-guidance facilities and wiser parent education we shall limit the number of anti-social psychopaths. (I will leave it to you to discuss this vexing problem further.)

The Unmanageable Girl Psychopath.

This girl of 18, with one year's service in the W.A.A.F., was referred to us in 1945 by a Military Psychiatric Hospital after she had made a suicidal attempt by aspirin. She was of good intelligence and there is again a story of broken home life. Her mother died whilst she was young, and she lived in very close contact with her father, who took her out with him everywhere until his death in 1942. She then went to live with an uncle and aunt, who were strict and frowned on the free and easy habits she had acquired whilst living with her father. There was, further, some erotic attraction between herself and the uncle. A visit to the uncle before this girl was discharged from hospital revealed that the mother had been a flighty type. The uncle was very censorious of the patient's promiscuous habits, but at the same time was obviously attracted by her. On the girl's discharge from the Hospital, the After-Care Officer arranged for her to stay at a hostel and tried to keep in close touch with her. She seemed lost at first and started to stay out odd nights. She seemed depressed and also distressed that she did not belong anywhere and she expressed deep conflicts regarding her uncle. It was not possible to establish a really close contact with the girl, as she kept disappearing from the hostel. After she had been missing for several weeks she finally turned up, collected her clothes, and has not been heard of since.

This girl, who is drifting into promiscuity has again quite obvious deep problems connected with her childhood experiences. Reading through her case it becomes very clear that she is driven by something much stronger than her conscious self into her promiscuous life, which she does not really enjoy, as she seems depressed and unhappy most of the time. She was quite unable to make a contact with the Social Worker and had to be left to drift along her unhappy path.

General.

This group of the unmanageable girl presents a grave problem, to which, I believe, no positive answer has been found yet. Some of these girls are sent to Approved Schools or Borstals, but so often they emerge from there only to repeat their previous pattern of behaviour. I think they are a serious problem,

not so much from the effect their asocial behaviour has on the community, but because they will become the type of unloving mother who produces a problem child, who, in turn, will hit back at society.

Have Psychiatric Social Workers any contribution to make to this problem which is so often regarded as purely a social one and dealt with by Moral Welfare Workers ?

The Chronic Alcoholic.

I propose to say very little about this group of failures because it seems to me that when alcoholism has reached the chronic stage necessitating Mental Hospital treatment it is too late for the Social Worker to do any constructive work. Very good contacts have actually been established with alcoholics in the sober remorse state, but in all the cases presented the relationship has never resulted in helping the patient to overcome his alcoholic bouts. I think the essential point here again is that the patient, though consciously even asking for help, has unconsciously accepted the " bottle " as a means of dealing with his conflicts.

The Paranoid Psychopath.

This man, aged 44, was referred to the After-Care Service by a Council of Social Service as he seemed unable to settle down to civilian life. He was married and had four children. He showed no responsibility towards his family, refusing to support them, and they were living on Public Assistance. He was spending his time at dog racing tracks and was creating considerable disturbances in the home. He had apparently been fairly stable before the War, but it was not possible to check on this statement. When the After-Care Officer first met this family she referred patient to the local psychiatric clinic and the psychiatrist described the man as an irresponsible rogue, but he was prepared to help the family and see the man at the clinic. The After-Care Officer then set about trying to improve conditions in the home. Arrangements were made for the small children to attend a Day Nursery and for the older child to have meals at school so that patient's wife could give more attention to the home. Material assistance was obtained from the very co-operative Council of Social Service, and for a time it looked as though things were settling a little. Patient seemed more co-operative and inclined to do his bit. Patient's wife was responding to the Worker's encouragement and tried to keep the home better. However, this state of affairs did not last long ; patient's aggressive and rather paranoid attitude got the better of him, he made unreasonable demands for large resettlement grants from the Ministry of Labour. The marital difficulties became very severe indeed and the wife began to neglect the home again. The parents were not able to get up early enough to get the children to the Nursery School, and conditions in the home deteriorated until they were again as bad as at the time when the After-Care Officer had first visited. It was then decided to close the case, as it was obvious that in spite of intensive family case work the After-Care Officer had been unable to bring about any improvement in the general situation.

General.

What has contributed to our failure in the psychopathic group ? In most cases the work was on an intensive scale in co-operation with many other Social Agencies, as these people so often find themselves in the most involved and complex situations. One of the characteristics of this group is that unconsciously and at times consciously they prefer their way of life and do not really

want to be helped to achieve the social standards generally accepted. In most of their histories we find evidence that they have been emotionally thwarted in early life and they are now getting the emotional satisfaction of hitting back whether their aggression shows itself in being " agin " the Government and refusing to work unless they get a Government grant of £1,000, or whether it is the aggressive taking of denied pleasures, called stealing, or whether it is symbolized in sexual promiscuity, where quite often longing for affection and revengeful hostility are mixed. These people, emotionally immature, live like children according to what Freud called the pleasure principle. It is a force that drives them mercilessly and which they seem utterly unable to control ; the price they have to pay for such behaviour is heavy we know, as most of these psychopaths are miserable, dissatisfied people, and this depressive colouring is, I think, due to an unconscious deep sense of guilt, of which the delinquent type rids himself by going to prison. Their values are, as it were, upside down and they do not possess the tools of control. Is it to be wondered at that in most cases we cannot reach them ? In fact, I think by our understanding and unprejudiced attitude we often increase their unconscious sense of guilt as their pattern of life is built on the assumption that nobody wants them and everybody is against them. It is clear that only a very deep going process of rehabilitation, of tackling the problems, both from without and within, will stand any chance of success, that is to say, a process of undoing their false values, followed by a gradual process of helping them to grow up more normally. This is an immense task and probably even if it were feasible there would still be complete misfits in our community, those who are almost constitutionally unable to grow up emotionally along healthy lines. I do not want to appear too gloomy, however, and I must mention here that some few and all the more astonishing successes have been achieved with psychopathic personalities. With these cases I feel that difficult though they were the pattern as described just now was not fully and irretrievably established yet. One case was of a boy described by the psychiatrist of the invaliding Hospital as a criminal psychopath, who was in severe jungle fighting as a youngster, spending his time brothel crawling in India. He was generally completely wild and irresponsible after his discharge. He had experienced great friction in his home, where his mother rejected him, preferring a younger brother. He had always been impulsive and wild as a boy and was regarded as the black sheep in the family. When he came to the notice of the After-Care Service he was already labelled criminal psychopath, and he was full of aggressive impulses, but he was afraid of the aggressive forces in him, had a strong conscious sense of guilt and was still at the stage of openly longing for his mother's affection and approval. He was just standing on the brink, as it were, of becoming a confirmed anti-social being, compensating for the lack of security in his home. The After-Care Officer was able to make a real contact with this boy and to evoke his tender and positive feelings. She became his substitute mother for the time being and he opened up, confiding all his difficulties to her. Having the After-Care Officer's support he was able to relinquish his quest for his mother's love, when attempts to change her attitude towards the boy had failed. After a tremendous row at home he was helped to establish himself in lodgings, and eventually it was possible to fix him up in

agricultural training, which was no small task in view of the fact that he had been labelled a criminal psychopath and moral defective in the D.P.I. This boy has been on a poultry farm now for seven months, and apart from one outburst when he smashed up a few windows, is keeping a precarious adjustment. Here you see was a boy who had all the potential makings of a psychopath and who was just on the point of finding satisfaction in anti-social behaviour because he could not secure his mother's love and approval. It was his good fortune that just at that time he was sent to the people who recognized his fundamental problem and did not spare any effort to see him through this immensely difficult and significant period.

There is hope I feel when there is still a positive conscious longing for affection and approval and feelings of anxiety and guilt about anti-social trends, but even then the potential psychopath with his uncontrollable hunger for emotional satisfaction makes the most enormous demands on the P.S.W., and only mature people who have come to terms with their own aggressive impulses and are able to bear the strain of the patient's incessant demands without anxiety are capable of dealing with them. There are many Social Workers and Psychiatric Social Workers who cannot stand such severe demands and rather than cope anxiously and almost reluctantly it is better not to attempt the case at all.

Here I must reluctantly leave the fascinating subject of the psychopathic personality, a subject that needs much sociological and psychiatric research.

The clue as to why we succeeded in helping some patients and not others is the patient's accessibility. The first group of successes consisted largely of people who had basically a fairly normal structure of personality, but they had come up against specific problems that had created conflict and faulty attitudes or they had not been able to develop their potentialities. They were conscious of their disability and anxious to get better. It was possible, therefore, to establish a contact of dynamic quality, and they were able to take advantage of the help both psychological and material we were able to give them. The group of failures consists largely (though not always) of people with whom we were unable to establish a really creative relationship. The psychotic living in another world and the psychopathic personalities who, because of their abnormal basic pattern of behaviour, were unable to take advantage of the help offered.

The Role of the Psychiatric Social Worker.

What is the function in the work described above? I should say that our primary function, without which our work cannot be successful, is to assess correctly and on the deepest level possible the patients' problems and needs so as to arrive at a comprehensive social diagnosis. This applies particularly to the cases referred without a diagnosis from social agencies which naturally normally only recognize the immediate difficulty in the patient they have come across, i.e. the D.R.O. says "This man is unsettled in his work." This complete assessment involves a full social history; psychiatric insight, as we must be able to recognize the patient's possible need for psychiatric advice and for treatment, and sociological knowledge to evaluate the significance of the social problems.

Having made an adequate asessment of the patient's problems and needs it is our function to devise a plan of work. Although it is not always possible to have initial conferences on our cases as in Child Guidance practice, we should be clear in our minds about the basic problem and the aim in our case work. I think we social workers have an unfortunate inclination, through pressure of work and other less obvious mechanisms, to be driven to "do something," and we are not always clear what this "something" is. At times, I admit, we have to feel our way intuitively, but there comes a time when we should be able to say what we are aiming at and why. We hope that with the appointment of Consultant Psychiatrists to the Regions an initial conference with a psychiatrist will become a reality in most cases.

Having decided on the treatment plan I think our functions can be divided into three:

(1) Personal help to the patient.

(2) Interpretation of the patient's problems and needs to the family, helping them to adjust to his often changed personality.

(3) Interpretation of the patient's needs to the community, mostly in the shape of social agencies which are enlisted to help in the rehabilitation of the patient.

The first part of our function is the vital one, without which we are not able to fulfil the other two. We all know that our personal help to the patient may vary from helping him to fill in a form, to a complex relationship amounting to some form of psychotherapy. The vital thing in both forms of contact is our relationship with the patient. Whether we are able to establish this relationship depends not only on the willingness of the patient to co-operate, but also on our own attitude. It is an attitude of opening your mind completely to the needs of another human being, a willingness to understand and accept the situation in which he finds himself as a reality, however confused or shocking this situation may be. It does not always matter so much whether we are completely able to follow the patient in his fantasies as long as we are really prepared to be receptive with our conscious minds, as free as possible from other preoccupations. This understanding and tolerance has an amazing releasing and therapeutic quality. It gives the patient a new feeling of relief and security. There is ample evidence in patients' letters that what they have valued most in the After-Care Service was the understanding and tolerance shown. This experience has been more important to them than practical advice or alterations in their material circumstances which we have been able to achieve. So often patients thank us for what we have done and our reply is that we have done nothing. We have been unable to get the house or the job they were hoping for, and yet they feel the reality of our help. The fact that we have taken their problems seriously and have tried to understand and have made real genuine efforts to help, has had a reassuring and therapeutic effect.

This relationship, which is the key to all personal social service, may make great demands on the tolerance and detachment of the social worker. In intensive case work of the kind described in the depressive group of success cases where patients tend to become utterly dependent for a time and we

clearly stand for a mother substitute, we have to guard against the dangers of the over protective and over-possessive mother. We also have to beware of the danger of the over-indulgent mother, whose child is always right, the danger of over identification with our patient. At the beginning of our relationship, when the patient is so helpless and immature, we may have to nurse him, but in our satisfaction at being able to help him, we should not accept his dependence as a permanent state, and aim at him helping to grow up toward independence. Similarly, in our ardent desire to help our patients, we tend to become so identified with their cause that we cannot see their problem in their wider social context, and so push their claims with a tenacity which, though laudable, ignores the existence of other urgent claims for different sections in the community. The only safeguard against emotional involvement, apart from our training, is, I suggest, to stop our frantic work occasionally and look at ourselves and ask ourselves " What am I doing here ? What do I feel about this case, and why ?." If we cultivate an awareness of our own attitudes, the danger of our emotions running away with us is minimized. This emotional detachment is also important because of its therapeutic value. We are able to bring relief to the patient because we are outsiders, seeing his problems more objectively. As soon as we become emotionally involved or over-identified with the patient we lose this ability to see his problems in their wholeness, and our usefulness to the patient will be limited.

Whatever the difficulties of this transference relationship, without it we can do very little to help our patients, and whilst we must guard against the dangers of emotional entanglement, we must equally guard against the desire to run away from such relationships. Some people prefer to tackle anything rather than the patient's inner problems. If the patient has difficulties within himself that need adjusting, no amount of environmental changes such as suitable work, material aid, rehousing, will bring about complete rehabilitation. We must, therefore, be at least prepared to acknowledge these personal difficulties, even if we cannot deal with them and shall have to refer them to a psychiatrist. This distinguishes our work from other forms of social work ; that we should be aware of the underlying causes of social failure and relate social failure to personality difficulties. If we shut our eyes to these underlying emotional difficulties we shall make very poor interpreters of the patient's needs to the community.

Our role as interpreter to the family, explaining the patient's difficulties and trying where necessary to modify the relatives' attitude towards him, is an important one, as the psychiatrically disabled person is so much more dependent on his environment and his family's ability to understand him than the emotionally mature and balanced person. Indeed much of his eventual recovery will depend on the helpfulness of his immediate environment. Many unhelpful attitudes are due to ignorance and over-protectiveness and are often the result of real concern for the patient such as the mistaken ideas about rest, sanatogen and breakfast in bed ! These attitudes can be modified fairly easily by convincing and imaginative explanation.

Often the family really bears the burden of the patient's illness, and much of our most valuable work consists in showing the wife or mother or husband of

our patient means and ways of shouldering this burden, particularly in cases of permanent personality defect or disablement. In our work with the patient's family we are occasionally faced with a very grave ethical issue. Sometimes the patient's instability is so severe as to endanger the happiness and perhaps permanent well-being of a young family, and yet the patient is utterly dependent on his family and their rejection of him would probably result in a final major breakdown. What are we to do in this dilemma? Encourage the wife with her young children to leave the husband and ensure the happiness of her children at the expense of the patient, or shall we encourage her to stick to the patient and help him toward recovery although the price paid in happiness and stability for the whole family may be very high indeed? It is no good saying the decision lies with the wife or husband. By our contact with the family we do, in fact, influence their decisions, and it is therefore important that we should ourselves face this problem squarely when it arises.

The range of our interpretative work to the community is ever growing and undoubtedly the most important development is adult psychiatric social work. I do not think that explanation of psychiatric illness, its social causation and resulting social problems has ever been carried so far into the community as in our After-Care work. There is now hardly a D.R.O. in the country who has not had personal contact with an After-Care Officer and the opportunity of discussing psychiatric problems as they affect employment. We all know that the D.P.1 in itself is hardly ever sufficient to explain psychiatric disability in terms of employment problems and that particularly in the more complex type of case a much fuller explanation of the patient's difficulties is needed. It is clear that our link with the Ministry of Labour will only be completely satisfactory if and when we have the services of a vocational psychologist also. Most D.R.Os. acknowledge freely that they have derived much help fro discussing the bewildering problems of the psychiatrically disabled with us We, in turn, have also learnt a great deal by coming out of our precious clinics into the hustle and bustle of employment exchanges and by having to face up to some of the grim reality problems in connection with the labour market.

Psychiatric social workers have, for the first time, co-operated with the commissioners of medical services. We have brought to their notice on many occasions the patient's need for treatment and have, I feel, done a great deal towards opening their eyes to the possibilities of skilled social work amongst the psychiatrically disabled. In many instances the Ministry of Pensions doctors have worked with us in a true team spirit. We, in turn, have learnt that the Ministry of Pensions is not quite such a remote, mysterious and inhuman machine as we imagined, and that they are concerned with the pensioner's human problems, and that they are prepared to use their cumbersome machinery to the pensioner's best advantage.

But our activities in the community take us much further than the Ministry of Labour and the Ministry of Pensions. We enlist the help of all possible social resources in the community for his recovery. This brings us into contact with a wide variety of social agencies, statutory and voluntary, and gives us a unique opportunity of widening understanding of mental illness, its social causations, and the possibilities of treatment and social rehabilitation. We

have all spent many useful, though occasionally exasperating, hours discussing a patient's case with the Hon. Secretary of the local S.S.A.F.A., with the Clerk to the Rural District Council, with the Secretary of a Price Regulation Committee, with some obscure official at the Board of Trade, with Area officers of the Assistance Board, with the Red Cross, and countless other representatives of Social Agencies in the community, not to mention colleagues in other fields of social work. I am sure we are not always aware of the cumulative effect of such unobtrusive educational work by personal contact, but I feel confident that its effect will make itself felt in demands for more information and a resulting better understanding of mental illness. Our interpretative function to the community is two-fold. It enables the patient to make use of the social resources in the community which, on account of his instability, he is not able to use efficiently himself, and it enables the social agencies to play a useful part in the rehabilitation of our patients once their problems and needs have been adequately interpreted to them. Without us as the communicating channel, as it were, those two might never meet, as the patient often does not know that the resources exist or are applicable to his case, and the social agencies do not recognize the patient's needs as they are often obscured by complex situations.

Here lies our major strength as P.S.Ws. in recognizing people's inner needs and being able to relate them to the social resources in the community in the widest sense. The more fully we recognize the patient's problems, and the more widely we permeate the community as an interpreter of their needs, the more amply will we justify our title Psychiatric Social Workers.

Finally, in what way does the Psychiatric Social Worker in the community differ from the Psychiatric Social Worker attached to a hospital or clinic? The main essential difference is that we work mostly on our own, and the focus of our work is the patient himself, although activity extends to his family and the community. The Psychiatric Social Worker in a hospital or clinic is the member of a team. She works definitely under the direction of a psychiatrist and her main concern is the patient's family and immediate environment. Some people maintain that, ideally, the P.S.W. in the community should be definitely linked with a psychiatric clinic or hospital. These people have overlooked a vital part of our work. Because we are free floating, as it were, in the community, and have the wide contacts described above, we come across problems of instability and maladjustment that will never reach a clinic without our intermediary help. We have access to them in the first place because we are P.S.Ws. not linked with a definite hospital or clinic. The patient, though unstable and causing concern, may not be aware of his need for treatment, and often we have to do much patient work to awaken this insight; or he may deliberately refuse treatment in which case most clinics and hospitals wash their hands of the patient, but we are able to carry on; perhaps supporting the relatives and seeking patiently for a solution. There are great numbers of unstable people in the community who will never find their way to the clinic directly, and who need at any rate preliminary work by a P.S.W. in the community. There is also the large group of the rather chronic neurotic type, that cannot be helped much at a clinic but needs the patient services of a social

worker with psychiatric insight, who, in conjunction with other social agencies, aims at bringing about some social adjustment within the patient's limits. There is further the large group of patients who only attend for a diagnostic interview, and whose problems are mainly of a social nature which could best be met by a Psychiatric Social community service. At present these patients are shot back into the community by the diagnostician with a short note to the panel doctor. As regards After Care and social rehabilitation of the ex-hospital patient, I feel strongly that we have proved the usefulness of a service radiating from the community rather than from the hospitals from which the patient is trying to break away. The After-Care Officer, working from the community, symbolizes to the patient the first step towards adjustment to community life and, whilst weaning him from the protection of the hospital, she is still able to to provide continued support. In this way After Care has developed into a positive service rather than an after thought to treatment. In social rehabilitation, after specific psychiatric treatment is completed, it is further necessary to enlist the help of the social resources in the community, and this a P.S.W., working in the community, may find easier to achieve than the hospital P.S.W., who is of necessity more interested in treatment aspects and not so closely in contact with the wider social resources in the community.

I think, then, that there is a big field for the P.S.W. in the community. By means of her training she will know when to consult a psychiatrist and, in fact, once there are sufficient psychiatric facilities there will be very few cases in which such advice will not be sought. In many instances, however, as we have seen in the cases studied, the problem will be handed back to the social worker with valuable diagnostic guidance. The field that could be covered by the P.S.W. in the community might be summarized as follows:

(*a*) Preventive work, spotting minor difficulties of adjustment by making her services freely available to all types of social agencies, including panel doctors.

(*b*) Preliminary work with potential patients and their families to pave the way towards treatment.

(*c*) After Care and rehabilitation work of the ex-hospital patient and participation in the social re-education of the chronic patient not suitable for clinic or hospital treatment.

(*d*) Educational work and research.

Apart from the functional differences that lie in the fact that the P.S.W. in the community is not attached to a specific hospital or clinic and covers fields so far very largely untouched or insufficiently covered by the hospital or clinic P.S.W., her range of work is also, in some ways, different. Psychiatric social community care, as demonstrated by the After-Care service, is an attempt to combine psychiatric social work with general social case work in the widest sense. In clinic work the P.S.W. is usually concerned with the more psychiatric aspects of the patient's or the family's problems, and problems of social and material care are entirely left to the appropriate agencies and very often, I am afraid, they are not tackled at all. This is due to the fact that the clinic P.S.W. must confine herself to her specialist function and has not the time for wider social work. It is also due to her training, where the field is rather

purposely narrowed to the non-material side of her work. In community care, however, where we help the patient to readjust either after treatment is completed or in the absence of psychiatric treatment, we have to use both our trainings to the full, so that hand in hand with psychiatric rehabilitation goes social and economic rehabilitation. I think we have all been amazed to learn how material and practical aid given psychiatrically, that is to say, at the right moment, within the framework of a treatment plan, can contribute substantially to social adjustment.

As I see it, the services of the community P.S.W. are complementary to those of the clinic or hospital team. We hope to fill the gaps before and after treatment, linking up with the clinic services wherever necessary. This will in time mean that the clinic workers will be able to concentrate on the really worthwhile selected cases capable of responding to psychological treatment. So far we have not been able to do much of the sifting and pre-treatment work in the community as we have been overwhelmed with the demand for psychiatric after care, but I think we have proved beyond doubt that there is a useful and essential place for the P.S.W. in the community whose function last but not least will be to link effectively psychiatric and social services.

NEUROSIS AND RELIGIOUS AFFILIATION.*

By ELIOT SLATER, M.D., F.R.C.P.

INTRODUCTION.

DURING the six years of the war, from the opening of the hospital in September, 1939, until the end of September, 1945 (to choose a convenient end-point), 13,556 soldiers, sailors and airmen of non-commissioned rank were admitted to the wards of Sutton Emergency Hospital. From this number have been excluded all women, all foreign troops and prisoners of war, Dominions troops, foreign nationals in the British Army, and also a half dozen or so men of whose religious affiliation no record was kept. Apart from these few accidental exceptions, all men on admission to the hospital gave to a nurse particulars which included their religious affiliation, and which were subsequently entered on the Hospital's Admission Register. From this Register the data which will be discussed below have been obtained. It is to be noted that the religious classification is based solely on the men's own statements; and these may at times have been lacking in precision, or have implied a distinction which does not exist. It is doubtful, for instance, whether there is any real difference between "Wesleyans" and "Methodists"; but as this distinction was made by the men themselves it has been retained.

Out of these 13,556 men, 9,354 were admitted to the neuro-psychiatric wards and 4,202 to the general wards of the hospital. A full account of the first 2,000 men admitted to the neuro-psychiatric wards has already been published (Slater, 1943). About 77 per cent. of them were found to be suffering from neurotic reactions, such as anxiety or hysteria or from psychopathic personality, and the remainder showed states of partially organic causation (8 per cent.), endogenous disorders such as epilepsy, schizophrenia or manic-depressive psychosis (9 per cent.), or minor degrees of mental defect (7 per cent.). The men admitted to the general wards were suffering from wounds, accidents, injuries, infections, such conditions as gastric and duodenal ulcer, defects such as hernia requiring surgical treatment, and the like. The main difference, therefore, between the two groups was the presence or absence of psychiatric disorder. The men in the general wards can be looked on as roughly representative of the Forces as a whole, from whom the neurotic population had also been drawn. The selective processes which secured admission to the general wards may have meant that the men who came there were physically

* A paper read at a Meeting of the South-Eastern Division of the Royal Medico-Psychological Association on 28 October, 1945, at Banstead Hospital, Surrey.

slightly inferior to the average; but we have no evidence that this would be correlated in any way with religion. There were, however, some other differences between the two groups. At the time of the Dunkirk evacuation in 1940, and again at the time of the invasion of France in 1944, there were considerable numbers of men admitted to the general wards almost directly from the battlefields. But on the whole, the majority of the men in these wards came from locally situated units, and included a higher proportion of R.A.F. ground staff than the admissions to the psychiatric wards. The psychiatric wards received patients as a part of general routine from a large part of South-Western England, and took considerable numbers of men invalided home on psychiatric grounds from all theatres of war, including the Far Eastern. These differences have to be mentioned; but it is difficult to see how they could affect the validity of the differences between the two groups in point of religious affiliation.

Religious Affiliations.

Taking together all men who gave the same religion on admission to hospital, we have the following numbers of men admitted to the psychiatric and general wards respectively:

Established and Similar Churches: Church of England, 6,541, 3,174; Church of Scotland, 107, 67; Church of Wales, 1, 0; Church of Ireland, 7, 1; Anglo-Catholics, 2, 1. Total, 6,658, 3,243.

Nonconformist Churches: Presbyterian, 290, 139; Methodist, 377, 132; Wesleyan, 83, 44; Baptist, 154, 70; Congregational, 69, 35; Unitarian, 22, 7; Episcopalian, 1, 0; Evangelical, 1, 0; Denomination unstated, 79, 42. Total, 1,076, 469.

Roman Catholics: 1,100, 427.

Jews: 418, 38.

Other Small Groups: Salvation Army, 41, 7; Plymouth Brethren, 6, 4; Spiritualist, 11, 2; Quaker, 6, 0; Four-Square Gospellers, 2, 0; Mormons, 2, 0; Christian Scientists, 2, 0; Theosophists, 2, 0; Total, 72, 13.

Oriental Churches: Greek Orthodox, 4, 2; Armenian Orthodox, 1, 0; Buddhist, 0, 1; Hindu, 0, 1; Moslem, 1, 0. Total, 6, 4.

Unbelievers: No religion, 9, 3; Freethinkers, 2, 0; Agnostics, 4, 1; Atheists, 9, 4. Total, 24, 8.

Over 70 per cent. of the total belong to the Church of England, which may be taken as a standard for showing whether members of other religious groups have any preferential tendency for or against admission to the neurotic wards. If the quotient obtained by dividing the number of men of one denomination in the psychiatric series by 6,541 is divided by the quotient obtained by dividing the number of men of the same denomination in the general series by 3,174, a figure is derived which will measure this tendency. Dealt with in this way, for instance, the affiliations to the Church of Scotland give a ratio of ·775. This is less than 1, and it might be concluded that members of the Church of

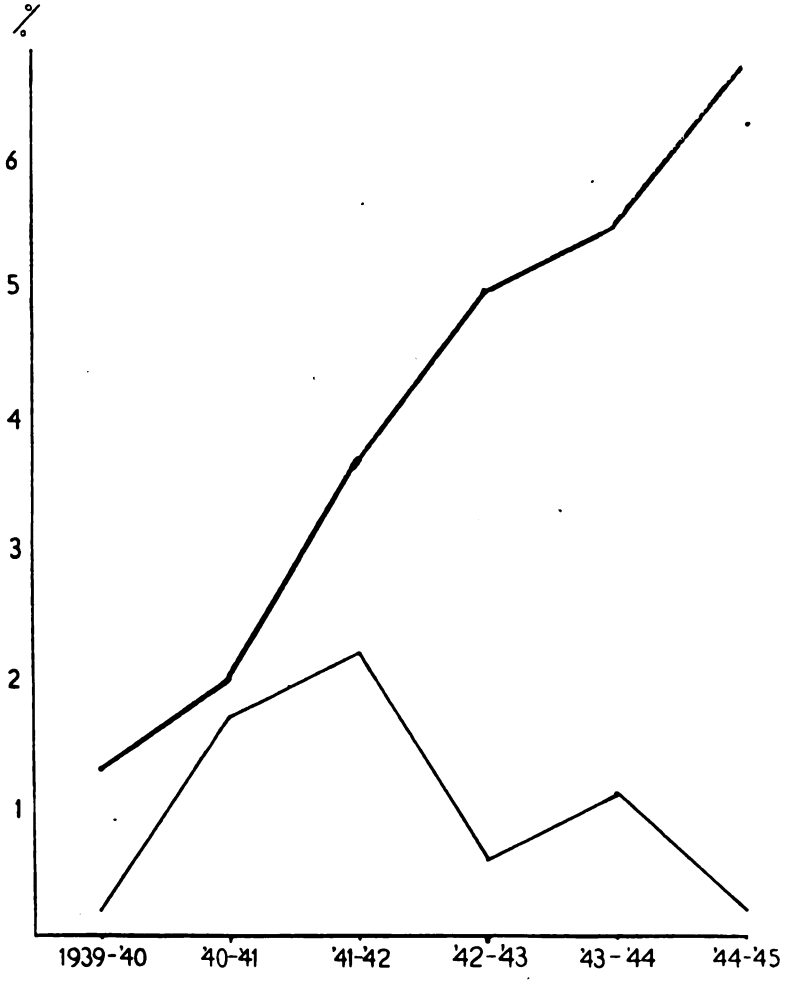
Scotland on the whole do not have such a high tendency as members of the Church of England to neurotic breakdown; or at least under war-time Service conditions to admission to a psychiatric hospital. Tested by χ^2, however, the result is not significant. All the significant differences in distribution are provided by those groups who have a greater tendency to neurosis than the Church of England. They are, with their appropriate ratios and the probability value of the associated χ^2 : Roman Catholics 1·250 ($P< \cdot001$), Methodists 1·386 ($P< \cdot001$), Salvationists 2·843 ($P< \cdot02$), Jews, 5·338 ($P< \cdot001$). If Methodists and Wesleyans had been taken together the corresponding values would have been 1·268 ($P< \cdot01$).

Discussion.

The findings suggest, therefore, that Roman Catholics and Methodists have a somewhat greater tendency to neurosis than members of the Church of England, that members of the Salvation Army have nearly three times and Jews over five times as great a tendency in this direction. Interpretation of these findings cannot, however, be more than speculative. The suggestion arises that in these groups the incidence of neurosis may be raised by men of neurotic disposition finding that particular religion attractive. It is probable that members of the Salvation Army are recruited to a very large extent by conversion. The Salvation Army makes a special effort to attract to a better way of life persons of an irregular social record, among whom a high incidence of neurosis could legitimately be expected. The relative incidence in this group of admissions to general and to neurotic wards can be no matter of surprise. The same considerations apply in a more limited way to the Roman Catholic and Methodist faiths. Both Churches are active evangelically and contain a fair proportion of fresh converts ; in both, the non-rational and emotional aspects of religion are given considerable emphasis. This factor would by itself be sufficient to account for the whole of the differences observed. If we assume a 10 per cent. incidence of fresh converts among Roman Catholics and a chance of approximately one in ten (Slater and Slater, 1944) of a man being admitted to a Neurosis Centre during six years of service in the Army, then it is sufficient to treble this chance among the fresh converts to account for the enhanced tendency to neurosis. The fact that this hypothesis is adequate does not, however, mean that it is true.

Matters are different when we consider the Jews. In the Jewish community, as a whole, the proportion of fresh converts must be negligible. Nearly all Jews have been born into the faith, and this has been so for generations. Jews, however, are well known to show constitutional differences from their compatriots in every land where they have been studied ; and it is an old clinical observation that they are more than normally subject to psychiatric disorder. The figures reported here would seem to go a long way to support that view. There are, however, other points to be considered. In this material the Jews were unique among all religious groups in showing a progressive rise in their frequency in the neurotic series during the course of the war. The relevant figures are given in the table and diagram below.

	Percentage of Jews in admissions to	
	Neurotic Wards.	General Wards.
Sept. 1939–Sept. 1940	1·3	0·2
Oct. 1940–Sept. 1941	2·0	1·7
Oct. 1941–Sept. 1942	3·7	2·2
Oct. 1942–Sept. 1943	5·0	0·6
Oct. 1943–Sept. 1944	5·5	1·1
Oct. 1944–Sept. 1945	6·7	0·2



It is to be noted that the proportion of Jews in the admissions to the general wards rises to a peak in 1941–42, and thereafter falls. This would suggest that the proportion of Jews in the Army as a whole was also falling. But the pro portion of Jews in the admissions to the neurotic wards rises steadily, until in the last year of the war it is actually over thirty-four times the proportion of Jewish admissions to the general side of the hospital. This change had nothing

to do with, for instance, the enlistment of foreign-born refugees into the Army; for, as has been said, all foreign nationals were excluded from the figures.

It is clear that we must call into account some factor which varies very largely with time, and that the supposed greater constitutional instability of the Jew is not an adequate explanation. This factor most probably lies in those subtle influences which we designate morale. Few who have worked with neurotic soldiers during the war would deny that the morale of the Jewish neurotic casualty was even lower than that of his non-Jewish brother in arms. It would be superficial to look no further, and simply to lay this to the discredit of Jews as a class. It is a matter of historical record that morale was high among the members of all-Jewish fighting units during the war; and we know from the distinctions awarded to individual Jewish soldiers in war time, as well as from more recent events in Palestine, that Jews are capable of surviving great military stress without neurotic breakdown. Nevertheless, the Jews of this country are commonly regarded as a pacific people, and they are certainly even more than the average Englishman attached to their immediate domestic circle and the society of their co-religionists. It seems probable that for reasons like these Army life represented for them a relatively greater strain.

Summary and Conclusions.

Among the admissions to the neuro-psychiatric and the general wards of Sutton Emergency Hospital during the war, the relative proportions of British soldiers of various religious affiliations have been analysed. It is shown that there is an excess of Roman Catholics, Methodists, members of the Salvation Army and Jews in the admissions to the psychiatric wards. The proportion of Jews in the admissions to the psychiatric wards rose consistently throughout the war from 1·3 per cent. to 6·7 per cent. These findings are discussed.

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CLINICAL NOTE.

A CLINICAL NOTE ON A RAPID METHOD OF DIAGNOSING BACILLARY DYSENTERY.

By A. W. PETTIT,

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THE following method of rapidly establishing the diagnosis of Bacillary Dysentery has been used at this hospital for the past sixteen years. It is reliable and simple. The technique allows for the transfer of material direct from the infected person to the laboratory medium and obviates waiting for specimens of patients' excreta to become available.

Apparatus.

Test-tubes 8 in. by 1¼ in. fitted with corks (for swabs). Test-tubes 5 in. by $\frac{9}{16}$ in. with cotton-wool plugs (for medium). Flexible indiarubber vaginal douche nozzles as used with enema syringes (the swabs).

Media.

Nutrient broth and MacConkey's bile-salt-lactose-agar.

Method.

The sterile swabs are stored in batches of four in sterile water in the large test-tubes (a similar tube with cork containing disinfectant is used to place the swabs in after use). The smaller tubes contain about 5 c.c. of sterile nutrient broth. A swab is taken from the test-tube and passed into the rectum of the patient for a distance of four inches. On withdrawal it is immediately inserted into the broth tube and agitated, thus washing material from the rectum into the broth. The swab is then transferred to the disinfectant tube for subsequent cleaning. The broth tubes are incubated for approximately half an hour and then plated on to MacConkey's medium. For this procedure the use of a platinum loop is favoured rather than a bent glass rod. A single plate and three drops of broth are used, two being deposited as single drops, while a third is drawn across the plate to form a base line from which other lines are drawn at intervals of about $\frac{3}{8}$ in. The loop is then sterilized and cross lines are drawn. By this method of plating single colonies are easily obtainable.

Plates are examined by a 100 watt lamp (the ordinary microscope lamp will serve), the red colonies of the *B. coli* being easily distinguished from the brownish-yellow colonies of Flexner. A single colony of the suspected type is picked off and used for slide agglutination, which will thus establish a diagnosis in 18–24 hours after collection of the swab. For further confirmation, sugar reactions and agglutination in dilution are proceeded with.

Routine.

Single cases are regarded as sporadic. A second case in a ward is an indication for all patients to be examined. This is quite quickly done. All cases are thus classified within 24 hours.

Typical examples recorded in the following tables show that 56·0 per cent. of dysentery patients did not exhibit clinical signs, though they were bacteriologically positive.

Number of patients examined.	Number bacteriologically positive.	Number exhibiting clinical signs.
52	2	1
88	7	3
58	12	5
47	9	4

More than 30,000 swabs have been examined by this method during the past sixteen years, and the need for more selective media than MacConkey's is considered unnecessary.

I wish to thank Dr. G. S. Nightingale, Medical Superintendent, Brentwood Mental Hospital, for permission to publish this technique.

MALE URETHRAL SMEARS IN MENTAL DISORDERS.

(A preliminary communication.)

By R. Sessions Hodge, M.R.C.S., L.R.C.P., Y. M. L. Golla, H. M. Jackson, M.B., Ch.B., and Owen George, M.B., B.S.

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In a recent communication Andrews(1) claims that smears made from the end of the urethra of sexually immature or impotent males differ markedly from the smears obtained from a normal potent male.

The classical researches of Mott demonstrated the existence in many cases of dementia praecox of some degree of testicular atrophy. These observations have been recently confirmed by Hemphill, Reiss and Taylor(2), using a method of biopsy. It appeared, therefore, that the smear method might give information when a series of mental hospital cases were investigated.

Inasmuch as the previous work dealt chiefly with schizophrenics, it was thought that we were more likely to obtain results of value if all cases of conduct disorder in a mental hospital were investigated, without any attempt at more than provisional classification and none at selection of the cases.

A urethral smear was obtained, using a platinum loop, from the terminal ½ cm. of the male urethra, and the smear, spread on a microscope slide, was stained by the Giemsa method. A drop of water on the slide was found to facilitate the preparation of the smear. Each slide was distinguished by a number only, and no comparison between clinical state and microscopic finding was made until the final assessment.

We have attempted a rough classification of the cell types encountered, but we wish to emphasize that our classification has no other justification than the pragmatic one that it allows practically all the normals to be grouped together, whilst a large number of the cases of mental disorder belong to groups excluded from this normal grouping. Beyond this we are not prepared to go. Our grouping in no way predicates any developmental or other relationship between the cell types. In every smear from a normal subject the types of cell shown on the Plate may be found.

In the smears from normal cases A and AB predominate. In the abnormal types, found frequently in our cases of mental disorder, B and BB predominate.

Table I.—*Classification of Clinical Types.*

Class.	Number.	Group *A*—*AB*.	Group *B*—*BB*.
Normals	46	44 (95·6%)	2 (4·3%)
Schizophrenics	147	81 (55·1%)	66 (44·9%)
Secondary dementias	59	31 (50·8%)	28 (49·2%)
Delusional	47	28 (59·7%)	19 (40·3%)
Melancholic	15	7 (46·6%)	8 (53·4%)
Epileptic insanity	21	13 (61·9%)	8 (38·1%)
Mental defectives	36	23 (63·8%)	13 (36·2%)

It is obvious that our results might easily lead to a false interpretation if age bore any relation to the presence or absence of abnormal smears. We decided that our best method would be to take all those groups of cases in which the incidence of abnormal smears was about the same, and it was found that the age-group to which the patient belonged bore no relation to the frequency of an abnormal smear. None of the patients, however, fell into an age-group above eighty-five.

No further speculation as to the meaning of the above findings is offered at this stage. It is planned to carry the investigation further into keto-steroid estimations, when additional information may aid in interpretation.

The majority of the cases of mental disorder were investigated by two of the authors at the Gloucester Mental Hospital by kind permission of the Superintendent, Dr. Logan. Another series was investigated at Tone Vale Mental Hospital by kind permission of Dr. K. C. Bailey. The microscopy and assessment, together with the obtaining of normal records, was done at the Burden Neurological Institute, to whose Director (Prof. F. L. Golla) the authors are deeply indebted for his stimulating advice and criticism.

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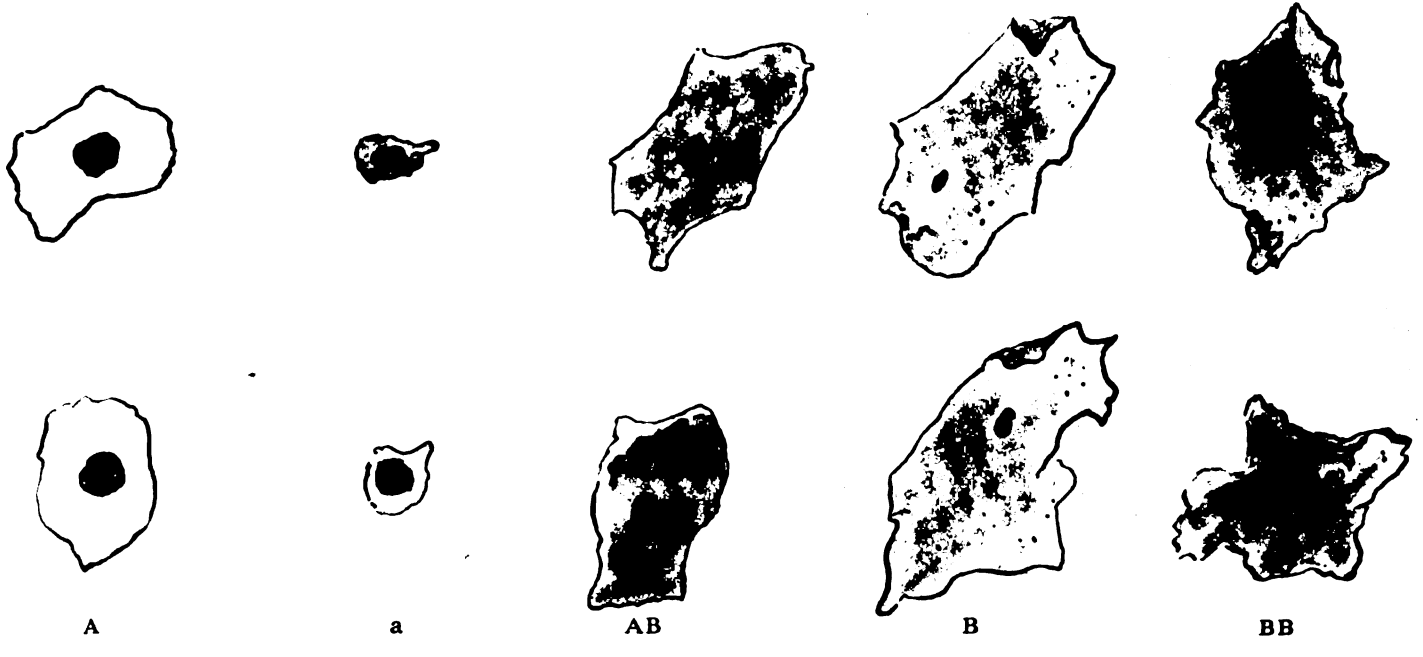
(2) HEMPHILL, REISS and TAYLOR (1944), *J. Ment. Sci.*, **90**, No. 380, July.

EPITHELIAL CELL TYPES FOUND IN URETHRAL SMEAR.



Classification of Cell Types.

a.—Small round cells with red staining nucleus and very little cytoplasm.
A.—Medium size epithelial cells with red nucleus, cytoplasm blue or pinkish.
AB.—Larger epithelial cells than *A* with blue nucleus, cytoplasm slightly granular or cornified.
B.—Cells round or angular, larger than in all preceding groups. The nucleus is very small and stained blue. Cytoplasm markedly cornified.
BB.—The nucleus is absent. The cytoplasm blue, taking stain badly and completely cornified.

Normal.—*A* and *AB* predominate.
Some cases of mental disorder.—*B* and *BB* predominate.

Part II.—Reviews.

Les Dissolutions de la Mémoire. By JEAN DELAY. Published by Presses Universitaires de France, Paris, 1942. Pp. 152. 35 francs.

In this book Professor Delay considers many of the problems o f dissolution and disintegration of memory. He endeavours to bridge the gap between memory defects of psychogenic and organic origin. In so doing he discusses various types of memory defect, and considers agnosias and aphasias as special forms of memory failure.

The theories propounded show the influence of Hughlings Jackson and his followers, and reflect the traditional philosophy of French neurology.

This erudite and convincingly written book is of special interest. The bibliography is excellent, and there is a notable preface by the late Pierre Janet.

R. E. HEMPHILL.

The Juvenile Courts : Their Work and Problems. By F. T. GILES, LL.B. Foreword by Sir BERTRAND WATSON. London : George Allen & Unwin, Ltd., 1946. Pp. 131. Price 6s.

This small book is written by the Chief Clerk of the Clerkenwell Magistrates' Court, who was for some years Chief Clerk of the London Juvenile Courts. His material is lucidly presented in ten chapters, and gives the layman a general idea of the problem of juvenile delinquency and the methods available for dealing with it.

The facts and arguments are introduced with unprejudiced and well-balanced conciseness, and the author's long experience adds weight to the discussion. He aptly sums up the principle underlying the treatment of delinquent children in a sentence : " Are the circumstances which have brought this boy or girl into court so bad that he must be taken away from his home ; or can it be hoped to effect a cure or help him to cure himself by less drastic treatment which can be carried out at home ? " Some practical alterations of procedure are suggested, but the value of the courts in dealing with the problem of juvenile delinquency is emphasized.

Medical men who submit written reports to the Juvenile Courts will be interested to know that the Rules allow reports to be put in without being shown to the child or his parents. At the same time Mr. Giles states that this does not mean what so many courts take it to mean, that undisclosed reports are to be the rule and not the exception. Indeed there can be no doubt that a medical report may have therapeutic value for the parents as well as for the delinquent if its contents are disclosed on appropriate occasions.

The psychiatrist who is sometimes forced to use technical terms in his report is defended by Mr. Giles, and he reminds the lawyer of his own professional jargon, which may be as unintelligible to the doctor as medical terms may be to the lawyer. He agrees that a psychological report may have great value in elucidating the cause of a particular delinquency, and in suggesting the most appropriate method of dealing with the delinquent. He considers that so far the psychologist has not been given a chance to prove his real worth because there are few courts, if any, which allow him to try out the treatments he would prescribe.

The book will be of particular value to those who are about to take up work in the Juvenile Courts. It also can be wholeheartedly recommended to doctors whose work is concerned with juvenile delinquency, and to others who wish to be introduced to the subject by a reliable writer. W. NORWOOD EAST.

L'Electro-Choc et la Psycho-Physiologie. By JEAN DELAY. Published by Masson et Cie, Paris, 1946. Pp. 169. 230 francs.

This book describes in some detail certain biochemical and physiological investigations conducted by the author and his collaborators on patients undergoing electro-shock treatment.

He has endeavoured to demonstrate physiological phenomena due to electrically-induced convulsions, and from his results to construct a theory for the mechanism of cure.

The number of patients studied is not large, and being divided among various psychoses, the conclusions can only be regarded as tentative.

The author suggests that disturbances in the hypothalamus are causative of various psychoses, and attributes the beneficial effect of electro-shock treatment to its influence on the hypothalamic and vegetative systems.

The book is of value chiefly for the lines of thought it suggests, and should be studied by those undertaking research in convulsive therapy.

The bibliography is extensive, and demonstrates the lively research in psychiatric problems that was conducted in France even under German occupation. R. E. HEMPHILL.

Part III.—Bibliography and Epitome.*

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VOL. CXXI. 1945.

VOL. CXXIII. 1946.

VOL. CXXIV. 1946.

ACTA NEUROL.

VOL. I. 1946.

ACTA OTO-LARYNG.

VOL. XXIII. 1945.

ACTA PSYCHIAT., KBH.

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AM. IMAGO.

VOL. III. 1946.

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* 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.

AM. J. PHYSIOL.

VOL. CXLIV. 1945.

VOL. CXLV. 1945.

AM. J. PSYCHIAT.

VOL. CIII. SEPTEMBER, 1946.

Two New Drugs in Epilepsy Therapy.

Two new drugs increase the range and the effectiveness of the control of epileptic seizures.

Trimethyloxazolidine dione (tridione) used alone has proved wonderfully effective in controlling seizures of the *petit mal* triad—*petit mal* (pykno-epilepsy), myoclonic jerks and akinetic seizures. In contrast, *grand mal* convulsions were not helped or were made worse. Psychomotor seizures were occasionally aided by tridione combined with an anticonvulsant drug.

Methyl phenyl ethyl hydantoin (mesantoin), used in 35 patients, did not help *petit mal*, but in approximately one-third of patients subject to frequent major seizures it has replaced diphenyl hydantoin (dilantin) with profit; the benefit resulted either from a reduction in the frequency of convulsions, or from an absence of the unpleasant side-effects of either muscular inco-ordination or gum hypertrophy. Generalized rash or somnolence were side-effects which limited the usefulness of the drug in many patients. (Author's abstr.)

Further Observation on the Use of Tridione in the Control of Psychomotor Attacks.

Tridione, a new addition to the treatment of the cerebral dysrhythmias, is helpful in the control of psychomotor seizures. While effective in certain instances if used alone, it is most helpful if used in combination with sodium diphenylhydantoinate and/or phenobarbital.

Toxic symptoms are infrequent in patients who respond to the drug, and do not constitute an important contraindication to its use.

Further research on the oxazolidine-2,-4-dione derivatives and related drugs may afford further advances in the therapy of epilepsy. (Author's abstr.)

Orbital Cortex Syndrome following Leucotomy.

1. The orbital cortex was partly isolated in 22 schizophrenics, and good response was observed where there were symptoms of introversion, blockage, emotional dulling and depersonalization present.

2. The isolation of the orbital lobe produced a triad of symptoms described as extroversion, increased motor activity and euphoria.

3. It was emphasized that the new symptoms produced balance well with the pre-existing psychotic symptoms. (Author's abstr.)

AM. J. PSYCHOL.

VOL. LIX. 1946.

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VOL. CXII. 1943.

ARCH. INT. PHYSIOL.

VOL. L. 1940.

Studies of the Cortical Projection of the Labyrinth. I. *Some Effects of Labyrinthine Stimulation upon the Electrical Activity of the Cerebral Cortex.*

Electroencephalographic measurements made on a cat placed in an activity cage, the speed of which could be regulated, revealed that either positive or negative acceleration of the speed of the cage resulted in electrical activity of increased amplitude and frequency. The maximal effect was localized in the vestibular projection area in the posterior suprasylvian convolution. (Psychol. Abstr.)

VOL. LI. 1941.

The Functional State of the Cerebral Cortex in the Course of Animal Hypnosis.

Cats and rabbits in a hypnotic state showed a marked rise in the threshold of excitability of the cortical motor area controlling mastication. It was also observed that the electrical activity of the brain was similar to that in sleep in that the amplitude of the brain waves increased while the frequency decreased. These results are interpreted as illustrating the effect of a subcortical inhibition.

(Psychol. Abstr.)

ARCH. MAL. PROFESS.

VOL. VI. 1944–45.

ARCH. NEUR. PSYCHIAT.

VOL. LVI. SEPTEMBER, 1946.

Chicago Neurological Society.

Philadelphia Psychiatric Society.

New York Neurological Society and the New York Academy of Medicine.

Pre-traumatic Personality and Psychiatric Sequelae of Head Injury. II. Correlation of Multiple, Specific Factors in the Pre-traumatic Personality and Psychiatric Reactions to Head Injury, Based on Analysis of One Hundred and One Cases.

One hundred and one civilians with acute head injuries were subjected to intensive study of multiple factors in the pre-traumatic and the post-traumatic personality status. A clinical quantitated estimate was made of the degree of each of these specific personality factors. With such a method a multidimensional perspective of each patient was obtained, by which it was possible to quantitate changes, if any, in personality following head injury.

In addition, all patients were given categorical classifications of the pre-traumatic personality (normal, psychoneurotic, psychovariant and psychopathic).

Correlations were made with the nature and estimated severity of the acute

cerebral trauma and with various potentially complicating factors, such as associated bodily injuries and various possible sources of psychologic stress (litigation, occupation and financial and marital difficulties).

It was found that in a number of patients neurotic symptoms appeared for the first time after head injury. In most patients psychologic changes following head injury became most manifest shortly after discharge from the hospital and were at a maximum three to six weeks after discharge. The duration of post-traumatic symptoms varied, but in general they were substantially receding at the end of three months. However, approximately 50 per cent. of the patients showed some persistence of symptoms at six months, and approximately 15 per cent. had symptoms which persisted a year or longer. The duration of incapacity for work paralleled the persistence of psychologic symptoms; but most patients returned to work before they were entirely free of symptoms.

Patients with pre-traumatic psychoneurotic personalities showed a greater proportion of post-traumatic psychiatric symptoms than did patients in other groups. However, the patients with pre-traumatic normal personalities were closer to the psychoneurotic patients than were members of other groups.

There was no close correlation between the severity of the acute injury of the brain and the severity of the sequelae.

There was high correlation between the existence of persistent complicating psychosocial factors, such as continuing compensation, pending litigation, occupational stresses and persistent associated bodily injuries, and the severity and persistence of psychiatric sequelae.

No correlations were found which would permit the ascription of psychiatric sequelae to one particular cause or group of causes. The psychiatric sequelae in an individual case were usually the resultant of various factors. The etiologic factors in the psychiatric sequelae in a particular case depended on specific factors in that case. (Author's abstr.)

OCTOBER.

Illinois Psychiatric Society.

New York Neurological Society and the New York Academy of Medicine.

Chicago Neurological Society.

Primary Behavior Disorders and Psychopathic Personality. I. Correlations of the Electroencephalogram with Family History and Antecedent Illness or Injury.

1. Two hundred patients, 100 each with primary behavior disorders and with psychopathic personality, showed considerably higher percentages of electrocortical abnormality, 56 and 58 per cent., respectively, than the percentages reported for presumably neurologically normal children and adults.

2. Fourteen per cent. of the patients with primary behavior disorders, in contrast to 2 per cent. of the patients with psychopathic personality, had paroxysmal electroencephalographic activity.

3. The incidences in the family history of epilepsy, maladjusted personality, chronic alcoholism and psychosis were similar in the two diagnostic groups.

4. The incidences in the personal history of convulsions, severe illness and questionable birth injury were greater for the group of patients with primary behavior disorders than for the group with psychopathic personality. The incidences of head injury were similar for the two groups.

5. When the two groups of patients were combined, significantly greater proportions of abnormal electroencephalograms were found when there was a family history of either epilepsy or of maladjusted personality.

6. The proportion of patients showing electroencephalographic abnormality appeared to be greater when the mothers were judged maladjusted or alcoholic than when the fathers were so judged.

7. When the two groups of patients were combined, significantly greater proportions of abnormal electroencephalograms were found when there was a personal history of convulsions, head injury with unconsciousness or severe illness.

8. For the category of severe illness, the younger the patient at the time of the illness and/or the more severe the illness, the greater the probability of abnormal electrocortical activity. (Authors' abstr.)

NOVEMBER.

Philadelphia Neurological Society.

Philadelphia Psychiatric Society.

Effect of Glutamic Acid on Mental Functioning in Children and in Adolescents.

On verbal, motor and personality tests given, definite improvement following glutamic acid therapy could be observed in each of our nine subjects during a six months' interval. A number of experiments have pointed to the fact that l (+)-glutamic acid has a particular relation to cerebral metabolism. Weil-Malherbe reported that l (+)-glutamic acid is the only amino acid known to be metabolized by slices of brain tissue. Recent investigations of Nachmansohn and his associates suggest that the release of acetylcholine is intrinsically connected with the electrical changes during nerve activity. They found that the energy of the action potential

is derived from energy-rich phosphate compounds and concluded that these compounds yield the energy for the formation of acetylcholine. As a result of these observations they isolated an enzyme from the brain which synthesizes acetylcholine. This enzyme, choline acetylase, becomes inactive on dialysis. Addition of l (+)-glutamic acid reactivates the enzyme.

While the precise mechanism of the action of glutamic acid on the rate of acetylcholine has still to be elucidated, the intrinsic connection of acetylcholine with nerve activity and the demonstration of an increased rate of formation of acetylcholine in the presence of glutamic acid *in vitro* make it possible to assume that the physiologic basis of the observed effects of glutamic acid is in some way related to the formation of acetylcholine. At present this seems to be the best interpretation. (Authors' abstr.)

Electrical Resistance of the Skin : Effect of Size of Electrodes, Exercise and Cutaneous Hydration.

The following observations were made : 1. Apparent skin resistance decreases (*a*) as the size of the electrode is increased, and (*b*) as the superficial layer or layers of skin become hydrated as a result of continuous contact of electrode paste with the skin. 2. Apparent skin resistance increases during rest following exercise or activity. 3. The size of the electrode is determined by the area of skin wet with the electrode paste or sweat (effective electrode), and not by the absolute size of any part of the electrode itself. 4. Any aqueous film, such as sweat, outside the area of the electrode, but continuous with the electrode paste, acts to increase the size of the effective electrode. 5. The values for apparent resistance of two areas of skin, such as the palmar and the volar surface of the forearms, which may differ greatly when the subject is at rest, approach the same magnitude when the patient exercises vigorously.

In any experiment in which the effect of a stimulus on apparent skin resistance is being measured one should be sure that the resistance is not changing as a result of (*a*) variation in the area of skin wet with the electrode paste or with sweat, (*b*) rest following exercise, or (*c*) hydration of the skin by the electrode paste. (Authors' abstr.)

Intravenous Injection of Sodium Amytal as a Test for Latent Anxiety.

1. Anxiety or tension states may give rise to symptoms referable to many systems of the body, even in patients not considered psychoneurotic.

2. Symptoms due to organic disease may be exacerbated because of tension.

3. Sodium amytal in average doses of 1½ grains (0·097 gm.) given intravenously will frequently relieve a symptom which is entirely due to tension within one to five minutes.

4. The same amount of sodium amytal will relieve that portion of the symptom due to tension in instances in which tensional pain is superimposed on pain or organic cause.

5. Sodium amytal in small doses can be used as a diagnostic test to separate symptoms of organic disease from tension symptoms.

6. The test should be used only to supplement thorough physical and psychiatric investigation. (Authors' abstr.)

ARCH. OPTH.

VOL. XXXV. 1946.

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VOL. XLIII. 1946.

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VOLS. I–II. 1944–45.

ARCH. SURG.

VOL. LII. 1946.

BRAIN.

VOL. LXIX. JUNE, 1946.

Anosognosia and Disorders of Body Scheme.

Anosognosia, it is suggested, may be produced by brain damage of two kinds—focal and diffuse. That anosognosia of blindness can result from peripheral lesions blotting out the visual fields, has been shown by Redlich and Dorsey (1945): there is always co-existing clouding of consciousness. The second patient here described is another example of anosognosia of total blindness which was peripherally determined. Anosognosia of hemiplegia unassociated with agnosia of the body-half, it is thought may likewise result from non-specific lesions outside the thalamo-parietal segment but that there needs must be a defect of judgment such as may exist in a confusional state. The third patient is thought to illustrate such a mechanism.

It is also suggested that psychological factors underlying the delusion that disease does not exist, include defects in perception and in memory retention. The affective element in perception is thought to be another factor in the production of anosognosia. In Case 2 a strong desire not to suffer the disability which afflicted her was thought to be an additional factor in warping judgment and producing denial of blindness.

Anosognosia of blindness and of hemiplegia are believed to be predisposed by disorders of space perception. A distinction is drawn between awareness of personal space and awareness of extra-personal space. Though there may exist agnosia of both these aspects of space in the same subject, they may occur separately so that it is probable that they are subserved by separate neural links. Interruption of association paths from the occipital and parietal cortex to other parts of the brain probably account for the impaired space perception.

Agnosia of half extra-personal space may lead to neglect not only of half-space but to neglect of inability to see the contents of half-space (anosognosia of hemianopia). Bilateral lesions producing bilateral neglect of extra-personal space are thought to predispose towards anosognosia of total blindness, a condition which exists as a fixed delusion only when mental confusion is added.

Agnosia of half personal space leads not only to neglect of its contents (the body-half) but to paralysis involving the body-half (anosognosia of hemiplegia), a condition which exists as a fixed delusion only when mental confusion is added.

Agnosia of personal and extra-personal space, it is thought may be due to specific kinds of memory loss.

The first patient is an example both of agnosia of extra-personal space, producing anosognosia of hemianopia and of agnosia of personal space, producing agnosia of the body-half and anosognosia of hemiplegia. The delusion was fixed because mental confusion impaired judgment.

In this patient there was also an unusual response to pain stimulation which was interpreted as being a pseudo-affective reflex analogous to "sham-rage" seen in thalamic animals. (Author's abstr.)

Coughing and Unconsciousness: The So-called Laryngeal Epilepsy.

It seems probable that the syndrome in which loss of consciousness associated with coughing are the predominant symptoms has no single basis of causation. True vertigo is rarely, if ever, present, and the name "laryngeal vertigo" should not be used.

Some cases are epileptic in origin, but there is evidence that a majority may result from the circulatory changes induced by the cough. A diagnosis of epilepsy should only be made when other evidence points to the patient being an epileptic. Unless there are clear indications, as shown for instance by the tendency to recurrence and the occurrence of attacks unassociated with coughing, or when the EEG points to epilepsy, the basis of attacks should be regarded as cardiovascular in origin. (Author's abstr.)

BRIT. J. EDUC. PSYCHOL.

VOL. XVI. NOVEMBER, 1946.

BRIT. J. OPHTHAL.

VOL. XXIX. 1945.

BRIT. J. SURG.

VOL. XXXIII. 1945.

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1945 (ii).

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VOL. XXVI. 1946.

BULL. CANAD. PSYCHOL. ASS.

VOL. VI. 1946.

BULL. JOHNS HOPKINS HOSP.

VOL. LXXVII. 1945.

VOL. LXXVIII. 1946.

BULL. LOS ANGELES NEUR. SOC.
VOL. XI. 1946.

Acute Porphyria. Report of a Fatal Case with Severe Neurologic Manifestations Encountered in the South-West Pacific.

This case proved of particular interest to the authors, for at the time they first examined the patient, they had in their neurologic ward several patients who had symptoms of neuronitis, neuromyelitis and various types of peripheral neuritis. Patients with such symptoms had been coming into the hospital with surprising frequency. The symptoms of many of these patients seemed to be due to a virus infection or to scrub typhus fever, malaria, trauma, vitamin deficiency and so forth. However, in this case, the authors were confronted with the classical picture of recurrent episodes of abdominal pains and constipation (obstipation) followed by pain in the extremities and weakness. Appendectomy had been performed as is so frequently reported by those who have had recurrent attacks of acute porphyria. The color changes in the urine and the subsequent chemical analysis of the urine disclosing increased amounts of coproporphyrin and large concentration of uroporphyrin and porphobilinogen substantiated the authors' first impression of acute porphyria.

The neurologic picture presented by the authors' patient is of particular interest in that he did not display the typical Landry's syndrome; his paralysis first involved the proximal muscles of the extremities and spread peripherally with more involvement of the upper than the lower extremities. Likewise there was early and intensive involvement of the extensor muscle groups. This was in keeping with the condition of many of the patients suffering from a probable virus form of neuronitis who were under the authors' care at that time. Although the patient's paralysis was relatively symmetrical the paralysis of acute porphyria is not always so, for in most of the 143 cases reviewed by Waldenstrom, in 60 of which neurologic signs were present, the paralysis was irregularly distributed, and frequently involved only small muscle groups, although in many almost the entire striated musculature was involved. Generalized convulsions (*status epilepticus*) and paralysis of deglutition (bulbar) experienced by the authors' patient are common findings, as have been emphasized by Mason and his associates, Hoagland, Nesbitt, Baker and Watson.

The therapy of acute porphyria is at best only symptomatic. As has already been noted, it would seem that serious attention might well be directed toward protecting the liver against the agent responsible for the necrobiosis, whatever it may be, since there is unmistakable evidence of diffuse liver damage. For the present, the intravenous administration of glucose and thiamin appears to be the authors' best means of protecting the liver. Although this type of therapy seems to have delayed only slightly the fatal issue in the authors' case, it must be remembered that acute porphyria is actually a chronic disease with acute exacerbations, and in certain instances the intensive use of glucose and thiamine, may carry the patient through the acute phase.

Parenteral administration of calcium has been suggested since calcium forms an insoluble salt with porphyrins. Its intravenous administration has been reported to diminish the excretion of porphyrins in the urine as well as to relieve abdominal pain. The authors' patient failed to respond clinically to the intravenous administration of calcium gluconate. Likewise it did not alter the port-wine color of the urine. (Authors' abstr.)

BULL. MENNINGER CLIN.

VOL. X. SEPTEMBER, 1946.

VOL. X. NOVEMBER, 1946.

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VOL. I. 1946.

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VOL. XI. 1945.

VOL. XII. 1946.

C. R. SOC. BIOL., PARIS.

VOL. CXXXIV. 1940.

VOL. CXXXV. 1941.

Effect on the Nerves of Central Inhibitory Phenomena.

When a head band protecting their eyes from light was used, an increase in the chronaxie of peripheral motor and sensory nerves was noted in the case of guinea-pigs and frogs. It was further noted that pressure of the head sufficient to produce a state of torpor left the chronaxie measurements unchanged. (Psychol. Abstr.)

Effect of the Central Nervous System on the Variations of Excitability of Motor Nerves in the Course of Peripheral Thermal Activity.

A slight warming of a dog's paw or a human subject's hand results in an increase in the chronaxie of peripheral nerves. For the dogs, chronaxie measured in the motor cortex is affected similarly. Either chloroform anaesthesia or expanding the surface stimulated, however, reverses the effect. (Psychol. Abstr.)

DELAWARE ST. MED. J.

VOL. XVIII. 1946.

DIA MÉDICO.

VOL. XVII. 1945.

DIS. NERV. SYST.

VOL. VII. OCTOBER, 1946.

Sub-shock Insulin Therapy in Anxiety States and Anxiety Depressions.

1. Thirty-seven patients with anxiety states, depression, and psychosomatic disturbances have been treated with daily 30–60 unit doses of insulin.

2. The rationale and technique of administration of this therapy have been discussed, together with a synopsis of the successful termination or alleviation of their symptoms.

3. Several case-histories have been selected from the group to illustrate the type of patients treated and the responses obtained by treatment.

4. This series of cases indicates that this therapy is a valuable, effective, safe method of treatment in a variety of anxiety states, particularly those arising in the military service and in men with combat experiences. (Authors' abstr.)

NOVEMBER.

DISCH. Z. NERVENHEILK.

VOL. CLVI. 1944.

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VOL. III. 1945.

FLORIDA M. A. J.

VOL. XXXII. 1946.

GENET. PSYCHOL. MONOGR.

VOL. XXXIV. AUGUST, 1946.

The Relation of Emotional Adjustment to Intellectual Function.

Since 1937 personality studies of normal children have been in progress at the Payne Whitney Nursery School. The records include anamnestic data, physical examination reports, psychometric test findings, daily behavior records, and individual play sessions. This method of investigation permits the analysis of any one phase of behavior in relation to any other phase. In the present study, an attempt has been made to establish whether any relation could be found between intellectual function, as measured by means of psychometric tests, and emotional adjustment, as evaluated through the total data. The trends of emotional adjustment were formulated independently of the findings of the psychometric tests.

Of the children admitted during the period from 1937 to 1942, 39 children had at least two psychometric tests in the course of two or three years' attendance at the school. On retest, 22 showed changes in I.Q. which were considered significant (10 points or more in either direction), and 17 showed no significant changes (less than 10 I.Q. points, or no change in either direction).

Of the 22 children with significant changes, 12 showed an increase in I.Q. rating of from 10 to 31 points, and 10 a significant decrease of from 10 to 19 points. In all of the 22 children which made up the two subgroups, there was a close parallel between emotional adjustment and psychometric test findings.

The 17 children without significant changes in I.Q. presented a more complex problem of analysis. They included two categories of children: stable, well-adjusted children whose home life seemed to present no cause for emotional disturbances; and children whose home conditions, while unsatisfactory, did not show variations or tendency toward marked improvement or further dislocation. The margin of error for predictability of I.Q. changes on the basis of biographical data was higher in this group than in the group with significant changes. In six children, variations in I.Q. were predicted in another direction than that afterwards noted or were quantitatively inaccurate though in the direction predicted.

The present study emphasizes that intellectual function, as measured through psychometric tests, shows fluctuations, and that the child's total emotional adjustment influences his test score. It also points to the need of a projective technique, in addition to the usual methods of psychometric testing, as a means of detecting factors inhibiting the intellectual function.

The clinical data have been presented and analyzed, but no hypothesis has been formulated regarding the inhibition of the intellectual function through emotional causes. (Authors' abstr.)

GERIAT.

VOL. I. 1946.

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VOL. LXXXVIII. 1945.

VOL. LXXXIX. 1946.

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VOL. IV. 1944.

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IRISH J. MED. SC.

VOL. CIV. NOVEMBER, 1946.

J. ABNORM. SOC. PSYCHOL.

VOL. XLI. OCTOBER, 1946.

What Price Lobotomy?

1. The subjects of this study are ten schizophrenic patients who have undergone bilateral prefrontal lobotomy. Five of them are discharged, and five still hospitalized. They are compared with a group of seven patients of similar diagnosis and vocabulary ability who have not suffered the operation.

2. The lobotomized individuals maintain many of their prepsychotic character traits, but they are lacking in a normal degree of deliberateness.

3. They show no unique characteristics in the projective (Rorschach) and intelligence (Binet) tests, do about as well as the control group of schizophrenics in abstract thinking (Shipley-Hartford), better in learning (Hunt-Minnesota), but less well in alternating attention and making a plan (Porteus Mazes).

4. They do significantly less well than the controls on two tests demanding deliberation (Rhymes and Numbers), standardized on a group of 105 junior college students.

5. They do significantly less well than the controls of tests demanding deliberative behavior (Downey's Speed of Decision, Volitional Perseveration, and Motor Inhibition).

6. It is concluded that bilateral prefrontal lobotomy, though of proved therapeutic value (and affording remarkable opportunities for research) is productive of a definite mental deficit; it reduces the capacity for prolonged attention.

(Author's abstr.)

J. ANAT.

VOL. LXXX. OCTOBER, 1946.

J. APP. PSYCHOL.

VOL. XXX. 1946.

The Effect of Prolonged Mild Anoxia on Speech Intelligibility.

(1) Using the method and materials employed in an earlier study in collaboration with C. P. Seitz, twelve subjects were tested for their ability to perceive standard speech sounds at four periods during an eight-hour exposure to mild anoxia encountered at an altitude of approximately 10,000 ft., simulated in a nitrogen dilution chamber. (2) The decrement in speech intelligibility at altitude was very slight and unreliable at the ¾-hour period; it was nearly reliable at the 2¼-hour and 4¼-hour periods; but there was a marked lessening of the altitude effect at the last period, 6¾ hours after entering the chamber.

Psychological factors, such as wandering of attention and boredom are suggested as explanations of the apparent losses in efficiency, although some physiological consequences of altitude changes are indicated by enlarged angioscotoma during prolonged exposure to increased altitude. H. HILL (Psychol. Abstr.).

Validity of the Hunt-Minnesota Test for Organic Brain Damage.

(1) When the Hunt-Minnesota Test for organic damage was applied to 64 presumably normal employees of the Norwich State Hospital, 55 per cent. had T scores indicating organic pathology. (2) The discrepancy between our results and Hunt's original validation results could not be explained by the fact that our data included cases with very high vocabularies and cases given only the short form of the test. (3) Since the test produces so many "false positives," its validity for diagnosing organic brain damage must be seriously questioned.

H. HILL (Psychol. Abstr.).

J. AVIATION MED.

J. BELGE NEUR. PSYCHIAT.

J. BONE JOINT. SURG.

J. CLIN. ENDOCRIN.

J. CLIN. INVEST.

J. CLIN. PSYCHOL.

J. CLIN. PSYCHOPATH.

VOL. VII. APRIL, 1946

VOL. VIII. JULY.

J. COMP. NEUR.

VOL. LXXXV. OCTOBER, 1946.

J. COMP. PSYCHOL.

VOL. XXXIX. OCTOBER, 1946.

J. CONSULT. PSYCHOL.

VOL. X. 1946.

J. EDUC. PSYCHOL.

VOL. XXXVII. 1946.

J. EXP. PSYCHOL.

VOL. XXXVI. OCTOBER, 1946.

J. GEN. PSYCHOL.

An Experimental Study of the Reactions of Neurotics to Experiences of Success and Failure.

A modified form of the pursuit rotor, involving an integrating mechanism, was used in obtaining performance scores, aspiration scores, and judgments of past performances. One hundred male neurotic army patients were tested, 50 of whom showed predominantly hysterical symptoms, while the other 50 showed predominantly affective symptoms. The two groups were equated for age and intelligence. The main hypothesis tested in this experiment was based on Jung's analysis of extraverted (hysterical) and introverted (affective) personality traits, and more particularly on his view that introverts are more affected by subjective factors, while extraverts are more affected by objective factors.

The results showed no significant differences between the groups for performance or improvement on the test. It was found, however, that both as regards their level of aspiration and their judgment of past performances the affective group showed significantly greater deviations from their actual scores than did the hysterical group. Quite generally the reactions to success and failure of the hysterical group were more objective, taking more account of external reality (test scores), while the reactions of the affective group were more subjective, taking more account of subjective states of mind.

Correlations were found between level of aspiration and judgment of past performance which indicated that " tendency to subjectivity " could be shown to be an important factor common to both these superficially quite unrelated scores. Further correlations were found between intelligence test scores, improvement,

level of aspiration, judgment of past performance, and a number of desirable and undesirable social qualities. It was also found that hysterics showed a greater intrapersonal variability, while the affectives as a group showed a greater interpersonal variability. (Authors' abstr.)

Expectancy versus *Performance in Hypnosis.*

This article is devoted primarily to the description of experiments on 10 selected and highly developed hypnotic subjects in whom strength of grip and expectancy were controlled by hypnosis. Complete or partial paralysis was produced in all the subjects, while their hypnotically controlled belief was that they were weaker than usual. Then their strength of grip was increased while their hypnotically induced belief was that they were weaker than usual.

These results contradict the suggestion theory of hypnosis, as illustrated by an experiment described by Crane, in which the two factors of expectancy and hypnotic performance are commonly said to be related causally—hypnotic phenomena being regarded as caused by expectancy.

Implication of the results of these experiments are pointed out, not only in regard to the distinction between the art of suggestion and the art of hypnosis, but also in regard to the relation of expectancy to disability in clinical cases of functional illness. (Author's abstr.)

OCTOBER.

Electrometric Studies of Sleep.

A technique has been described, embodying simultaneous DC and AC recording, for the measurement of changes taking place in the steady-state DC field of the human organism between the waking and the sleeping states.

The results indicate:

1. That the DC field of the human organism exhibits during sleep a decrease in the mean values of the potential differences recorded from different points related to the organism's nervous system.

2. That sleep produces a gradual reduction of the characteristic waking differences in E.M.F. which distinguish one individual from another at a given time and from himself at other times.

3. That the DC field of the human organism exhibits during sleep less intersubject variability for a given electrode placement than during waking.

4. That the DC field of the human organism exhibits during sleep less variability among different electrode placements than during waking. (Author's abstr.)

Level of Muscular Tension as an Aspect of Personality.

A general factor of muscular tension level in the individual has frequently been postulated. In previous studies the writer has found evidence for this assumption in the fact that subjects who were most tense during the performance of one task tended to be most tense during the performance of another task, and the tension *rank* (as opposed to the absolute tension *level*) of the individual during the performance of a given task tended to remain constant over a period of several months. In the present study the aim was to find further evidence of a factor of general level of muscular tension through determining whether such a factor could be extracted from measures of tension secured: (*a*) On different occasions, (*b*) during the performance of different tasks, and (*c*) by different techniques of measurement (some involving grip pressure and some point pressure).

Twelve measures of muscular tension and four measures of fluctuation in tension, obtained while the subjects were performing a wide variety of tasks, were subjected

to factorial analysis. These measures were secured on three separate occasions, the first separated from the second by three months, and the second separated from the third by one week. Three different techniques for measuring tension were employed: (*a*) Recording grip pressure from the unused hand, (*b*) recording grip pressure from the used hand, and (*c*) recording point pressure by counting the number of sheets of carbon paper through which pencil marks had penetrated.

Five factors were obtained, four of which appear to be meaningful. Of the meaningful factors, Factor I is widely general, Factor IV has considerable generality, and Factors II and III appear to be specific.

Factor I, the most general of the factors extracted, is interpreted as representing a general tension factor of the sort postulated by the writer in the first quantitative investigations in which individual differences in tension were regarded as a significant aspect of personality. This factor incorporates a variety of tasks, all three techniques of tension measurement, and all three experimental sessions. Its generality is attested by the fact that, in addition to its six weights above ·40, it includes more weights between ·30 and ·40 than does any other of the factors extracted. Factor I, then, is interpreted as a factor which represents the general tension level of the subjects, or the tendency of the subjects to function more or less consistently at a relatively high or a relatively low level of tension during a wide variety of tasks performed on three separate occasions over a period of several months. It is a factor attesting the fact that tension is not specific to the task being performed, nor to the time of measurement (within the limits of the experiment), and is, to only a limited extent, dependent upon whether point pressure or grip pressure is being measured, or whether the measurement is made from the used or the unused hand.

One other factor, Factor IV, has some degree of generality, since it may be described as a factor of point pressure during a variety of tasks performed at two different experimental sessions separated by an interval of one week. The fact that the weights on this factor are arranged in what would appear to be the order of difficulty of the tasks involved, suggest that Factor IV is an aspect of tension and not merely a factor representing some incidental feature of the technique of measurement.

Factors II and III are specific factors. Factor II appears to represent point pressure during maze tracing. Factor III is probably specific to color-naming, or to the first experimental session, or to grip pressure from the unused hand, or to some combination of these aspects of the experimental situation. The design of the experiment does not permit finer delineation of this factor.

From the present study it may be concluded that there are both specific and general factors in the measurement of tension. Tension scores vary somewhat with the technique of measurement, with the nature of the task being performed, and with the time at which the measurement is made. But there is a general factor of tension which is more or less independent of the task, of the mode of tension measurement, and of the time at which the measurement is made. The isolation of this factor lends support to the notion that tension level is a more or less persistent characteristic of the individual, and is, in this sense, an aspect of personality.

The general factor of muscular tension found here is, the author believes, but one of a number of indicators of the energy mobilization of the individual. Palmar skin conductance, for example, has been found to vary directly with variations in tension of the muscles. Muscular tension would also correlate, no doubt, with insensible weight loss or other measures of metabolic activity. In fact, we should expect a correlation between muscular tension and any one of the physiological changes found by Cannon to be a part of the energy mobilizing processes which occur during the excited emotions—and which, we should suppose, would occur under any other circumstances which involve the mobilization of energy.

Energy mobilization tendencies constitute one of the most significant aspects of the individual's personality. They represent the intensity with which he responds to the various environmental situations with which he is confronted. They indicate, then, whether he is likely to be relatively unresponsive to situations, highly responsive, or moderately responsive. And this tendency to respond to situations with high, with low, or with some intermediate degree of energy mobilization is the basis for a wide variety of behavioral mainfestations which differentiate one individual from another. (Author's abstr.)

The Effect of Prolonged Mild Anoxia on Sleepiness, Irritability, Boredom and other Subjective Conditions.

Sixteen male college students, with a median age of 18 years 4 months, were asked to rate themselves with respect to 10 different subjective conditions at five different periods during a continuous 8-hour session in a nitrogen dilution chamber in which an altitude of approximately 10,000 ft. was simulated. The same procedure was followed during an 8-hour control run. The conditions rated were sleepiness, fatigue, boredom, attention, irritability, headache, elation-depression, motivation, co-ordination, and general feeling of well-being. Although the results for the altitude and control runs varied from one condition to another, there was, on the average, a pronounced trend on the altitude run in the direction of poorer adjustment from the first period, 1½ hours after admission to the chamber, through the fourth period, which occurred after an exposure of 6½ hours. The differences between the mean ratings for the control and altitude runs were in every case reliable at the points of maximum divergence, which occurred most frequently at the fourth rating period. There was, in general, a marked end-spurt between the fourth and fifth period when the subjects were aware that their ordeal was nearly over. There was also a marked drop in adjustment on most of the control runs following the lunch period. If such a tendency was present in the altitude runs this was submerged by the general downward trend of the curves. The results jibe with the frequent reports by crews of heavy bombers of feelings of boredom, sleepiness, and wandering of attention on protracted bombing sessions while flying without oxygen masks at comparatively low altitudes on the way to and from target areas. They would seem to indicate the need for more adequate precautions against anoxia even at relatively low cruising altitudes if alertness, freedom from distraction, and a higher order of motivation are required.

(Author's abstr.).

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J. GERONT.

VOL. I. 1946.

J. LAB. CLIN. MED.

VOL. XXX. 1945.

VOL. XXXI. 1946.

Analysis of One Hundred Cases of Epilepsy.

(1) The catamnesis of 100 epileptics has revealed that among the dispositional factors head injuries play a major role, whereas the role of heredity is negligible.

(2) There are infrequent cases of epilepsy which do not exhibit a disturbance in the brain waves during the attack-free intervals. The change in the brain waves, if present, persists even after cessation of the attacks. Any medicinal treatment of epilepsy should be combined with hygienic measures, and with a particular diet omitting and reducing the salt intake.

(3) Three types of drugs are capable of controlling epilepsy: The barbiturates, sodium dilantin and methylphenylethyl-hydantoinate (mesantoin). Whereas the effect of the barbiturates frequently starts only after some years, even as late as after ten years, that of the hydantoinates sets in immediately or after a few months. Apart from an occasional rash, no unfavorable sequelae of the hydantoinates were observed.

(4) Apparently there is an individual reactivity to the remedies in question, and there are even cases intractable to all of them. One may, as necessity arises, replace the barbiturates with dilantin, and the latter with the hydantoinate preparation which exercises a particularly favorable influence on *petit mal* attacks.

(5) When the attacks have been controlled, the treatment has to be continued, since interruption might precipitate recurrence of the attacks.

(Authors' abstr.)

The Relationship of the Vegetative Nervous System to Anginal Anxiety.

What is the biological meaning of anxiety?

Anginal anxiety is to be considered as an irritation to certain "vegetative" structures within the diencephalon. From the clinical viewpoint it is comparable to physiologic sleep, which also is dependent upon excitation of certain portions

within the diencephalon, along the axis of the brain and adjacent to the ventricles. During the sleep there are numerous signs of parasympathetic hyperactivity. In anxiety the sympathetic tone is prevailing, although not to the exclusion of the antagonist system. During sleep restorative processes due to parasympathetic impulses are promoted. During anxiety the opposite effect is to be assumed, resulting in extreme weakness and prostration.

The irritation, confined primarily to the vegetative diencephalic centers and to the sympathetic fibers, may spread to the vagus. After the use of adrenalin, i.e., after sympathetic stimulation, ventricular flutter and sudden death, due to abrupt standstill of the heart, have been reported, the increased sympathetic tone causing vagal inhibition by reflex. This is the other biologic aspect of anginal anxiety.

The considerations in this article confirm the stand taken elsewhere regarding the relationship of the vegetative nervous system to angina pectoris abdominalis (L. Hess). In both conditions, in angina pectoris abdominalis and in anginal anxiety, the vegetative system is involved. It seems likely that even the primary site may be located outside the heart, within the centers of the vegetative nerves. In angina abdominalis, the vagus plays an important role; in anxiety, we are confronted with the predominance of sympathotonic features.

(Author's abstr.)

Results of Repetition of Electroencephalography in Adult Epileptics.

For 140 adult epileptic patients (100 idiopathic, 40 symptomatic) electroencephalography was repeated after an interval of five to seven years, under essentially the same anticonvulsant treatment.

Among idiopathic epileptic patients the subsequent electroencephalogram was the same in 85 per cent., worse in 10 per cent. and better in 5 per cent.

Among symptomatic epileptic patients the subsequent electroencephalogram was the same in 95 per cent., worse in 2·5 per cent. and better in 2·5 per cent.

Since only where the subsequent electroencephalogram was improved might the incidence of abnormality be lowered, it was evident that in the idiopathic group there was only a 5 per cent. chance that this might occur had electroencephalography been done at another time, whereas for the symptomatic group this was a 2·5 per cent. chance.

It was concluded that a single electroencephalogram taken at any one time has a 95 to 97·5 per cent. likelihood of representing the true electroencephalographic non-convulsive state of an epileptic adult, under unchanging therapy, and is, therefore, extremely reliable. (Author's abstr.)

DECEMBER.

Study of Electroencephalographic Findings in 209 Cases Admitted as Head Injuries to an Army Neurological-Neuro-Surgical Center.

(1) Electroencephalographic abnormalities are apparently a valid indicator of brain injury.

(2) The percentage of electroencephalographic abnormality increases with severity of injury. It is most marked when the dura has been penetrated, less in cases of open head injury without dural penetration and least in closed head injuries.

(3) The percentage of electroencephalographic abnormality decreases as time elapses from injury.

(4) Amplitude asymmetry is a guide to site of injury and an index of electroencephalographic improvement.

(5) Focal records were not found in cases with mild injury, but were more frequent with severe injury and penetrating wounds, and in our series occurred relatively soon after injury (under six months). Focal records without accompanying convulsions were found almost entirely in cases that had been injured less than six months before the initial electroencephalogram. Focal records with convulsions occurred in cases where the initial record was taken longer than six months after injury. This suggests the possibility that cases with focal records may eventually develop post-traumatic epilepsy, though initially asymptomatic.

(6) There is a suggestion that electroencephalographic improvement may occur after insertion of tantalum plates over skull defects. This may be due either to the healing influence of time or to a specific effect on the plate itself.

(Authors' abstr.)

A Preliminary Study on the Use of Methedrine in Psychiatric Diagnosis.

Fifteen to 20 mgm. of methedrine, given intravenously, produced definite effects in five patients with various psychiatric disorders. The vascular responses, namely, increase in arterial tension and ventricular slowing, occurred typically in each instance. No toxic manifestations were observed, although the patients complained of insomnia on the night following the injection.

The drug made all patients become more talkative; some disclosed previously unobtainable material. In several cases emotional outbursts occurred. In one instance paranoid delusions, previously expressed but more recently concealed, were released.

Conclusion.—From this preliminary study it is suggested that methedrine may have a place in the armentarium of psychiatric diagnostic methods.

(Authors' abstr.)

J. NEUROPATH. EX. NEUROL.

VOL. V. OCTOBER, 1946.

Morphologic Changes in the Brain of Monkeys following Convulsions Electrically Induced.

Electrical currents similar in type, intensity, duration of current flow and frequency with that used in human electric shock therapy, may cause morphologic changes in the central nervous system of monkeys.

The nerve cell alterations are mostly of the reversible type. The changes are mostly related to circulatory disturbances and increased permeability of the blood vessel walls. The latter is shown by distension of the perivascular spaces and perivascular edema and by some diapedesis of form blood elements. Compound granular corpuscles filled with presumably hematic pigment and free pigment in the blood vessels seem to confirm such an occurrence.

When more intense current and of longer duration is applied, occasional minute petechial hemorrhages result. This seems to support the contention that the severity of the lesions are proportional to the intensity of the electrical current, the duration of the current flow and, to a lesser extent, to the number of electric shocks.

The histopathologic changes are more pronounced in the areas of tissue traversed by the main path of the current.

In comparing the slight morphologic changes in experimental animals with

those encountered in control animals, it is necessary not only to evaluate them qualitatively but also quantitatively.

Reversible chemical or structural changes, and possibly some permanent slight structural damage may be at the base of the temporary alterations in the mental processes occurring in patients in the course of electric shock therapy.

(Authors' abstr.)

Experimental Arteriosclerosis in the Nervous System.

Experimental cholesterol arteriosclerosis in rabbits, caused by a diet of milk, yolk powder and yolk cake, supplemented by pure cholesterol in some cases, showed an involvement of the nervous system. Foam cells were found in the vascular tissue of the choroid plexus in all cases, and in the capillaries of the suprachiasmatic region in five out of 17 animals. In four cases the ependymal lining of the third ventricle was distorted or dissociated. The leptomeninx, too, showed occasionally foam cell aggregation, the source of which could not definitely be determined.

In peripheral nerves, foam cells were found between the nerve fibers. The problem of their origin is discussed. In two other cases axons had become swollen, fragmented and strongly basophilic. No explanation is given for this alteration.

It is believed that an endotheliopathy is the primary lesion in experimental cholesterol arteriosclerosis.

The pathological changes in experimental cholesterol arteriosclerosis of the central nervous system seem related to the hemato-encephalic and hemato-cerebrospinal fluid barrier. (Author's abstr.)

Acetylcholine-Induced Depression of Cerebral Cortical Activity.

Application of acetylcholine to the cortex causes a depression of electrical activity of the cortex. This depression is a cortical phenomenon independent of systemic effects of acetylcholine. Decrease of electrical activity is associated with decreased cortical responsiveness. The depression spreads over the cortex, probably in linear fashion. While the depression induced by acetylcholine occurs prior to acetylcholine discharges, the diminution of activity does not always presage increased activity. (Authors' abstr.)

J. NEUROPHYSIOL.

VOL. IX. SEPTEMBER, 1946.

Presence and Action of Acetylcholine in Experimental Brain Trauma.

1. As a result of experimental trauma to the head, ACh is consistently present in the C.S.F. in estimable quantities, 2·7 to 9·0 gamma per cent. within a few hours of injury. The abnormal amounts of ACh may be detected for as long as 48 hours following trauma, after which the time concentration falls below the sensitivity of the test object. The abnormal presence of ACh is presumed to be due to an excess production or release of the substance, an insufficient destruction, and consequent persistence within the intercellular spaces. It has been suggested that such persistent ACh be termed " free ACh."

2. The EEG of a number of cats and dogs have been studied for varying periods of time following trauma. Confirmation for both the previously described intense neuronal discharge and the transient flattening of all recorded electrical activity

has been obtained. Following these effects, there occurs a prolonged period of abnormality in one or both hemispheres. The abnormalities are essentially paroxysmal, high amplitude sharp waves with frequencies varying from 6–7 per second to 16–20 per second.

3. Changes in behaviour include tonic-clonic seizures, apnoea, and loss of ocular and corneal reflexes followed by partial or complete loss of hopping and placing reactions, sense of equilibrium, orientation, and a stuporous condition for varying periods of time of from hours to days.

4. The EEG patterns and the stuporous condition may be abolished by appropriate doses of atropine sulphate.

5. ACh perfused over an exposed area of cortex produces high amplitude sharp waves in small physiological concentrations, 1 gamma per cent. or less, and a flattening of recorded cortical potentials in high physiological concentrations, 2 gamma per cent. or more (depending upon the depth of general anaesthesia).

6. The intracisternal injection of ACh in amounts ranging from 0·02 to 10·0 gamma produces similar behavioral and EEG changes as previously noted, i.e., transient flattening with high concentrations and paroxysmal, high amplitude sharp waves of varying frequencies with low concentrations.

7. The EEG and behavioral effects of intracisternal ACh may also be abolished with appropriate doses of atropine sulphate.

8. It is suggested that " free ACh " may be one of the physiological factors underlying the acute paralytic and excitatory phenomena of cerebral concussion and more severe craniocerebral injuries. (Author's abstr.)

The Relation of Electric Potential Changes to Contracture in Skeletal Muscle.

Experiments were performed on nerve-muscle fibre preparations of the M. adductor longus and on whole isolated sartorius muscle of frogs (*Hyla aurea*). Contractures were set up by constant current pulses and by application of drugs.

1. Negative potential changes are always recorded at the site of origin of contractures in isolated muscle fibres.

2. Contractures, like propagated muscle responses, are initiated, after a sufficient depolarization of the muscle membrane. Contractures may arise: (i) Following on muscle impulses, which may gradually fail to propagate fully from the region of their origin. In these preparations a transition can be detected from normal to " abortive " impulses and to a maintained negative potential change which may give rise to contractures without appreciably exceeding the potential level at which the preceding propagated responses had been set up; (ii) not preceded by propagated responses following on the depolarizing action of drugs or currents in fatigue narcotized or injured muscles.

3. Contractures set up by chemical application are actively maintained by the depolarizing action of drugs. This action is analogous to the " cathodic shortening " effect which lasts for the duration of the current flow. " Chemical " or " electrical " contractures can be graded, depending on drug concentration or current strength.

4. Relaxation of chemically produced contractures can be effected at the anode of constant currents.

5. Novocaine does not raise the threshold at which contractures are set up by constant currents or by potassium application. The apparent threshold for brief shocks, however, is greatly increased. The electric time constant and the resting potential of the muscle membrane is not significantly affected.

6. The connection between the muscle membrane and the contractile elements is discussed. It is suggested that the action currents which accompany depolarization or the propagated muscle impulse are not the essential link in the transmission of " excitation " from the membrane to the contractile elements.

(Author's abstr.)

Righting and other Postural Activity in Low-decerebrate and in Spinal Cats after d-Amphetamine.

Righting and other postural activity was observed in low-decerebrate cats, and in spinal cats, after the intraperitoneal injection of d-amphetamine sulphate, usually in a dose of 10 mg./kg. In the decerebrate cat the righting activity consisted of elevation of the head and shoulders from the surface upon which the cat

was lying and of movements of the fore- and hind-legs, rump, and tail which resulted in incomplete righting of the body. The tail rotated in a manner suitable to promote righting. In spinal cats similar righting movements were observed in the hind-legs, rump and tail.

Asymmetry of body contacts is essential for righting activity in the decerebrate cat under the influence of d-amphetamine. In spinal cats after d-amphetamine, righting activity does not appear unless there is asymmetry of body contacts plus additional tactile stimulation of the lateral aspect of the hind knee, which is next on the table.

The authors' data indicate that, in addition to the previously known centers in the mid-brain, there are centers for righting caudad to the mid-brain, i.e., in the pons, medulla, and even the spinal cord. (Authors' abstr.)

Stimulation with Minimum Power.

An exponentially rising current will stimulate nerve with least power. Such waves are not easily generated. A square wave of correct intensity only requires 22 per cent. more power, and is easily generated. The exponentially falling current obtained from thyratron stimulators requires 85 per cent. more power than the best current form. The use of square waves for stimulators and electric shock therapy is indicated. (Author's abstr.)

Responses of Single Human Motor Units to Electrical Stimulation.

1. The responses of single human motor units to stimulation with instantaneously or slowly rising currents are demonstrated.

2. Accommodation curves with the electrical response of a single motor unit as index were determined and are compared to those given by a muscle twitch.

3. The duration of the motor unit responses to constant currents of various strength—the so-called adaptation time—was determined. Significant differences were found to exist for the proximal and distal parts of the same fibre, the former showing a longer adaptation time. (Authors' abstr.)

Natural and Artificial Activation of Motor Units: A Comparison.

The activation of motor units evoked by voluntary innervation and by electrical stimulation of the motor nerve has been studied in certain human muscles.

1. Stimulation with slowly rising currents has made a separate study of motor units of different thresholds and spike sizes possible. A typical experiment, involving the response of three different units to linearly rising currents of different gradients and strengths and to constant currents of different strengths, is described.

2. The recruitment of motor units to nerve stimulation with very slowly rising currents has been shown to be similar in certain respects to that found during sustained voluntary contractions.

(*a*) Both types of contraction start with a unit of small amplitude, followed by units of progressively larger spike size. The electrical stimulation experiments, as well as some with selective blocking of the motor nerve during voluntary innervation, indicate that the initial small spikes from the muscle correspond to activity in low threshold nerve fibres. The factors determining muscle spike size are briefly discussed.

(*b*) In most experiments the units appearing in a particular order during a voluntary contraction are identical with those recruited in the same order by electrical stimulation.

(*c*) The initial discharge frequencies of identical units at thresholds in both contractions are about the same. The increase of frequency during increased contraction exhibited by a given unit when the next in the sequence appears is also the same in both cases.

The results are discussed in the light of the theories of central excitation, and special attention is directed to the parallelism between the thresholds of different motoneurons during peripheral stimulation and central excitation.

(Authors' abstr.)

Competitive Reinnervation of Rat Muscles by their Own and Foreign Nerves.

The problem of whether the original motor fibers of a muscle have any advantage over any other motor fibers in reinnervating that muscle was investigated by letting

the tibial and peroneal nerves compete for reinnervation of the denervated plantar extensors. In 14 white rats the proximal tibial and peroneal stumps were joined to the distal tibial stump only. The junction was effected by means of a Y-shaped sleeve consisting of the reversed posterior end of the aorta, with the two iliac arteries serving as inlets for the two proximal nerves and funnelling the regenerating fibers into the common aortal trunk, which contained the distal tibial stump. Fibers from both sources thus travelled side by side and arrived in the muscles together.

After regeneration was completed, isometric tensions of the plantar extensors in response to supramaximal stimulation of the two nerve sources were determined. The results proved that the fibers from both sources had reinnervated the muscles at random, and the original supply had no systematic advantage over the fibers of foreign origin. In half of the cases the original nerve innervated a greater share of the muscle fibers, and in the other half the foreign nerve took the greater share. The statistical average of all cases shows both sources to be of equal weight. The concept that there is any selectivity, absolute or relative, in the establishment of regenerative connections between motoneurons and muscle fibers is therefore contradicted by the facts.

The experiments have also brought further confirmation of the fact that a single muscle fiber in general does not accept innervations from more than one motoneuron. (Authors' abstr.)

NOVEMBER.

Facilitation and Inhibition of Spinal Motoneurons.

Facilitation and inhibition, by the direct actions of primary afferent fibers, of two-neuron-arc reflexes has been examined by experiment.

An afferent volley, in group 1 fibers arising in one head of a muscle, facilitates the action of its synergists and inhibits the action of its antagonists. Details of the distribution of these actions are presented elsewhere.

The temporal characteristics of facilitation and inhibition have been defined. Facilitation is maximal on the occasion of synchronous convergence of " conditioning " and " test " volleys, and decays exponentially along a curve falling to 1/e in approximately 4·0 msec. duration, thereafter decaying in the same manner as facilitation.

Reasons are given for supposing that the facilitation described here is the expression of a process additional to the detonator action of earlier descriptions. Accordingly it may be called " residual facilitation."

The assumption of two excitatory events, detonator action and residual facilitation, makes no demand for elementary processes unknown in peripheral nerve. Their existence is predicted by the nerve-block model of synaptic transmission, only the significance of the latter, as far as the central nervous system is concerned, having remained in doubt in the absence of demonstration. The functional importance of residual facilitation has now been established.

According to present evidence it is permissible to assume a correlation between residual facilitation and the " synaptic potential " of Eccles.

Residual facilitation and inhibition are regarded as functional opposites, they being similar in all known characteristics excepting direction.

Of many possible factors, three—detonator action, residual facilitation and inhibition—have received sufficient documentation to necessitate inclusion in theoretical consideration of the known properties of synaptic transmission.

Reason is given for supposing that the brief facilitation periods evident in appropriately designed experiments do, as had been supposed, measure the effective duration of the detonator action. (Author's abstr.)

Integrative Pattern of Excitation and Inhibition in Two-neuron Reflec Arcs.

An afferent volley arising in the nerve of a given muscle of muscle fraction has, by direct impingement upon motor nuclei, the following actions :

1. If above threshold it discharges motoneurons that supply that muscle or muscle fraction ; otherwise, excitation is subliminal.

2. It facilitates the action of motoneurons that supply the muscle remainder, or synergists, at the same joint.

3. It inhibits the action of motoneurons that supply antagonists at the same joint.

The afferent volley in question, by direct action, neither excites nor inhibits motoneurons of muscles, flexor or extensor, that act at neighbouring joints.

In every instance the actions described are in strict accord with the requirements of reciprocal innervation.

The origin and distribution of excitation and inhibition so evoked indicate the role they play in myotatic reflex performance.

The mutually dependent muscles of a joint, together with the direct reflex paths that bind them, may be considered as constituting a myotatic unit.

The myotatic units in the first instance are independent one from another. Two-joint muscles form peripheral bridges between adjacent myotatic units.

Without the necessity for other than direct reflex connections, the myotatic unit exhibits, complete within itself, the elementary mechanism of reciprocal innervation. (Author's abstr.)

Reflex Control of the Ciliary Muscle.

In cats under nembutal anesthesia, faradic stimulation of a peripheral nerve or of the skin of the snout elicited a dioptric change in the direction of hypermetropia both before and after sympathetic denervation of the eye. Complete atropinization of the eye with resulting depression of cholinergic fibers did not abolish this response. It was abolished, however, when the oculomotor nerve was severed intracranially and when the adrenergic fibers were depressed by means of intravenous administration of ergotoxine phosphate.

Intracranial stimulation of the oculomotor nerve caused a dioptric change in the direction of myopia following depression of the adrenergic nerve fibers with ergotoxine phosphate, while identical stimulation of the oculomotor nerve following complete atropinization of the eye, with depression of cholinergic nerve fibers, resulted in a dioptric change in the direction of hypermetropia.

These results seem to indicate that reflex inhibition of the ciliary muscle is an actively integrated and controlled reaction mediated through the parasympathetic innervation of the eye, which involves the efferent conduction of impulses from the ciliary ganglion to the ciliary muscle through adrenergic components of the short ciliary nerves.

In human subjects mild faradic stimulation of the skin of the forearm or of the finger tips elicited a dioptric change of small magnitude in the direction of hypermetropia in untreated eyes as well as during cycloplegia produced by instillation of homotropine into the conjunctival sac, with resultant depression of cholinergic fibers.

The reflex control of the ciliary muscle appears to be mediated exclusively through its parasympathetic innervation. (Authors' abstr.)

Cortico-cortical Connections in the Monkey with Special Reference to Area 6.

1. Afferent cortical connections to area 6a have been described for the first time from areas 46 and 5 + 7 of the lateral hemispheral surface, areas 41 and 42 of the temporal lobe, and areas 7, 23b and 24 of the medial surface of the macaque brain by the method of physiological neuronography.

2. Additional observations on homolateral inter-areal connections have been made, including afferents to many of the suppressor regions. (Authors' abstr.)

Centrifugal Functional Deterioration of Asphyxiated Motor Nerve within the Neural Axis.

By means of placing stimulating electrodes along the intramedullary portion of the facial nerve and observing electrical thresholds before and after clamping the trachea, it has been shown that asphyxial deterioration of the nerve begins in

the nucleus and extends progressively distalward with time. These results complement the previous finding of a proximo-distal deterioration gradient along the medial popliteal nerve and contributing ventral roots, and with it establish the existence of a gradient along the entire length of living motor nerve.

(Authors' abstr.)

J. NUTRITION.

VOL. XXXI. 1946.

J. PARAPSYCHOL.

VOL. X. 1946.

Hypnotic Suggestion in PK Tests.

In tests of psychokinesis (PK), 5 male subjects were tested individually in procedure which involved the mechanical release of 96 dice at a time. Each subject made 20 throws of the 96 dice in the prehypnotic control session. Then " each subject was hypnotized and told that he would try very hard to make the specified target face turn up when he released the dice and that he would be able to influence them by his concentrated effort." The subjects were then retested, with the result that their scores were far below those of the control session. " With two subjects, however, it was found that an incidental break in the hypnotic spell brought about a reversion to high scoring." Thereafter, when other subjects scored low in the post-hypnotic session, they were rehypnotized and told that they would do further tests in a spirit of fun and relaxation. These subjects then produced scores higher than those of their control session. There were significant differences between the scores of the first post-hypnotic section and the other sections of the data.

B. M. HUMPHREY (Psychol. Abstr.).

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VOL. XXII. OCTOBER, 1946.

Electroencephalographic Studies of Mental Fatigue.

1. Twenty-six medical students and one professor were examined before the beginning of a typical day of classes and at the end of it. Electroencephalograms were taken, together with physiological variables, such as blood sugar, susceptibility to hypocapnia, white blood picture, etc.

2. Of the 23 persons having alpha waves, seven showed loss of alpha and four increase of alpha time. Statistical analysis shows that loss of alpha, claimed as an electroencephalographic evidence of mental fatigue, was not significant.

3. The susceptibility of the EEG to deep breathing was twice as great at 8 a.m. as it was at 5 p.m., when corrections were made for blood-sugar level, vital capacity, and evidence of peripheral vasoconstriction. (Authors' abstr.)

Effects of Electro-convulsive Shocks on "Reasoning" Ability in Albino Rats.

Evidence based on data from six adult rats indicates that electro-convulsive shocks alter and impair the performance of rats in the Maier "reasoning" test. The amount of disturbance appears to be inversely related to the length of the period of recovery after individual shocks. Suggestions have been given for further investigations which may shed considerable light on the influence of convulsive shocks on cognitive functions in infra-human subjects.

(Authors' abstr.)

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VOL. XLIII. NOVEMBER, 1946.

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VOL. LIII. SEPTEMBER, 1946.

On the Nature of Fear.

(1) Anthropoid fears of inert, mutilated or dismembered bodies are spontaneous —that is to say, although experience of a certain kind is a pre-requisite and learning is definitely involved, the avoidance of such objects is not built up by association with a more primitive cause of fear.

(2) These and a number of other fears are evidently not determined by a sensory event alone, and the behavior is not intelligible except on the assumption that its control is a joint product of sensory and " autonomous " central processes. Consequently no amount of analysis of the stimulating conditions alone can be expected to elucidate the nature of fear, or to lead to any useful generalization concerning its causes.

(3) An adequate hypothesis of the nature of fear cannot be framed in psychological terms alone, but must utilize physiological concepts of cerebral action. No common psychological ground can be discovered for all the various causes of fear. What is there in common, for example, between the characteristically high level of the auditory and low level of visual stimulation which induces fear in children, or between fear of strangers, which decreases, and fear induced by pain, which tends to increase, with repetition ?

The hypothesis developed here has made a considerable synthesis of formerly unrelated facts, although it remains vague on some crucial points. It proposes, in brief, that fear originates in the disruption of temporally and spatially organized cerebral activities ; that fear is distinct from other emotions by the nature of the processes tending to restore cerebral equilibrium (that is, *via* flight) ; and classifies the sources of fear as involving (1) conflict, (2) sensory deficit or (3) constitutional change. By distinguishing between processes which break down and those which restore physiological organization in the cerebrum, the variability of fear behavior is accounted for.

The conceptions of neurophysiological action on which this is based were developed originally as an approach to other problems, and will be presented in detail elsewhere. When this is done, and the neurophysiological implications are made explicit, it may appear that a basis has been laid at last for an adequate theory of emotion and motivation—something which is lacking in psychology at present. (Author's abstr.)

NOVEMBER.

PSYCHOSOM. MED.

VOL. VIII. SEPTEMBER–OCTOBER, 1946.

Studies on the Nature of Certain Symptoms Associated with Cardiovascular Disorders.

Day-to-day studies were made over a period of almost a year of the symptoms and cardiovascular and respiratory functions of healthy human subjects, and short term observations were made on selected patients.

Emphasis was placed upon reactions to persistent low-grade stresses and strains which are a part of " every day " living and which constitute the core of the bedside problem rather than upon the well-known responses to major life crises. These studies have revealed the following :

1. Dyspnea associated with inefficient pulmonary ventilation may occur in

response to stress-producing life situations in association with anxiety, anger, guilt, rage, frustration, and tension.

2. Palpitation associated with increased stroke volume may occur under similar circumstances.

3. Heart pain in the presence of anatomical narrowing of the coronary arteries may result from increased work of the heart attendant upon prolonged elevation of the blood pressure and cardiac output in association with rage, resentment, anxiety, fear, and tension.

4. Heart pain in the presence of anatomical narrowing of the arteries may result from a fall in the cardiac output and coronary blood flow in association with desperation and defeat.

5. Giddiness and faintness may result from cerebral anoxia attendant upon diminished venous return to the heart. Also, giddiness and faintness may result from hyperventilation, which is followed by cerebral vasoconstriction, impaired dissociation of oxyhemoglobin and cerebral anoxia. Both type of cerebral anoxia occur in response to stress-producing life situations in association with feelings of exhaustion, anxiety, fear, and during the early part of convalescence.

6. Fatigue, as experienced by patients is a complex state dependent upon emotional attitude, the absence of a dominant motivation and the presence of a stress-producing life situation with accompanying inefficiency of cardiovascular and respiratory function.

7. Individuals differ as regards the intensity and duration of the cardiovascular and respiratory responses to life situations. The fact that a single subject tends to react under different circumstances in many different ways suggests that the individual is manifesting a variety of ways of dealing with his environment as regards his cardiovascular and respiratory functions.

8. These results indicate that, in a setting of adverse life circumstances and associated emotional reactions, performance in terms of respiration and work of the heart is costly. This high cost may manifest itself in cardiovascular symptoms which are not dependent alone upon gross structural heart disorder. This uneconomical performance may also manifest itself in impaired total efficiency of the individual. (Authors' abstr.)

An Electrocardiographic Study of Psychoneurotic Patients.

The mechanism of non-specific electrocardiographic abnormalities observed in normal, psychotic and neurotic individuals is still not entirely understood. It is generally accepted, however, that the deviations from the normal are associated with an imbalance in the autonomic nervous system. The appearance of these abnormalities is apparently independent of the degree of nervous imbalance, since in only a relatively small percentage of cases with psychoneurotic cardiac dysfunction do these occur. Mainzer and Krause showed that an emotion such as fear before an operation produced changes in the electrocardiogram strongly suggestive of transitory coronary insufficiency. When consciousness was depressed by anaesthesia the electrocardiographic record reverted to a normal pattern. This observation was interpreted by them as indicating the marked influence the autonomic nervous system has on the coronary circulation. They suggested that vagal influence was dominant in decreasing the coronary flow. Since, however, there is no unanimous agreement among workers as to the precise action of the sympathetic and parasympathetic supply on the coronary circulation, it would appear hazardous to insist that the essential action of psychic impulses to the heart is directed precisely upon the coronary flow. Furthermore, in all published reports on this problem, as well as in the present investigation, no combination of abnormalities suggestive of a myocardial infarction pattern was observed. It would appear, rather, that the psychic impulses to the heart may act upon any of its elements, producing in this way non-specific deviations from the normal pattern. Further evidence to support the view of the effect of autonomic imbalance on the cardiac mechanism was presented by Wendkos, using vagolytic and sympatholytic drugs on normal individuals having an inverted T wave in lead CF_5 of the electrocardiogram. Earlier observations of the effect of emotion on the electrocardiogram contribute little towards a better appreciation of the use of this instrument in differentiating benign from organic heart disease. Since anxiety is the central symptom of nearly all neuroses and psychoses, and all fears either apparent or

obscure form the essential component of the psychoneurotic states, it would appear that the electrocardiographic abnormalities noted in such cases may be attributed to inherent fear reactions.

In an electrocardiographic study of 1,000 young aviators, Graybiel *et al.* found that P waves with an amplitude of 2 mm. or greater occurred in 2·1 per cent., and 0·5 per cent. of their records in leads II and III respectively, and none in lead I. In the present report P waves of the same amplitude occurred in 3·9 per cent. of the records in lead II, and 0·7 per cent. of the cases in leads II and III. In ten instances, tall P waves were associated with small upright or diphasic QRS complexes in lead I, tall QRS complexes in leads II and III, with a slight S-T depression in lead III, giving the impression of a right heart strain pattern. It is well known that persons with asthenic body builds, low diaphragms and small hearts show a right axis shift pattern in the electrocardiogram. In the present study only 60 per cent. of the patients with neurocirculatory asthenia had this type of body habitus, and only one-third of this group had right axis shift. This has been the experience of other workers in this field.

Graybiel *et al.* showed that deep S_2 waves greater than 4 mm. occurred in 2·4 per cent. of their records, while Hall *et al.* on a similar study of 2,000 young aviators, found S_2 greater than 3 mm. in 20·7 per cent. of their records. In the present investigation, the presence of deep S_2 waves was observed in only 1·5 per cent. of the records. This suggests that the occurrence of a deep S_2 wave alone, unassociated with other well-defined abnormalities in the electrocardiogram, should be regarded as an individual variation and not indicative of myocardial damage.

Flat or small T waves in leads I and II occurred in 5·3 per cent. of the present series of records. Graybiel *et al.* reported inversion of T_2 in 0·2 per cent. of their records in a large group of healthy individuals, and Hall *et al.* in a similar study observed this abnormality in 0·3 per cent. of their cases. Graybiel and White reported seven cases of neurocirculatory asthenia, known to be free of organic heart disease, showing inverted or flat T waves in leads I and II. According to these workers there was no evidence in these cases to indicate inadequacy of the coronary circulation to explain the abnormality in the T wave. White *et al.* observed T_2 inversions occurring occasionally in persons with asthenic habitus and vertical hearts. They suggested that this electrocardiographic abnormality may be produced either by variation in position of the heart, depression of the diaphragm or by overventilation resulting in alkalosis. Barker *et al.* reported that alkalosis decreased and acidosis increased the amplitude of the T waves in the limb leads, and believed that abnormal T waves produced by voluntary hyperventilation may be due to alkalosis. When they induced alkalosis by feeding large quantities of sodium bicarbonate (25 to 50 gm.) to normal patients, they were able to produce in 5 out of 7 cases similar T wave changes. However, they were unable to show a strict parallelism between the pH of the blood and the electrocardiographic changes. Thompson explained the T inversions found in tracings of patients with anxiety neurosis and the hyperventilation syndrome as being due to alkalosis. He believed that smoking may produce similar changes by deep inspiration, contrary to the view of Graybiel *et al.* that flattening or inversion of the T waves in the limb leads are due to the toxic action of nicotine. Scherf and Weisberg presented convincing evidence showing that the alterations in the T waves may be attributed to the diaphragm during respiration. Logue *et al.*, from a study of 74 cases of neurocirculatory asthenia, reported 30 per cent. of their records showing low T waves. In a recent report, Loftus *et al.* studied a series of 41 cases with anxiety neurosis, with only 2 cases (5 per cent.) showing low amplitude of the T wave in leads I and II, which is in close agreement with the findings of the present investigation. Their other 39 cases apparently showed no electrocardiographic deviations from normal, in spite of the marked personality disorders, which is significant. Other workers have observed transient T wave inversion in lead II following a paroxysmal ventricular tachycardia in patients without psychoneurotic personality patterns.

T wave inversions in the precordial leads were not observed in the present investigation. Wendkos reported T inversions in CF_2 in 4 cases of neurocirculatory asthenia and ascribed this change to a preponderance of either the vagal or sympathetic tone—not to the position of the heart, since the stability of the inversions was unaffected by postural changes. Logue *et al.* recorded 3 per cent. of their cases having the T wave inverted in lead CF_2. Inverted T waves in lead CF_2,

having the characteristic feature of a long descending and short ascending limb, have been commonly observed in normal infants' and children's electrocardiograms. Occasionally similar T inversions in this lead have been noticed in young, healthy adults and their occurrence has been ascribed to the residual qualities of the juvenile heart; for that reason, it is not a characteristic feature of autonomic imbalance in psychoneurosis.

S-T segment depressions occurred in 8 per cent. of the present series of records. This abnormality has been frequently observed following shock treatment and in electrocardiograms of emotionally unstable individuals. However, the degree of deviation of the S-T segment from the reference level, or how commonly this abnormality occurs, had not been recorded. While 36 per cent. of the present records reveal S-T depressions in the limb leads, actually only 8 per cent. of these showed depressions of at least 0·5 mm. in leads I and II, and 0·75 mm. in lead III, taking the P-Q segment as the reference level. Graybiel *et al.* found 0·9 per cent. of their records of 1,000 normal aviators showing a mean S-T junction depression of 0·64 mm. in lead I, 1·2 per cent. of the records with a mean depression of 0·46 mm. in lead II, and 7·7 per cent. with a mean depression of 0·33 mm. in lead III. Since S-T depressions occur in a variety of electrocardiographic patterns indicative of disease involving various cardiac elements, the significance of this abnormality in benign cardiac dysfunctions is difficult to evaluate. It is significant, however, to note that this abnormality occurs at least six times more commonly in patients with personality disorders than it does in normal individuals under the age of 40 years. (Authors' abstr.)

NOVEMBER–DECEMBER.

Organ Function and Form Perception.

The Rorschach records of two groups, each consisting of 60 patients, were compared. One group, designated as V group, was picked for the common feature of arterial hypertension. The other group, designated as L group, was composed of 30 cases of chronic arthritis and 30 cases of Parkinsonism.

The two groups showed specific preferences for certain types of responses which made it possible to distinguish between an L type and a V type of response. The critical responses could be subsumed under 4 general categories. In all 120 patients the number of responses of their own type exceeded the number of responses of the other type in at least two categories. The four categories and the differences between the two groups are as follows:

1. Vertical axis.

(*a*) Location: Patients of the L group had a much greater tendency to center one-half or more than one-half of their responses in the axis than the V group.

(*b*) Form: Patients of the V group saw the axial part as an opening about five times more often than the L group.

(*c*) Content: Warm-blooded organisms and dynamic emphasis centred in the axis were observed more often in the L group than in the V group. The V group saw more anatomical structures, ritualistic objects, and water and fire than the L group.

2. Kinesthetic responses: Goal-directed activities were indicated more often by the L patients, while actions determined by convention or by efforts to maintain a certain position were indicated more often by the V patients.

3. Integration and disintegration: The tendency toward integration of the ink-blots into a comprehensive interpretation was more pronounced in the L group, while the tendency toward disintegration was more pronounced in the V group.

4. Animals: Eagles and pigs were most frequently seen by the L group, while cows, sheep and beasts of prey were most frequently seen in the V group.

The psychological interpretation of the findings suggested that arthritic and Parkinsonian patients are dominated by an urge for individualistic, independent

action. Obstacles are liable to provoke aggressiveness in excess of the chances for success. Patients suffering from arterial hypertension have a tendency toward dependent relationships in form of identification with their social environment. Action is determined by material needs and by social standards. Obstacles easily provoke conflicts between dependent and aggressive impulses, resulting in restriction of the range of action and of perception.

Specific correlations between organ dominance, disease liability and form of perception were discussed. They gave added insight into the physiological basis of the Rorschach method and of physiognomical understanding.

The discovery of two gestalt tendencies associated with individualistic and with collectivistic personality types suggested the possibility of making current personality and aptitude tests more reliable, and the possibility of further extending the use of the Rorschach method. (Author's abstr.)

The Sleep of Patients with Manic-Depressive Psychosis, Depressive Type: An Electroencephalographic Study.

(1) The entire night's sleep of 6 patients with manic-depressive type, was studied electroencephalographically and compared with data similarly obtained from normal subjects. The categories for the electroencephalograms were waking or daytime and sleep, the latter being subdivided into low voltage, spindles, spindles plus random, and random.

(2) There was considerable variability among the patients in the percentage of time that each electroencephalographic type appeared during the entire night's recording. This variability became less when the waking records were excluded and only the electroencephalographic patterns that occurred in sleep were considered.

(3) In a comparison of the mean percentage of time each electroencephalographic sleep pattern appeared in the sleep records of patients and normal controls, it was found that the patients had almost twice as much low voltage activity as the normal controls (37·5 to 19 per cent. respectively) and approximately one-half as much spindles plus random activity as the normal controls (23 to 40 per cent. respectively).

(4) In a comparison of the minute by minute fluctuations from one electroencephalographic pattern or level to another for the entire night's recording of patients and normal controls, it was found that the fluctuations were more frequent for the patients.

(5) The per cent. of the minutes during the night's sleep which contained two or more of the electroencephalographic sleep levels was nearly twice as great for the patients as for the normal controls (52·7 to 28·5 per cent. respectively).

(Authors' abstr.)

Psychodynamic and Electroencephalographic Factors in Duodenal Ulcer.

Twenty-five cases of duodenal ulcer were studied from a psychodynamic and electroencephalographic point of view. The cases represented an unselected sample of the naval ulcer population. The electroencephalographic data showed a high incidence of dominant alpha activity in this ulcer group. Using the Davis classification for the measurement of normal electroencephalograms, it was found that 76 per cent. of the cases were in the dominant alpha group, 4 per cent. in the subdominant alpha group, and 20 per cent. were in the rare alpha group. Thus there were almost four times the expected number in the dominant alpha group.

The psychological data revealed a rather consistent ulcer personality constellation. Duodenal ulcer individuals were characterized by marked feelings of insecurity associated with strong passive dependent trends. There was usually a marked reaction against these trends with the development of a facade of independence and aggressiveness. The ulcer syndrome seemed to result from the interaction of this personality constellation and the frustrating service environment.

The basic correlation between a dominant alpha rhythm and psychic trends to passivity and dependency appears valid. However, one must not assume any causality between these two aspects of the total organism. The alpha rhythm is best considered as a concomitant electrocortical activity of the tendency of the individual to assume a passive, tensionless, unstimulated state.

(Author's abstr.)

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The Effects of Certain Parasympathomimetic Substances on the Emotions of Normal and Psychotic Individuals.

Desoxycorticosterone acetate and prostigmin methylsulfate were used with some 60 psychotic and neurotic patients and with normal controls. The acetate, an extract of the adrenal cortex, had a somewhat less marked effect than the prostigmin, a synthetic drug. A variety of physiological changes were carefully recorded. The emotional effect was in general relaxing. Under prolonged treatment, several manic patients and schizophrenics became eligible for discharge. A single administration of either substance produced measurable chemical and vascular effects over a period of about four hours.

H. D. SPOERL (Psychol. Abstr.).

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Alterations of Conditioned Reflexes in Old Age.

Observations on a 15-year-old dog who had been subjected to 12 years of experimentation show that, in this animal, trace conditioned responses could not be produced at all. Delayed conditioning could be accomplished only with difficulty. A previously learned discrimination between two auditory stimuli was lost. During the last half year of the dog's life, the conditioned salivary response decreased by two thirds, while the magnitude of the unconditioned salivary response increased markedly. Theoretically, these results are taken to mean that, in senility, the cortical processes of inhibition and excitation are lost in the order named, although subcortical function remains unimpaired. G. A. KIMBLE (Psychol. Abstr.).

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1. Biochemistry, Physiology, Anatomy, &c.

Studies in Cholinesterase. V. Selective Inhibition of Pseudocholinesterase in vivo. Hawkins, Rosemary D., and Gunter, Josephine M. (Univ. Toronto, Can.). [*Biochem, J.*, **40**, 192–7 (1946).]

The prostigmine analog (dimethyl-carbamate of (2-hydroxy-5-phenylbenzyl) trimethylammonium bromide) inhibits almost completely and selectively the non-specific or pseudocholinesterase. Injections of this compound produce almost complete inhibition of the pseudocholinesterase in the blood and tissues of dogs, but do not produce symptoms suggesting an accumulation of acetylcholine, which appear only when the true or specific cholinesterase is significantly suppressed at the same time. It is, therefore, concluded that the pseudocholinesterase plays no significant part in the *in vivo* splitting of acetylcholine.

S. MORGULIS (Chem. Abstr.).

Iron Concentrations in Cholinesterase Preparations. Barnard, Robert D. (Fox Hills, Staten Island, N.Y.). [*Science*, **104**, 331 (1946).]

A sample of electric eel material, 1 mgm. of which hydrolyzed 1,200 mgm. of acetylcholine per hour, had an Fe content of 47·3 mgm. per cent.; a serum esterase preparation, which split 20 mgm. of acetylcholine per hour, had 19·8 per cent. of Fe; while a human erythrocyte cholinesterase preparation, with an esterase activity of 7·8 mgm. per mgm./hour, had an Fe content of 9·0 mgm. per cent. This suggests that the Fe either is concentrated along with the esterase fractions or comprises an actual component of the latter. E. D. WALTER (Chem. Abstr.).

True Cholinesterases with Pronounced Resistance to Eserine. Hawkins, Rosemary D., and Mendel, Bruno (Univ. of Toronto). [*J. Cellular Comp. Physiol.*, **27**, 69–85 (1946).]

Planaria (*P. dorotocephala*) have a true cholinesterase which shows increasing activity with rising concentrations of acetylcholine (I) up to 0·006 M. To inhibit its activity to the same extent as that of the specific cholinesterase of mammalian brain or erythrocytes, 50 and 1,000 times the concentrations of eserine and Nu-489 (dimethyl-carbamate of o-hydroxybenzylamine-HCl), respectively, are required. Frog brain has a true cholinesterase with maximum activity at a concentration

of (I) about 0·0006 M and with decreasing activity with greater concentrations. Approximately 100 times the concentration of eserine is required to inhibit activity to the same extent as cholinesterase of mammalian brain. Inhibition of activity by excess substrate cannot be considered a primary characteristic of specific cholinesterases. The ratios of activity toward (I) to activity toward β-acetyl-methylcholine differed markedly for the cholinesterases of *Planaria* and frog brain. Caution must be used in interpreting experiments in which there is lack of potentiation of the effects of nerve stimulation on addition of eserine.

H. L. MASON (Chem. Abstr.).

Changes in the Activity of Cholinesterase of Nervous Tissue Under the Influence of Constant Current. Babskii, Eug. B., and Minaev, P. F. (Acad. Med., Moscow). [*Nature*, **158**, 343–4 (1946); *cf. C.A.*, **40**, 1545[8], 2212[7].]

The cathode of constant current lowers the activity of cholinesterase, while the anode produces the opposite effect. This can be explained on the basis of the changes that take place in the distribution of ions in the nerve under the influence of polarization.

E. D. WALTER (Chem. Abstr.).

Mechanism of Action of Cholinergic Substances. III. Moratschek, Johann (Univ. Berlin). [*Arch. exptl. Path. Pharmakol.*, **203**, 278–81 (1944); *cf. C.A.*, **35**, 3328[8].]

In the isolated frog heart acetyl-β-methylcholine chloride (mecholyl) and isobutylenetrimethylammonium chloride (esmodil) produce a prolonged but gradually diminishing decrease in the beat amplitude. Choline and tetramethylammonium chlorides inhibit this negative inotropic action of mecholyl and esmodil. Esmodil acts synergistically with mecholyl and acetylcholine.

IV. Acetylcholine and Choline. Voigt, Manfred (Univ. Berlin). [*Ibid.*, 282–304.]

The action of acetylcholine on the isolated frog heart was studied. The results are in accord with those of other investigators. Choline anatagonizes the action of acetylcholine.

L. E. GILSON (Chem. Abstr.).

VIII. Effect of High Oxygen Pressure on Enzymes; the System Synthesizing Acetylcholine. Stadie, Wm. C., Riggs, Benjamin C., and Haugaard, Niels. [*Ibid.*, 189–96.]

The aerobic synthesis of acetylcholine by slices or homogenate of rat brain is not affected by exposure to O at high pressure. The choline acetylase of rat-brain slices is likewise unaffected, but cell-free preparations of the enzyme are rapidly inactivated by O. The relation of these findings to the problem of O poisoning is discussed.

L. E. GILSON (Chem. Abstr.).

Effect of Adrenaline and Acetylcholine on Excitation, Inhibition and Neuroses. Gantt, W. Horsley, and Freile, M. [*Trans. Am. Neurol. Assoc.*, **70**, 180–1 (1944).]

In normal dogs having excitatory and inhibitory conditional reflexes and in neurotic dogs, adrenaline (I) impaired the higher nervous functions as measured by the motor, salivary, and cardiac conditional reflexes, while acetylcholine (II) improved the differentiation between the excitatory and inhibitory processes. These effects lasted days or weeks after the injection. In the neurotic animals (I) had a less disturbing effect, and (II) a greater improving effect, than in the normal animals. Both drugs became less effective on repeated injection.

MARION HORN PESKIN (Chem. Abstr.).

Muscular Contraction. The So-called Direct Sensitization of Striated Muscle to Acetylcholine. Scheiner, H. (Centre études scientifiques homme, Paris). [*Compt. rend. soc. biol.*, **139**, 1090–2 (1945). *Discussion.*]

An almost unlimited number of substances sensitize frog muscle to acetylcholine. This " direct " sensitization appears to be related to the existence of some mechanism which is present in vertebrate muscle, but absent in invertebrate muscle.

Sensitization of Striated Muscle to Acetylcholine by Tetrahydrofuryl Alcohol. [*Ibid.*, 1092–5.]

Tetrahydrofuryl alcohol (I) sensitizes frog rectus abdominis muscle to acetylcholine. With concentrations of 0·1–2·5 per cent. the effect is proportional to the concentration. When the muscle is washed it returns to its original state of sensitivity. In this respect (I) differs from eserine, since the sensitizing effect of the latter is not abolished by washing. L. E. GILSON (Chem. Abstr.).

The Mode of Action of Acetylcholine on Muscle Tissue. Kometiani, P. A., Klein, E. E., and Dolidze, Sh. V. (Georgian Acad. Sci., Tbilissi). [*Biokhimiya*, **11**, 253–62 (1946); *cf. C.A.*, **39**, 3361⁴.]

The specific action of acetylcholine on muscle is due to the transformation of part of the bound K into a form capable of diffusion. Acetylcholine has little effect on muscles with a low degree of excitability. The action of acetylcholine is associated with the physico-chemical state of the cytoplasmic substrate to which the K is bound. H. PRIESTLEY (Chem. Abstr.).

Reaction of the Sympathectomized Dog to Histamine, Acetylcholine and Peptone. Bennati, D., and Bacq, Z. M. (Facultad de med., Montevideo). [*Arch. soc. biol. Montevideo*, **12**, 211–15 (1945) (Pub. 1946).]

Sympathectomized dogs are hypersensitive to the action of acetylcholine, histamine and Witte peptone during 26 days after the last operation.
F. FROMM (Chem. Abstr.).

Effect of Alkaloids on Acetylcholine Synthesis. Torda, Clara, and Wolff, Harold G. (Cornell Univ., Ithaca, N.Y.). [*Arch. Biochem.*, **10**, 247–50 (1946); *cf. C.A.*, **40**, 2211⁷.]

The synthesis of acetylcholine (I) by minced frog brain in the presence of 3 per cent. physostigmine salicylate was increased 20–150 per cent. on the addition of adrenaline, cocaine, ephedrine, and ergotamine in concentrations of 0·03 to 0·003 mgm. per cent. Yohimbine and pilocarpine did not modify (I) synthesis, whereas veratrine, quinine, quinidine, strychnine, amphetamine sulfate, morphine, codeine, cinchonine, colchicine, d-tubo-curarine and atropine decreased the synthesis of (I).
VERNON L. FRAMPTON (Chem. Abstr.).

Thiamine and Contraction of Leech Muscle Provoked by Acetylcholine. Saviano, Mario (Univ. Naples). [*Boll. soc. ital. biol. sper.*, **17**, 21–4 (1942).]

Thiamine does not increase the sensitivity of untreated leech dorsal muscle to acetylcholine, but does increase the sensitivity of eserinized muscle.

Relation between Cholinesterase and Sensitization to Acetylcholine by Thiamine. [*Ibid.*, 24–6.]

Thiamine does not exert an anticholinesterase action on leech muscle.
L. E. GILSON (Chem. Abstr.).

Influence of Anticholinesterase on Reflexes of Sino-carotid Origin. Heymans, C. (Univ. Gand). [*Experientia*, **2**, 260 (1946) (*in French*).]

In dogs administration of diisopropylfluorophosphate (DFP) does not affect cardiovascular or respiratory reflexes of carotid sinus origin or the peripheral excitability of the heart vagus nerve. Injection of prostigmine after DFP still induces bradycardia, an increase of vagal excitability, an increase of intestinal peristalsis, and bronchospasm. Thus the theory of central or peripheral cholinergic transmission of cardiovascular and respiratory reflexes induced by stimulation of carotid sinus pressoreceptors is not supported. Several pharmacological actions of prostigmine are not related to the anticholinesterase action of the drug.
WM. M. GOVIER (Chem. Abstr.)

Action of Acetylcholine and Vitamin B_1 on Human Blood Pressure. Rotelli, Luigi (Univ. Pavia, Italy). [*Boll. soc. ital. biol. sper.*, **20**, 508–9 (1945).]

In 80 persons the injection of vitamin B_1 caused no alteration in blood pressure, injection of 200 mgm. acetylcholine caused a depression of 10 to 15 mm. Hg and the injection of combined vitamin B_1-acetylcholine produced no effect other than that caused by the acetylcholine. HELEN LEE GRUEHL (Chem. Abstr.).

Acetylcholine in the Pathogenesis of Peptic Ulcers. Al'pern, D. E. (Med. Inst. Kharkov). {*Byull. Eksptl. Biol. Med.*, **20**, *No.* 7/8, 43–4 (1945).]

More extensive observations confirm the significance of acetylcholine (I) in the formation of gastro-intestinal ulcers. Of 131 patients (I) was found in the blood of 91 per cent. of patients with x-ray-confirmed ulcers, 70 per cent. of patients with other ulcer symptoms, and 3 per cent. of patients recovering from ulcers. It was absent from the blood of 43 patients with non-ulcerous gastro-intestinal symptoms. K. STARR CHESTER (Chem. Abstr.).

Sensitizatiion of Muscle to Choline and Acetylcholine and the Supposed Existence of Choline Acetylase. Babskii, Eug. B., and Minaev, P. F. (Acad. Med., Moscow). [*Nature*, **158**, 268 (1946).]

Nachmansohn and his colleagues (*C.A.*, **39**, 2519[6]) and Feldberg and Mann (*C.A.*, **39**, 4667[8]) have suggested the enzymic synthesis of acetylcholine from choline and acetate in the presence of adenosine triphosphate. The alleged enzyme was named choline acetylase. Repeating their experiments, the authors found that the contraction of rectus abdominis of frogs and of the dorsal muscle of leeches in response to choline is greatly increased by the presence of adenosine triphosphate, this increase depending on the concentration of the latter. The increase of observed muscle contraction may possibly have been due not to the stimulation of acetylcholine synthesis by adenosine triphosphate, but to the sensitizing effect of this substance on the test muscles. E. D. WALTER (Chem. Abstr.).

The Content of Acetylcholine-like Substances and Cholinesterase in the Central Nervous System of Castrated Rats. Kakushkina, E. A., and Tatarko. T. (K. A. Timiryazev Biol. Museum, Moscow). [*Byull. Eksptl. Biol. Med.*, **20**, *No.* 9, 58–60 (1945).]

The removal of the sex glands of male or female rats did not have significant effect on the formation of acetylcholine-like substances in the cerebrum, but castration did result in a reduction in cholinesterase activity which led to a relative increase in acetylcholine-like substances. K. STARR CHESTER (Chem. Abstr.).

The Mechanism of Acetylcholine Liberation in Striped Muscles. Abdon, N. O., and Bjarke, T. (Univ. of Lund, Sweden). [*Acta Pharmacol. Toxicol. (Copenhagen)* (**1**), 1–17, (1945) (*in English*).]

Experiments with frog muscles are described. When the muscles are stimulated and contracted, free acetylcholine (I) is liberated from a precursor (II). During the first period the (II) is resynthesized rapidly and no free (I) is found by analysis. The resynthesis requires energy; when available sources of energy are exhausted the amount of (II) decreases and if cholinesterase is inhibited with eserine the liberated (I) accumulates. Oxidative as well as glycolytic processes can give energy for resynthesis of (II). When skeletal muscles are mechanically injured the (II) is broken down and a corresponding amount of (I) is formed. The rate of (I) formation is considerably more rapid than formerly believed. When resynthesis is blocked as far as possible, as in muscles treated with iodoacetate and KCN, the whole content of (II) can be broken down in 2–3 seconds. When normal frog muscles are continuously stimulated in O no breakdown is seen during the first 10 seconds. This means that all the (II) is broken down and rebuilt at least 200 times during this period. Resynthesis is the normal way for the removal of (I) in skeletal muscles. Neither the breakdown nor the resynthesis of (II) is influenced by eserine in a concentration sufficient to inhibit cholinesterase completely (1 : 50,000). (I) is liberated from (II), whether the muscles are stimulated directly or through their anterior roots. If transmission is blocked with curare, stimulation of the nerves produces no breakdown of (II) and no free (I) appears. Curare does not affect the mechanism for (I) liberation; when curarized muscles are stimulated directly the (II) is broken down just as in normal muscles. These findings are not in full accord with the humoral transmission theory of Dale.

Effect of Vagal Stimulations on the Acetylcholine Precursor in Rabbit Hearts. Abdon, N. O., and Borglin, N. E. [*Ibid.*, 162–8.]

All the acetylcholine (I) of the rabbit heart is present as precursor (II). In the ventricles the concentration is about the same as in skeletal muscles, in the auricles

it is 2–3 times higher, In the heart (II) is the immediate source of liberated (I). After prolonged vagal stimulation there is a significant decrease in (II). The vagus escape phenomenon is neither due to lack of (II) nor to inhibition of formation of (I) from (II).

Metabolism of Acetylcholine Precursor in Isolated Hearts. Abdon, N. O. [*Ibid.*, 169–83.]

In the isolated rabbit heart (Langendorff preparation) there is a constant breakdown and formation of precursor (II) independent of vagal mechanisms. Part of the liberated acetylcholine (I) is immediately resynthesized to (II) and this reaction is favored by the presence of glucose. Part of the (I) is hydrolyzed to choline by the esterase and lost by diffusion. This loss is remedied by addition of choline to the bath solution, some of the added choline is synthesized to (II). The synthesis requires energy. Anaerobic conditions cause a rapid fall in (II). The (II) metabolism goes on without vagal influences. The liberation of (I) by vagal stimulation means that the resynthesis of (II) is retarded. It is probable that the accumulated (I) secondarily transmits the vagal impulses to other chemical or physical mechanisms in the heart. Atropine has no influence on breakdown or formation of (II). There is a correlation between (II) content and mechanical properties of the heart. Addition of choline to the bath fluid, which enables the heart to maintain its (II) content, has a positive inotropic effect. The (II) is not only the source of the vagal transmitter, but also appears to be necessary for contraction of cardiac muscle.

Liberation of Acetylcholine from the Precursor in Voluntary Muscles without Motor End Plates. Abdon, N. O. [*Ibid.*, 325–35.]

After section of the motor nerves to a voluntary muscle (gastrocnemius) there is a loss of the precursor (II); about a quarter is left after 3 weeks in the rabbit or after 4 weeks in the frog. The decrease in (II) develops considerably slower than the degeneration of motor end plates and is probably more closely connected with the general degeneration of the muscle cell. After complete degeneration of the motor end plates the remaining (II) is readily broken down to free acetylcholine upon direct stimulation. As is known, a part of the normal frog sartorius muscle contains about the same concentration of (II) as the neural region of the muscle. If the muscle is stimulated through the motor nerve until it is completely fatigued, the (II) is broken down in all parts of the muscle and not just in the immediate vicinity of the motor end plates. This suggests that (II) has some other function in addition to that of humoral transmitter from nerve to muscle.

L. E. Gilson (Chem. Abstr.).

Present Views on the Mode of Action of Acetylcholine in the Central Nervous System. Feldberg, W. [*Physiol. Rev.*, **25**, 596–642 (1945).]

All the evidence in favor of acetylcholine as a central transmitter has been obtained by methods previously applied to the peripheral nervous system. There is strong evidence that transmission across a number of synapses in the central pathway of autonomic and motor neurones occurs through the mediation of acetylcholine. However, there is little evidence for such transmission across many other central synapses, and there are facts difficult to reconcile with the theory of acetylcholine as a universal transmitter. The evidence for and against is presented. Acceptance or rejection of the theory depends on the relative value attached to the various findings and the kinds of evidence regarded as decisive. The main danger at present for the theory is not the difficulties opposing it, but the attempt to base it on single facts. If, however, we must assume that acetylcholine is not the universal transmitter, then our concept of its role in the central nervous system will be influenced greatly by views concerning transmission across synapses not affected by acetylcholine. Possibly a completely new approach must be found to settle the question. M. E. Morse (Psychol. Abstr.).

Pain of Organic Disease Relieved by Prefrontal Lobotomy. Freeman, W., and Watts, J. W. [*Lancet*, **250**, 953–955 (1946).]

Five cases (recurrent carcinoma, tabes dorsalis, thalamic syndrome, trauma to the cauda equina and hysterical contractures) are reported of prefrontal lobotomy

performed for the relief of pain. " The present cases indicate that when pain due to organic disease becomes unbearable and the fear of pain becomes as dreadful as the pain itself, prefrontal lobotomy is a desirable procedure. Psychosurgery alters the subject's reaction to pain without materially changing his ability to feel pain."
A. C. HOFFMAN (Psychol. Abstr.).

Indophenol Oxidase of the Central Nervous System. I. Photometric Quantitative Determination of Indophenol. Mitolo, Michele (Univ. Bari, Italy). [*Bull. soc. ital. biol. sper.*, **20**, 829–31 (1945).]

A mixture of solutions of α-naphthol, *p*-phenylenediamine, and NaOH was added to pulped nerve tissue and stirred from time to time for one hour at room temperature in diffused light. The indophenol formed was dissolved in 97 per cent. alcohol, shaken, filtered off after 25 minutes and determined photometrically.
HELEN LEE GRUEHL (Chem. Abstr.).

Histochemical Differentiation of Lipoids. III. Critical Evaluation and Control of the Petroleum Ether Method for Sudanophile Histolipoids. Giordano, Alfonso. (Univ. Pavia, Italy). [*Boll. soc. ital. biol. sper.*, **20**, 510–11 (1945).]

To determine whether all or only part of the sudanophile fatty substances resist the solvent action of petroleum ether during fixation, tissue sections were treated with petroleum ether for 5 days. After this period, filter paper dipped in the solvent, evaporated and stained with sudan, showed the presence of a moderate amount of such fats in the solvent. For the first 9 to 10 days in petroleum ether the non-ether-soluble histolipoids maintained their sudanophilia. After the 10th day it diminished. The coloration of the fats with sudan was moderate at the 25th day, weak at the 27th and disappeared around the 34th day.
HELEN LEE GRUEHL (Chem. Abstr.).

Two New Colloid Reactions for the Cerebrospinal Fluid. Palma, Eugenio de. [*Rev. asoc. bioquim. argentina*, **13**, 109–12 (1946).]

The results of the Wassermann, Takata-Ara, Lange, benzoin and mastic tests in 120 cases of general progressive paralysis, tables, neurolues, and infectious processes are compared with those of a test with a colloidal solution of 20 per cent. asafetida gum in absolute EtOH and with a filtered, colloidal solution of 10 gm. gum ammoniac in 100 c.c. absolute EtOH. F. FROMM (Chem. Abstr.).

A Method for the Preparation of the Acetalphosphatide of the Brain and its Aldehyde Component in the Form of Dimethylacetal. Klenk, E., and Schumann, E. [*Z. physiol. Chem.*, **281**, 25–8 (1944).]

Thirty gm. of finely divided glycerol phosphatide (I) is thoroughly dried in a vacuum over H_2SO_4. (I) was obtained by ether extraction of human brain. It was dissolved in 225 c.c. C_6H_6 and after the addition of 75 c.c. of a concentrated alcohol Na solution (5·4 gm. Na in 100 c.c. 99 per cent. alcohol) the solution was placed in a pressure bottle and heated for one hour in a boiling H_2O bath. After standing overnight at room temperature it is filtered with suction and centrifuged. It is concentrated in a vacuum and a mixture of acetalphosphatide (II) and Na salts of fatty acids are precipitated with acetone. The precipitant is resuspended in CH_3OH and the Na salts go into solution. (II) remains undissolved and is removed by filtering with suction. The yield of (II) is 4·5 gm. Details for the chemical analysis of (II) are given as well as separation and characterization of aldehyde mixture. R. J. ALLGEIER (Chem. Abstr.).

A Simple Method for the Preparation of Phosphorus-free Cerebrosides and also Concerning the Decomposition Product of the Fatty Acids Formed. XVIII. Report on Cerebrosides. Klenk, E., and Leupold, F. [*Z. physiol. Chem.*, **281**, 208–11 (1944); *cf. C.A.*, **37**, 2762³.]

The preparation of cerebron and kerasin is described. The recrystallized products were analyzed and compared with the theoretical C and H values of the pure substances. The nervone acid fraction was converted to the methyl ester and distilled. The physical characteristics of the various fatty acids obtained are tabulated. R. J. ALLGEIER (Chem. Abstr.).

Comparative Studies of the Histochemistry of Vitamin C and Gold in the Nervous System of Mammals. Sebruyns, Marcel (Univ. Gent.) [*Natuurw. Tijdschr.*, **26**, 83–90 (1944).]

In the gray matter of the brain the highest amount of Au and vitamin C (I) was found in the pyramid cells, but (I) is mostly localized in the Golgi apparatus, while Au is on the opposite pole of the cell. The neuroglia and endothelial cells of the brain are rich in (I) and Au while the white matter of the brain and cerebellum is poor. In the cerebellum the Purkinje cells are richest in Au and (I), both of them diffusely distributed in the cytoplasm. The spinal cord is richer in Au than in (I). The Au is distributed mainly in the anterior column, while (I) is found equally in the anterior and the posterior column. The ependyma cells of the ventricles of the brain and of the aquaeductus mesencephali are free of (I) and have little Au, while the cells of the wall of the spine are rich in (I). The ependymic cells of the spine are free of Au. The plexus choroideus has a great affinity for Au, while only small nuclei of (I) are found there. The cerebrospinal ganglions have a very low content of (I) and Au, the content of the vegetative nerves is appreciably higher. The neuroplasm and the fibrils of the peripheral nerves have neither (I) nor Au. The content of (I) and Au in the epiphysis is low. Conclusion: The content of (I) and Au is an indication of the metabolic activity of the cell. The antagonism of the local distribution of (I) and Au in some cells and its causes are discussed. F. FROMM (Chem. Abstr.).

Sphingomyelins: Their Action on Blood Cells, Particularly Lymphocytes; Their Share in the Nucleinate-like Action of the Ether-insoluble Fraction of Brain Lipoids. Tompkins, Edna H. (Vanderbilt Univ. School of Med., Nashville, Tenn.). [*Bull. Johns Hopkins Hosp.*, **78**, 57–77 (1946).]

Intravenous injections of beef brain protagon (ether-insoluble tissue lipoid fraction) affect circulating leucocytes in the same way as nucleotides. Sphingomyelins, extracted from this protagon, used in identical experiments exert characteristically different effects. A. EDELMANN (Chem. Abstr.).

Pyruvate Oxidation in Pigeon Brain Catalyzed by Fumarate. Long, C. (Queen's Univ., Belfast). [*Biochem. J.*, **40**, 278–83 (1946); *cf. C.A.*, **39**, 5262[5].]

The O consumption of dialyzed pigeon brain suspensions metabolizing pyruvate is stimulated by fumarate only in the presence of PO_4 ion and adenine nucleotide. The rate of disappearance of pyruvate is always decreased somewhat by this fumarate, but since fumarate is also oxidized to pyruvate this exactly balances the decrease in pyruvate disappearance, it is concluded that fumarate does not affect the rate of pyruvate utilization. Under the conditions of the experiments with fumarate PO_4 ion, and adenine nucleotide the ration between O and pyruvate indicates almost complete oxidation to CO_2 and H_2O. The fumarate apparently acts upon some intermediate product formed during pyruvate oxidation.
S. MORGULIS (Chem. Abstr.).

Findings in the Cerebrospinal Fluid. II. Technique and Systematic Interpretation of the Albumin-globulin Ratio in Cerebrospinal Fluids. Lange, Carl (N.Y. State Dept. Health, Albany). [*J. Lab. Clin. Med.*, **5**, 552–9 (1946); *cf. C.A.*, **40**, 1895[8].]

Current methods of determining the albumin-globulin ratio in cerebrospinal fluid are markedly inferior to those for blood. The ratio in cerebrospinal fluid varies widely because of the amount of blood proteins that may be present. In low protein concentration, which prevails in neurosyphilis, misleading results are obtained by using 50 per cent. saturation with $(NH_4)_2SO_4$ to precipitate the globulin. With MeOH it is possible to secure consistent results in normal fluids and to determine the ratio in various pathological conditions. Evaluation of the ratio should, however, be based on a systematic interpretation of the results of various laboratory tests. An attempt to correlate an isolated finding directly with clinical conditions is, as a rule, misleading. It should be interpreted as an integral part of a complete syndrome. The application of this basic principle indicates that determination of the albumin-globulin ratio in cerebrospinal fluids provides, chiefly, information regarding the permeability of the meninges, which is more conclusively indicated by other procedures. LEONARD KAREL (Chem. Abstr.).

Glucolysis in the Brain. Lenti, Camillo (Univ. Torino, Italy). [*Boll. soc. ital. biol. sper.*, **20**, 530–1 (1945).]

Rabbit brain was minced and extracted twice for 20 mintues with Ringer solution. The extracted brain tissue was then incubated in buffered Ringer solution saturated with N_2 and CO_2, deproteinized with CCl_3COOH, centrifuged, and concentrated. The formation of pyruvic acid from glucose by brain tissue was demonstrated by the Jowett and Quastel method (*cf. C.A.*, **31**, 4376[9]). Glucolysis in the brain was discussed. HELEN LEE GRUEHL (Chem. Abstr.).

Further Studies on the Biochemistry of Reflex Activity. I. *Phosphorylation of Glucides in the Spinal Cord During Reflex Activity. Mitolo, Michele (Univ. Bari, Italy).* [*Boll. soc. ital. biol. sper.*, **16**, 721–2 (1941).]

Freshly isolated toad spinal cord contained, in mgm. per cent., inorganic P 3·19, phosphocreatine P 7·6, adenyl pyrophosphate P 19·8, P of difficulty hydrolyzable esters 77·2 and total acid-soluble P 136·5. For spinal cord allowed to stand 4 hours without excitation the corresponding values were 32·5, 0·0, 19·3, 84·8 and 136·5. For spinal cord stimulated at frequent intervals for 4 hours the values were, 35·6, 0·0, 11·3, 61·6 and 108·5.

II. Behavior of the Organic Phosphorus of the Spinal Cord. [*Ibid.*, **17**, 114–15 (1942).]

Freshly isolated toad spinal cord contained 62–68 mgm. per cent. of organic P. After 4 hours' repose in presence of air it contained 68–75 mgm. per cent., and after 4 hours of reflex activity provoked by pinching every 5 seconds it contained 72–78 mgm. per cent. L. E. GILSON (Chem. Abstr.).

Nicotinic Acid of Normal Human Spinal Fluid. Cesaro, Angelo Nunziante (Univ. Siena, Italy). Boll. soc. ital. biol. sper., **17**, 103–5 (1942).]

Values found were 10–50, average 26γ, per 100 c.c.
L. E. GILSON (Chem. Abstr.).

The Relation of Basal Metabolic Rate in Students to the Results of Various Tests for Physical Fitness and Mental Staleness. Jung, Frederick T., Cisler, Lillian E., Maynard, Mason S. (Northwest. Univ. Med. School, Chicago). [*Quart. Bull. Northwestern Univ. Med. School*, **19**, 105–10 (1945).]

As indications of physical condition, hematocrit readings and lymphocyte percentage appeared to have many advantages over basal metabolic rate and Flack test (pulse response to increased intrathoracic pressure) score. Among 37 medical students tested in the first quarter of their freshman year, the b.m.r.'s were, on the average rather low: − 5·94 per cent. and − 6·31 per cent. at two test periods 3–7 days apart (averages obtained after exclusion of one improbable high value from each set). MARION HORN PESKIN (Chem. Abstr.).

Distribution of Intravenously Injected Fructose and Glucose Between Blood and Brain. Klein, J. Raymond, Hurwitz, Ruth, and Olsen, Norman S. (Univ. of Illinois, Coll. of Med., Chicago). [*J. Biol. Chem.*, **164**, 509–12 (1946).]

The authors studied the distribution of fructose and glucose between arterial blood plasma and brain tissue of anesthetized cats after injection of the sugars. The results support a hypothesis that the rate of transfer of fructose from blood to brain is insufficient to meet the metabolic requirements of brain.
KARL F. URBACH (Chem. Abstr.).

Effect of Strong Doses of Lecithin on Lipoid Metabolism. Capraro, V., and Pasargiklian, M. (Univ. Milano, Italy). [*Boll. soc. ital. biol. sper.*, **20**, 454–7 (1945).]

In dogs, doses of 0·23–1·05 gm. lecithin/kgm. body weight diminished the respiratory quotient and greatly increased lipoid consumption.
HELEN LEE GRUEHL (Chem. Abstr.).

Inhibition of Phosphorylation of Glucose in Mouse Brains by Viruses and Its Prevention by Preparations of Diphosphopyridine Nucleotide. Racker, E., and Krimsky, I. (New York Univ. Coll. of Med., New York, N.Y.). [*J. Exptl. Med.*, **84**, 191–203 (1946).]

Glucose utilization in homogenates of brains of mice infected with poliomyelitis virus is inhibited with glucose or fructose-6-phosphate as substrate; no inhibition occurs in the presence of hexose-diphosphate. Purified preparations of the Lansing and the Theiler FA strains of mouse encephalomyelitis virus invariably inhibit glycolysis when added to homogenates of normal mouse brain. A similar but much less consistent inhibition is provoked by adding high concentrations of non-neurotropic viruses (influenza and tobacco mosaic virus) to normal mouse brains. The magnitude of inhibition caused by the purified virus is a function of the virus concentration and depends on temperature and time of incubation of the virus-brain mixture. The inhibition of glycolysis in the brains of mice infected with Theiler FA virus and in normal brain-Theiler FA virus mixtures is prevented by the addition of preparations of diphosphopyridine nucleotide and glucose.

C. J. West (Chem. Abstr.).

The Vitamin C Content of Cerebrospinal Fluid in Natural Malaria. Wozonig, Helmut (Military Hosp., Mariahilf, Munich). [*Z. Immunitats.*, **105**, 411–16 (1946).]

In malaria tropica the loss of vitamin C in the urine is five or six times more than normal. The concentration of vitamin C in cerebrospinal fluid reflects the depletion of the body by this excessive loss in urine. During the second and third post-febrile weeks the vitamin C reserves are gradually restored. The vitamin C content of the organism influences erythropoiesis.

J. H. Lewis (Chem. Abstr.).

Changes in the Cerebrospinal Fluid and Blood in Vernal-estival Encephalitis. I. Changes in the Pressure, Morphological Composition, Proteins, and Colloidal Reactions in the Cerebrospinal Fluid in Acute Stages of the Disease. Mandel'boim, A. B. (Inst. Physiol., Acad. Sci. S.S.S.R., and Kazakh. Med. Inst., Alma-Ata). [*Byull. Eksptl. Biol. Med.*, **20**, *No.* 7/8, 45–8 (1945); *cf. C.A.* **39**, 5314[9].]

In tests of 32 patients with acute and chronic vernal-estival encephalitis, the cerebrospinal fluid was clear, colorless, and with significantly high pressure, which reduced with abatement of clinical symptoms. In 25 per cent. of acute cases there was a fibrous precipitant in sterile cerebrospinal fluid, not correlated with symptom differences. In serous meningitis there was moderate pleocytosis, with 30 per cent. of the cells polynuclear and 70 per cent. large or moderate-sized lymphocytes. In 4 acute cases, 4–5 days after onset of symptoms, 8–10 per cent. of the cells were large, plasmatic cells. In early stages of acute cases the globulin and total proteins of the cerebrospinal fluid were supranormal, but these became normal within two weeks. The gold sol (Lange), paraffin (Kafka), and sublimate-fuchsin (Takata-Ara) reactions showed regular changes in the amounts of colloids and their color reactions, and were highly sensitive indexes of biochemical changes in the organism. In all cases the Wassermann reactions of blood and cerebrospinal fluid were negative, a positive reaction only appearing later in luetic cases. The morphological and colloidal changes noted only in early stages of the disease are believed to originate with inflammation of the brain, which later abates.

II. Changes in Pressure, Morphological Composition, and Colloidal Reactions of Proteins in the Cerebrospinal Fluid in Chronic Stages of the Disease. [*Ibid.*, *No.* 9, 25–8.]

In chronic stages of vernal-estival encephalitis, in all syndromes except the hyperkinetic, the pressure of the cerebrospinal fluid was normal; in the latter case it was abnormally high. In chronic stages of encephalitis the quantity of ordinary elements in transparent and colorless cerebrospinal fluid was normal, the globulin reaction was always negative, the quantity of protein varied within normal limits, the Wassermann reactions of cerebrospinal fluid and blood were negative, and the colloidal reactions often gave curves of the type of lues cerebri. Changes in the colloidal reactions in the disease relate to continual disturbance of carbohydrate-salt exchange.

K. Starr Chester (Chem. Abstr.).

Acute Porphyria I. The Pathology of the Porphyrins and Identification of the Excretion of Uroporphyrin I. Prunty, F. T. G. (Tt. Thomas's Hosp. Med. School, London). [*Arch. Internal Med.*, **77**, 623–42 (1946); *cf. C.A.*, **40**, 3178[3].]

Two cases of porphyria are described, one being of the Waldenstrom "latent type," and the other a typical case of acute porphyria. Evidence of hepatic impairment was obtained with histologic signs of necrosis. Urinary and fecal excretions of coproporphyrin and of uroporphyrin were followed; also, of urinary porphobilinogen in one case. A type III uroporphyrin was isolated from the urine, which was shown upon further examination to be largely type I porphyrin. Type I uroporphyrin was isolated from the liver and feces and type I coproporphyrin from urine and feces. Moderate amounts of porphyrin were demonstrated in the kidneys by ultraviolet microscopic examination.

J. B. BROWN (Chem. Abstr.).

Gaseous Metabolism of the Brain of the Monkey. Schmidt, Carl F., Kety, Seymour S., and Pennes, Harry H. (Univ. of Pennsylvania). [*Am. J. Physiol.*, **143**, 33–52 (1945); *cf. C.A.*, **38**, 5556.[1]]

Cerebral O metabolism was measured *in vivo* in lightly anesthetized monkeys by measuring cerebral blood flow directly, while samples of cerebral venous and arterial blood were collected for subsequent analysis. Cerebral O uptake changed in the same direction as cerebral functional activity. The physiological range of cerebral O uptake was from about half to nearly double the resting normal value. Convulsions were followed by a period of depressed O uptake of the same order as that produced by a deeply narcotic dose of pentothal. Of the three possible correlations among (*a*) arterial-venous O difference, (*b*) blood flow, and (*c*) O uptake of the brain, that between (*a*) and (*b*) was poorest, that between (*a*) and (*c*) somewhat better, but that between (*b*) and (*c*) the best. Previous work indicating that cerebral circulation of the monkey is affected more consistently and strongly by changes in pO_2 than in pCO_2 was confirmed. E. D. WALTER (Chem. Abstr.).

Maintenance of Respiratory Activity in Stored Peripheral Nerve. Wortis, Joseph, and Lapouse, Rema (N.Y. Univ. Med. Coll., New York, N.Y.). [*Science*, **104**, 247 (1946).]

The proximal portion of the sciatic nerve of the adult white rat can be preserved aseptically in cotton-stoppered flasks in plain Krebs-Ringer solution at 5°5°. The O uptake of fresh nerve in a glucose medium was 0·104 cu. mm. O/hr./mgm. wet tissue, or approximately one-tenth that of whole minced brain. After preservation for 2 and 30 days the O uptake had dropped to 0·055 and 0·044 cu.mm./hr./mgm. respectively. Actually these values should be higher, since the wet weight of the tissue increases by 20 per cent. after immersion in a protein-free solution of the type used. BRUNO VASSEL (Chem. Abstr.).

Oxygen Supply and Oxygen Consumption in the Nervous System. Bronk, D. W., Davies, P. W., Brink, F., jun., and Larrabee, M. G. [*Trans. Am. Neurol. Assoc.*, **70**, 141–4 (1944).]

O tension in various regions of the intact nervous system was studied by recording the current through a circuit through a small metallic electrode in contact with the tissue under investigation and a non-polarizable electrode maintained at an appropriate difference of potential with respect to the first electrode (Davies and Brink, *C.A.*, **37**, 1145[8]). When this potential difference was 0·3–0·8v. the current depended on the electrolysis of O at the surface of the small electrode, and the intensity of current was a linear function of the O concentration and a lightly anesthetized cat, the O tension at various points at or below the surface of the cortex was found to be 5–100 mm. Hg; the values increased as the electrode approached arterioles or venules, and varied greatly with changes in respiration and circulation. In peripheral nerve fibers the rate of O consumption increased as Ca in the environment decreased. MARION HORN PESKIN (Chem. Abstr.).

Nervous System Dysfunction During and Following Oxygen-controlled, High-Altitude Indoctrination. Brown, Gordon A., Cronick, Charles H., Motley, Hurley J., Kokour, Elmer J., and Klingman, Walter O. [*Trans. Am. Neurol. Assoc.*, **70**, 113–17 (1944).]

When the program of high-altitude indoctrination at Maxwell Field was altered to meet 38,000 ft. standards, nervous system reactions occurred that were not observed in the former program of test flights up to 28,000 ft. At 18,000 ft. adequate O_2 by diluter-demand regulator was provided, and above 30,000 ft. 100 per cent. O_2 was used. Despite this, conditions of mild anoxia were present, since at 34,000-38,000 ft. the O_2 saturation decreases approximately 86 per cent. Severe dysfunction of the nervous system occurred not only during the period of great change in atmosphere pressure, but also after exposure to high-altitude conditions and return to ground level despite constant O_2 supply. The symptoms were not relieved by continued O_2 administration, but disappeared spontaneously. Among the reactions seen (occurring in a very small percentage of the 40,000 individuals studied) were: Disturbances in equilibrium, co-ordination, consciousness, and functions of the cortex and large sensory or motor tracts; disturbances suggestive of meningeal irritation, increased intracranial pressure, migraine-like features; disturbances of subcortical mechanisms associated with dyskinesia, hyperkinesia, aphasia; and minor reactions, e.g. scotoma, neuralgia, urticaria, syncope, headache, nausea. MARION HORN PESKIN (Chem. Abstr.).

A Specific Sympathomimetic Ergone in Adrenergic Nerve Fibers (Sympathin) and Its Relations to Adrenaline and Non-adrenaline. v. Euler, U. S. (Karolinska Inst., Stockholm). [*Acta Physiol. Scand.*, **12**, 73–97 (1946).]

The thoracic and lumbar sympathetic chain and the splenic periarterial nerves are very suitable for the preparation of extracts with sympathomimetic activity and contained 30–100 adrenaline equivalent per gm. (determined by blood pressure in cat). The active substance gives the catechol reactions with $FeCl_3$, but resembles noradrenaline more than adrenaline, from which it differs by its effect on blood pressure following ergotamine or dihydroergotamine, by its action on the non-pregnant cat uterus, pregnant rabbit uterus or isolated intestine (cat or rabbit), by its pupil-dilating action and, finally, by the fluorescence test. The active substance is found in greater amounts in the grey sympathetic than in the white rami; in low concentration in sympathetic ganglia, vagus and phrenic nerves and in various parts of the brain, but in fairly high concentration in the sensory nerves of the skin. After the degeneration of the post-ganglionic periarterial splenic nerves the content of the active substance in the spleen is greatly decreased. It is concluded that the active substance is identical with noradrenaline, and is the physiological transmitter of adrenergic nerve action in mammals. Extracts from frog hearts contain an active substance with properties of adrenaline. The ergone obtained from adrenergic nerves exerting the action of noradrenaline should be named sympathin, corresponding to Cannon and Rosenblueth's sympathin E (*cf. C.A.*, **27**, 4288), whereas sympathin (I) corresponds to adrenaline.

S. MORGULIS (Chem. Abstr.).

Vital Studies of the Neuroplasm. Smitten, N. A. [*Am. Rev. Soviet. Soviet Med.*, **3**, 414–25 (1946).]

The purpose of the experiments was to study the colloidal physical state and reactive properties of neuroplasm, after injury and excitation of the neurons. The nerve cells responded immediately to injury and stimulation by uniform structural shifts in the protoplasm and nucleus. The protoplasm of the living nerve cells represents a very soluble liquid, which is able under the influence of injurious factors to pass instantly into the state of a highly viscous gel. Along with gelation of the injured cell there occurred a shift of the intracellular reaction toward the acid range (change in the color tint of methylene blue and neutral red). Gelation and the associated acidosis of the neuroplasm indicate the paranecrosis of the nerve cells. W. R. HENN (Chem. Abstr.).

Endemic Pellagra in Northern Portugal. Monteiro, A. Moura, Coutinho, Herculano, Janz, G. J., and de Loureiro, J. A. (Faculty Med., Lisbon, Portugal). [*J. Hyg.*, **44**, 518–25 (1946).]

A clinical and biochemical study of a group of 30 patients from northern Portugal showed them to have a mild form of pellagra, with no sign of severe malnutrition or of associated deficiencies except dental abrasion caries and pyorrhoea. Their diet was chemically satisfactory in most respects. Apart from very low consumption of animal protein, the gross intake on calories, total protein, minerals, and vitamins, including nicotinic acid, was satisfactory. The syndrome was completely cured by nicotinic acid, but it was suggested that the main characteristic of a diet on which pellagra is likely to occur is not a shortage of nicotinic acid, but a lack of high-grade protein. A maize diet, satisfactory so far as calories and total protein are concerned, may produce pellagra, because maize proteins are deficient in certain essential amino acids. Other cereal diets may also produce pellagra if the general level of nutrition is very low. Such a syndrome can be cured either by very large doses of nicotinic acid without change in diet, or by a moderate dose accompanied by abundant animal protein.

JOHN T. MYERS (Chem. Abstr.).

Food Ration and Brain Work. Binet, L., and Duhamel, G. [*Bull. acad. med.*, **124**, 355–67 (1941); *Chimie and Industrie*, **47**, 255 (1942).]

In brain work, questions of quality are more important than quantity equivalence; but it is, nevertheless, work that represents a certain amount of energy which can be supplied only by food and the organic reserves, and the quality itself of the work depends to a notable extent on the quality of the food. In the intellectual worker the consumption of O is definitely increased, and the working of the brain is accompanied by an increase in the inorganic P content of the blood and in the renal excretion of P. Cerebral activity is generally accompanied by muscular contractions which ultimately increase the amount of energy expended. Brain fatigue is often complicated by insomnia and frequently by headaches due to accumulation of waste matter resulting from excessive working of the brain. Insomnia, in turn, tends to increase this fatigue.

A. PAPINEAU-COUTURE (Chem. Abstr.).

The Determination of Cerebral Blood Flow in Man by the Use of Nitrous Oxide in Low Concentrations. Kety, Seymour S., and Schmidt, Carl F. [*Am. J. Physiol.*, **143**, 53–66 (1945); *cf. C.A.*, **40**, 7355[8].]

A method is described applicable to unanesthetized man for the determination of cerebral blood flow by means of arterial and internal jugular blood concentrations of an inert gas during the first 10 minutes of its inhalation in low concentration. Sixteen determinations of cerebral blood flow on 11 human subjects by this method have been made, and suggest the feasibility of applying it to clinical investigation.

E. D. WALTER (Chem. Abstr.).

Metabolism of Nerve Tissue. V. Creatine and the Phosphocreatine Index: Methods. Ciaccio, C., and Capri, A. (Univ. Messina, Italy). [*Boll. soc. ital. biol. sper.*, **17**, 397–8 (1942); *cf. C.A.*, **33**, 1800[6].]

Known methods of determining creatine and its derivatives are discussed. For obtaining true creatine values the 3,5-dinitrobenzoate method of Langley and Evans (*C.A.*, **30**, 7607[3]) is preferred.

VI. Creatine and the Phosphocreatine Index of the (Toad) Spinal Cord under Various Conditions. [*Ibid.*, 399–401.]

Normally practically all of the creatine is present as phosphocreatine. Small doses of strychnine or stovaine do not change this condition; iodoacetate brings about the liberation of much free creatine.

VII. Phosphorylations in Homogenates Treated with Potassium Chloride. [*Ibid.*, 401–3.]

KCl, $NaHCO_3$, and glucose or glycogen were added to toad spinal cord homogenates. Some unidentified, readily hydrolyzable hexose and triose phosphoric esters were formed in the presence of KCl, but not in its absence.

L. E. GILSON (Chem. Abstr.).

Resorptive Action of Mustard Gas on the Central Nervous System. II. Changes in Subordinate Chronaxia after Applying Mustard Gas to the Skin. Levitina, G. A., and Palatnik, S. A. [*Farmakol. i Toksikol.*, **8**, *No.* 1, 42–6 (1945); *cf. C.A.*, **39**, 3074.[2]]

Mustard gas (I) on the skin of rabbits increases chronaxia of flexor digitorum muscles; chronaxia of extensor digitorum muscles remains constant. The amount and duration of change in chronaxia depend on dosage; after a mild dose of (I) the change gradually relaxes, but not after a lethal dose. Chronaxia of the tibial nerve is also increased. The tests show that (I) lessens the subordination of the peripheral to the central nervous system.

JULIAN F. SMITH (Chem. Abstr.).

Synthetic Antihistamines: New Test of the Part Played by Histamine in Physiology and Pathology. Chauchard, P. [*Rev. sci.*, 466–7 (1943); *Chimie et industrie*, **53**, 405 (1945).]

Histamine injection produces hypotension with vasodilatation, cardiac acceleration, vomiting, diarrhea and asthma, the last three owing to contraction of smooth muscles. Affections which long remained mysterious (urticaria, hay fever, etc.) are now attributed to liberation of histamine in the body. There is now available a compound with a remarkable, specific antihistamine action; it is benzyl (dimethylaminoethyl)-aniline or antergan (No. 2339 R.P.). It protects the guinea-pig against 50–60 lethal doses of histamine, and the therapeutic dose is 175 times smaller than the m.l.d. It abolishes all the effects of histamine, including the cutaneous reaction, and is used successfully in cases of urticaria, hay fever, pruritus, and migraine.

A. PAPINEAU-COUTURE (Chem. Abstr.).

The in vivo Inactivation by Cyanide of Brain Cytochrome Oxidase and Its Effect on Glycolysis and on the High-energy Phosphorous Compounds in Brain. Albaum, Harry G., Tepperman, Jay, and Bodansky, Oscar (*Edgewood Arsenal, Md.*). [*J. Biol. Chem.*, **164**, 45–51 (1946); *cf. Keilin, C.A.*, **23**, 3719; *Stotz, et al., C.A.*, **32**, 7934[4].]

Rats injected intraperitoneally with 5 mgm. NaCN per kgm. body-weight showed approximately 250 per cent. decrease in cytochrome oxidase activity in the brain. The brains of these cyanide-poisoned rats showed significant decreases in the concentration of glycogen, phosphocreatine, and adenosine triphosphate, and significant increases in the concentration of inorganic phosphate, lactic acid, hexose diphosphate, phosphoglycerate, and phosphopyruvate. These results indicate that anoxia in tissue induced by inactivation of cytochrome oxidase results in a shift from aerobic to anaerobic metabolism and a depletion of high-energy P compound.

LEONARD KAREL (Chem. Abstr.).

Hyperglucemia from Convulsive Seizures. Tolone, Salvatore (*Univ. Napoli, Italy*). [*Boll. soc. ital. biol. sper.*, **20**, 295–7 (1945).]

Convulsive attacks were produced in dogs by injections of metrazole or NH_4Cl. Immediately after the attack the arterial blood contained 0·80 gm./1 glucose; ½ hour after attack 1·28 gm.; at the 4th hour blood sugar was normal. Venous blood immediately after the attack contained 0·32 gm. glucose; ½ hour after attack 1·07 gm.; 1 hour after, 1·12 gm. The values diminished to normal at the 4th hour. On the basis of the arterio-venous blood-sugar relationship the cause of the hyperglucemia was attributed to a neuro-dynamic character of the drug used to induce the attack.

HELEN LEE GRUEHL (Chem. Abstr.).

A Transitory Decrease in Glucose Tolerance following Experimental Lesions in the Central Nervous System (*of Dogs*). *Keller, Allen D.* (*Baylor Univ., Waco, Texas*). [*Proc. soc. Exptl. Biol. Med.*, **62**, 318–19 (1946).]

L. E. GILSON (Chem. Abstr.).

Neuro-humoral Nature of the Myotonic Syndrome. Minz, B., and Passouant, P. (*Univ. Montpellier*). [*Compt. rend. soc. biol.*, **139**, 950–2 (1945); *cf. C.A.*, **40**, 2218.[2]]

Chiefly discussion. In myotonia the cholinesterase of the blood, spinal fluid, and especially the muscles is below normal and the acetylcholine of the muscles is considerably above normal.

L. E. GILSON (Chem. Abstr.).

The Model of Lillie in Connection with the Growth of the Nerve Fiber. Brummelkamp, R. [*Proc. Netherlands Acad. Sci.*, **48**, 360–8 (1945) (*in English*).]

Lillie's model (a stretched iron wire immersed in a HNO_3 solution) furnishes a clue toward explaining the physiological properties of nerve conduction, and may help in explaining the growth of nerve fiber. The powers which influence the growth of nerve fibers may be considered as powers in an electric field, and Lillie's model and the nerve fiber correspond in having the same spatial pattern. The phenomenon of neurobiotaxis can be correlated with results secured using the model.

J. E. WEBSTER (Chem. Abstr.).

Sympathetico-adrenal Discharges in Hypophysectomized Rats. Safford, H., Wells, L., and Gellhorn, E. (*Univ. of Minnesota, Minneapolis*). [*Am. J. Physiol.*, **146**, 386–8 (1946).]

The hyperglycemic response to adrenaline secreted under conditions of anoxia, or to its injection, is present for several days after hypophysectomy. This indicates that the hypophysis plays no direct role in sympathetico-adrenal reactions. However, this effect disappears in the course of several weeks following hypophysectomy, although the fasting blood-sugar level is not significantly altered. This failure of adrenaline to cause hyperglycemia is not explainable on the basis of the regressive changes in thyroid and adrenal cortex, nor is it due to alterations in absorption, since it is observed under conditions of anoxia, when adrenaline is secreted into the blood stream as well as after intraperitoneal injection of adrenaline.

E. D. WALTER (Chem. Abstr.).

The Effect of Hypoglycemia and Age on the Glycogen Content of the Various Parts of the Feline Central Nervous System. Ferris, Shirley, and Himwich, Harold E. (*Union Univ., Albany, N.Y.*). [*Am. J. Physiol.*, **146**, 389–93 (1946).]

The concentrations of glycogen in various parts of the central nervous system of newborn and 6·5-week-old kittens subjected to intense hypoglycemia were determined. In the newborn animal the more caudal parts showed the greater fall in concentration. The spinal cord was depleted most, followed in order by the cerebellum, medulla, thalamus, and corpora quandrigemina, while the cerebral cortex showed the smallest decrease. In the 5–8-week-old kittens the higher parts exhibited a greater decrease. The glycogen in the cerebral cortex was depleted to the greatest extent, followed by the corpora quadrigemina and thalamus, while the concentrations in the cerebellum, medulla oblongata and cord were not changed significantly during hypoglycemia. The higher areas suffered smaller impairments than in the adult, while the phyletically older regions were not depleted, and in this way differ from the newborn. E. D. WALTER (Chem. Abstr.).

Localization of the Two Phosphatases in the Central Nervous System. Carandante, Giovanna (*Univ. Haples*). [*Boll. soc. ital. biol. sper.*, **16**, 443–4 (1941).]

L. E. GILSON (Chem. Abstr.).

Water Intoxication and the Electroencephalogram. Gellhorn, Ernst, and Ballin, H. M. (*Univ. of Minnesota, Minneapolis*). [*Am. J. Physiol.*, **146**, 559–66 (1946).]

A study of the changes in brain function by means of the electroencephalogram during progressing water intoxication. E. D. WALTER (Chem. Abstr.).

Pellagra: A Study in Human Nutrition. The Multiple-factor Principle of the Determination of Minimum Vitamin Requirements. Frazier, Ernestine I., and Friedemann, Theodore E. (*Northwestern Univ. Med. School, Chicago*). [*Quart. Bull. Northwestern Univ. Med. School*, **20**, 24–48 (1946).]

Dietary records obtained by Goldberger and others on 1,863 human subjects have been recalculated for protein, thiamine, riboflavin and nicotinic acid contents. It is concluded that the minimum daily intake of nicotinic acid needed in a marginal diet containing corn products is about 7·5 mgm. This can be decreased to about 5 mgm. by a high level of good quality protein, riboflavin, or other dietary factors in green vegetables. If any of the latter three classes of ingredients are low, the nicotinic acid requirement is increased. On a corn-containing diet supple-

mented by large amounts of milk, or on a diet without corn, the minimum nicotinic acid requirement is about 4 mgm./day. A liberal diet with generous amounts of green vegetables and good proteins (meat, milk, eggs) is the best safeguard against pellagra. MARION HORN PESKIN (Chem. Abstr.).

Causes of Experimental Gastroprival Pellagra. III. Therapeutic Experiments on Dogs with Preventative Parenteral Administration of Vitamin B_6 Alone or Together with Vitamin B_1, Lactoflavin, and Nicotinic Acid. Petri, Svend, Norgaard, Flemming, Trautner, Kjeld, and Kiaer, William (Kommunehosp., Patholog. Inst., Copenhagen). [*Acta Med. Scand.*, **117**, 90 (1944); *Chem. Zentr.*, **11**, 233 (1944); *cf. C.A.*, **40**, 1165.]

Studies were made on dogs from which the stomach and the beginning of the duodenum (Brunner glands) had been extirpated. In addition to an otherwise normal diet, the first group (two animals) received the following total amounts of vitamins per animal over a period of 202 days: Vitamin B_1 251, lactoflavin 90·9, nicotinic acid 720 and vitamin B_6 per animal over a period of 384 days. Clinically all the animals appeared to be ill, but none died. The animals showed a retardation of growth, emaciation, certain changes in the blood picture, and other phenomena; in only one animal were slight degenerative changes in the central nervous system observed. The symptoms of pellagra previously observed in such experimental animals (neuro-cutaneous symptom complex) were decidedly influenced by parenteral treatment with vitamin B_6, as the clinical findings indicated. In particular, the treatment prevented changes in the central nervous system and a decrease in the number of red blood corpuscles, and partially prevented changes in the pelts of the animals. The simultaneous administration of the other vitamins appeared at most to have only a supplementary effect on some of the symptoms. Vitamin B_6, therefore, appears to be the only one of the vitamins so far tested which has a definite therapeutic effect on experimental gastroprival pellagra. From these and earlier results it must be assumed that the fundus plays an important role in the behavior of vitamin B_6 in the organism. M. G. MOORE (Chem. Abstr.).

Further Tests on a Fit-producing Dog Food. Morgan, Agnes F., and Groody, Mary. [*J. Am. Vet. Med. Assoc.*, **108**, 179–83 (1946).]

A baked cereal dog food previously found to cause severe running fits in dogs within 5 to 19 days was found by rat growth to be deficient in protein, since its growth value was improved by the addition of 5 casein, 20 wheat gluten, or 20 per cent. baked wheat gluten, but not by the addition of 1 per cent. yeast extract of high vitamin content. RACHEL BROWN (Chem. Abstr.).

The Pseudo-cholinesterase of Serum and the True Cholinesterase of the Red Corpuscles. Casier, H., and Delaunois, A. L. (Univ. Gand, Belgium). [*Experientia*, **2**, 180–2 (1946) (*in French*).]

The sensitive method previously described (*C.A.*, **40**, 4759[2]) showed that the pseudo-cholinesterase activity of dog serum gave higher values with a solution of acetylcholine (I) of 250 mgm. per cent. than with one of 4 mgm. per cent. Similarly tested, the true cholinesterase activity of a solution of hemolyzed cells equivalent to 0·2 c.c. of washed corpuscles was highest for the first 3–5 minutes with a 200 mgm. per cent. solution of I, after which the rate decreased to a slower but constant rate. With a 100 mgm. per cent. solution of (I) the initial period of greater activity lasted about 2 minutes, with the 4 mgm. per cent. solution about 10 minutes. The difference in rate was attributed to the choline liberated. No such rate change was noted with a 50 mgm. per cent. solution. The cholinesterase activities of both serum and corpuscles were inhibited *in vivo* and *in vitro* by prostigmine. C. P. BERG (Chem. Abstr.).

Determination of Nicotinic Acid and Nicotinamide in Cerebrospinal Fluid. Cazzullo, C. L. (Univ. Milano, Italy). [*Boll. soc. ital. biol. sper.*, **16**, 755–7 (1941).]

Methods are discussed. For human spinal fluid the average is 16–20 γ per cent. of total nicotinic acid, of which most is in the form of the amide.

L. E. GILSON (Chem. Abstr.).

Further Studies on the Biochemistry of Reflex Action. Part III. Creatine in the Central Nervous System and Reflex Action. Mitolo, M. [*Fisiol. e Med.*, 9, (1943).]

In *Bufo vulgaris* the creatine content of the axon is compared in the living and dead animal under conditions of apparent quiet and reflex activity. The possibility of a correlation between the glycolytic process and reflex behavior is considered. M. STUPARICH (Psychol. Abstr.).

Electrical Processes in the Rabbit's Cortex During the Development of a Conditioned Defense Reflex in Response to a Rhythmic Stimulation. Livanov, M. N., and Poliakov, K. L. [*Bull. Acad. Sci. U.R.S.S., Ser. Biol., No.* 3, 286–307 (1945).]

A conditioned defense reaction was established in the rabbit, using as CS a rhythmic stimulus with a frequency of 3 stimulations per second, and, as US, shock to the hind leg presented in a corresponding rhythmic pattern. Simultaneous EEG records were taken. Long before the CR developed, oscillations appeared in the EEG record, having either the frequency characteristics of the stimulus or else a frequency of one half the stimulus frequency. Sample records showing this phenomenon are reproduced. It was noted that these oscillations appeared spontaneously outside the conditioning situation, and in response to the presentation of stimuli like CS. The appearance of the CR on about trial 50 was accompanied by the increase in EEG oscillations, however elicited. But by about trial 70, when the CR was firmly established, the 3 per second activity appeared only in response to CS. Whenever EEG activity of one half the stimulus frequency appeared, pneumograms revealed that the breathing rate approximated that of the EEG. Subsequently it was shown that sound, pain, and other stimuli which elicited the defense reflex also produced the brain wave pattern, as did spontaneous movements which duplicated the CR. Finally it was shown that these rhythms disappeared with the development of differentiation, somnolent states, and in extinction. On the basis of these results the authors suggest that conditioning the defense reaction to a flickering stimulus is dependent on the production in the cortex of periodic changes in the excitability of the motor areas.

G. A. KIMBLE (Psychol. Abstr.).

Nerve as a Model Temperature End Organ. Bernhard, C. G., and Granit, R. [*J. gen. Physiol.*, **29**, 257–65 (1946).]

Rapid cooling of mammalian nerve initiates a discharge which is preceded by a local temperature potential, the cooled region being electronegative to a normal portion of the nerve. Similarly, heating the nerve locally renders the heated region electronegative with respect to a region of normal temperature, and a discharge may be initiated from the heated region. The mechanism underlying these " generator potentials " is regarded as the prototype for temperature end organs.

P. KELLAWAY (Psychol. Abstr.).

An Attempt to Analyze the Mechanism of Sleep in Hibernation. Kayser, C. [*Ann. Physiol. Physicochim. biol.*, **16**, 313–72 (1940).]

The external factor responsible for hibernation is reported to be a lowering of the temperature of the environment to between 5° and 13° C. The internal factor appears to be a polyglandular deficit resulting from an involution of the hypophysis. The first behavioral signs of hibernation, food hoarding, and nest building appear when the anterior hypophysis begins involution. Hypophysectomized hamsters placed in an environment of 8° C. showed the behavioral manifestations, but sleep did not follow. The glandular changes, together with sympathetic dysfunction, appear to produce sleep through a disturbance of the thermo-regulatory function. (Psychol. Abstr.).

2. Pharmacology and Treatment.

Ether Concentration iv Blood and Brain in the Early Stages of Ether Narcosis. Dybing, Fred, and Dybing, Ottar (*Veterinary Coll., Copenhagen*). [*Acta Pharmacol. Toxicol.* (*Copenhagen*), **1**, 270–9 (1945) (*In English*).]

During ether narcosis in rabbits, with Et_2O–O_2 mixtures with high concentrations of ether, the ether content of the blood was 0·143–0·158 per cent. and of the brain 0·167–0·187 per cent. at the moment of respiratory and cardiac paralysis

during short periods of narcosis (10–15 minutes). These levels were not significantly raised by prolonging the period to 45 minutes. In experiments on rats with inhalation of ether in known concentrations, a picture of the ether diffusion in the early stages of narcosis was obtained by parallel determinations of ether in blood, brain and muscle after ether administration for 0·5–25·0 minutes. The results are shown as graphs. After 5 minutes the maximum concentrations were, blood 0·077, brain 0·108, and leg muscle 00·46 per cent.; after 25 minutes the maximum values were 0·13, 0·14 and 0·09 per cent. respectively.

L. E. GILSON (Chem. Abstr.).

Respiration of Peripheral Nerves in the Presence of Sulfonamides in vitro. Maleci, O. (Univ. Padova, Italy). [*Boll. soc. ital. biol. sper.*, **17**, 716–17 (1942).]

The respiration of guinea-pig nerve was decreased by a 0·3 per cent. solution of sulfanilamide or a 0·6 per cent. solution of sulfathiazole, but not by solutions of half these concentrations. It is doubtful if the concentrations attained *in vivo* by sulfonamide therapy have any effect on the nervous system.

L. E. GILSON (Chem. Abstr.).

Fixation of Salts of Procaine Base by Brain Powder and by Nerve Tissue in vitro. Regnier, Jean, Bazin, Suzanne, and Fere, Jacqueline (Univ. Paris). [*Compt. rend. soc. biol.*, **139**, 939–40 (1945); *cf. C.A.*, **40**, 4434.[2]]

Dried brain and fresh nerve tissue were soaked in diluted solutions of procaine phenylpropionate, isobutyrate, acid citrate and hydrochloride and the amounts fixed by the tissues determined. L. E. GILSON (Chem. Abstr.).

The Relief of Tic Douloureux with Large Doses of Ferrous Carbonate. Davidoff, Leo M. [*Trans. Am. Neurol. Assoc.*, **70**, 176 (1944).]

In confirmation of an observation made by Benjamin Hutchinson in 1822, Davidoff has found that 4 gm. $FeCO_3$ twice daily relieves at least 50 per cent. of the pain of paroxysmal trigeminal neuralgia.

MARION HORN PESKIN (Chem. Abstr.).

The Vulnerability to Drugs of Various Cortical Regions as Evidenced by the Electroencephalogram. Finesinger, Jacob E., and Brazier, Mary A. B. [*Trans. Am. Neurol. Assoc.*, **70**, 151–4 (1944).]

Na amytal, tried in 17 subjects, and Na pentothal, tried in 20, consistently caused high-voltage fast-activity (waves of 23–28 cycles/second and voltages above 50 μv.) in the electroencephalogram, after intravenous administration. The effects of the drugs appeared first in recordings from the frontal lobes, then in those from the parietal regions, finally in those from the occipitals. Regression was in the opposite direction. The presence of excess O_2 in the inspired air decreased the effect of the barbiturates; intravenous injection of Na succinate, which acts as an extra substrate carrying more O_2 to the cells for metabolism, had the same effect as inspired O_2. MARION HORN PESKIN (Chem. Abstr.).

A Cycle of Morphine Addiction; Biological and Psychological Studies. Part II. Psychological Investigations. Brown, R. R. [*Publ. Hlth. Rep., Wash.*, **61**, 37–53 (1946).]

Psychological and psycho-physiological studies were made on two post-addicts before, during and following the developments of tolerance to and dependence on morphine. Both patients were studied every other week over a 2-year period. The following measurements were taken: Johnson code learning, sensitivity to electric current, steadiness, tapping speed, continuous subtraction, Scripture's block oscillations, immediate and delayed recall of nonsense syllables, voice- and hand-response time and physiological reactions (blood pressure, pulse rate, skin conductance, and respiration) to word stimuli. It was found that addiction to morphine was associated with reduction in efficiency, with the possible exception of steadiness in the case of one subject. The amplitude of the electrodermal response to word stimuli was significantly reduced following the administration of morphine, whereas the blood-pressure response to the same stimuli was increased. Statistically significant differences between indifferent and disturbing words were found for both patients with respect to electrodermal response, respiratory changes and

voice-response time. Morphine decreased the response difference between these two types of word stimuli. The suggestion was made that morphine may act to ameliorate the disturbing effects of emotional stress.

C. P. FROEHLICH (Psychol. Abstr.).

Resorptive Action of Mustard Gas on the Central Nervous System. III. Mechanism of the Action of Mustard Gas on Cerebral Cortex after Application to the Skin. Levitina, G. A., and Palatnik, S. A. [*Farmakol. i Toksikol.*, **8**, *No.* 6, 32–5 (1945); *cf. C.A.*, **40**, 6172⁶.]

Application of mustard gas (I) to devascularized, denervated rabbit ears, and of mustard oil (II) and croton oil (III) to dorsal and aural rabbit skin, showed that (I) on the skin acts on cerebral cortex through the vascular system, not by stimulating peripheral dermal nerve ends. Effects were measured by determining cerebral cortex chronaxia. The reaction was not the same with (I) as with (II) and (III); it is known that (II) acts by stimulating peripheral nerve ends.

JULIAN F. SMITH (Chem. Abstr.).

Influence of Soviet Synthetic Antimalarials (Acriquine and Plasmocide) on the Nervous System. Shteinberg, A. D. [*Farmakol. i Toksikol.*, **8**, *No.* 4, 6–9 (1945).]

A single wetting with plasmocide (I) solution at 5 p.p.m. noticeably decreases the condition of frog sciatic nerve. For a like effect with acriquine (II) the concentration must be about 1,000 p.p.m. Whereas (I) prolongs the latent reflex period in canine spinal cord, (II) has only a slight effect. While (I) kills by respiratory paralysis, (II) kills by cardiac paralysis. Again, (I) has a slow but pronounced febrifuge action, (II) has scarcely any. To protect the central nervous system (II) may be given along with a bromide, e.g. 2 per cent. aqueous NaBr.

JULIAN F. SMITH (Chem. Abstr.).

Influence of Chinese Schisandra Fruits on Spinal Centers. Pozdyankov, F. E. [*Farmakol. i Toksikol.*, **8**, *No.* 4, 15–19 (1945).]

Finely powdered schisandra fruits, dose 0·5–2 gm./kgm. *per os* or by direct introduction into the stomach, stimulate the spinal reflexes of posterior extremities in dogs after low total chordotomy. Motor activity and general behavior are not significantly changed. Probably similar neurodynamic changes in anterior parts of the body require a different technique, e.g. conditioned reflexes, chronaxia, ergographic tests, or the like. A larger dose (3 gm./kgm.) causes hyperkinesis, emotional stimulation, heightened posterior spinal reflexes and retarded urination and defecation in 1–2 hours. Smaller doses take 4–6 hours; symptoms last 4–20 hours. Schisandra fruits appear to be suitable for use in stimulants for the central nervous system.

JULIAN F. SMITH (Chem. Abstr.).

Toxicological Studies on Mescaline. Tarsitano, F. (Univ. Napoli, Italy). [*Boll. soc. ital. biol. sper.*, **20**, 762–3 (1945).]

Tests were carried out on the viscera of dogs previously injected subcutaneously with mescaline sulfate. The most sensitive qualitative method for the identification of mescaline in the viscera was found to be the Bouchardat method. The Mayer reaction was almost as sensitive, followed in order of diminishing sensitivity by the Dragendorff, picric acid and $HgCl_2$ tests. In the viscera the greatest portion of the mescaline was found in the liver and kidney, much less in the brain, and no appreciable amount in the blood and lungs.

HELEN LEE GRUEHL (Chem. Abstr.).

Vitamin B_1 Content of the Blood During Insulin Shock. Bom, Fr., and Petersen, W. Gottlieb. [*Nord. Med.*, **25**, 393–5 (1945).]

By means of a biological method (Lehmann and Nielsen's modification of Schoppfer's phycomycetes test) the thiamine content of the blood was determined in 34 patients who had been given insulin shock therapy. The determinations were made partly while the patients were fasting, partly during the shock. The average fasting blood thiamine value was found to be 8·85 ± 0·30 γ per cent., which agrees with Lehmann and Nielsen's normal value of 9·0 γ per cent. During the shock all the patients showed an average increase in the thiamine value of 1·48 ± 0·19 γ per cent., and a positive correlation was demonstrated between this increase and

the rise in the white blood count, which amounted to $+ 0{\cdot}5 \pm 0{\cdot}2$ ($t = 2{\cdot}4$). This increase in the amine content is accordingly assumed to be largely due to the leucocytosis during shock. The present studies have thus been unable to confirm the hypothesis advanced by various authors that an absolute, perhaps temporary, vitamin B_1 deficit occurs during the insulin shock. The complications encountered in these patients (spasms, clonic convulsions, and difficult in awakening) were very slight. Only in two cases of such complications, however, was there a suggestion of subnormal thiamine values (6·1 and 6·7 γ per cent. respectively), nor were the average fasting values lower in patients with such complications. No connection between the frequency of such complications and possible low fasting thiamine values could thus be demonstrated. The patients with such complications seem, on the other hand, to present a somewhat smaller increase in thiamine and white blood counts than do patients without complications. This suggests that the tendency to complications, among other things, possibly may be due to a failure in the mobilization of thiamine and in the leucocytosis, but the smallness of the present material allows no definite conclusions in this direction.

H. KRINGSTAD (Chem. Abstr.).

The Relationship Between Cholinesterase Inhibition and the Pharmacological Action of Diisopropyl Fluorophosphate (DFP). Koelle, George B., Gilman, Alfred, and Binzer, Bertha D. (Edgewood Arsenal, Md.). [*J. Pharmacol.*, **87**, 421–34 (1946).]

Rats, dogs, and monkeys appeared to show no physiological abnormality when the cholinesterase of the blood and tissues was reduced to a small fraction of its normal activity by DFP. The signs associated with further reduction are described. Determinations of serum and red cell cholinesterase inhibition following administration of DFP do not provide accurate estimates of the activity of the enzyme in the tissues, except perhaps during the period immediately following a single dose. No deterioration was detected in solutions of DFP in peanut oil after autoclaving for one hour or storage at room temperature for one year. The ratio of effective intramuscular to oral dosage for DFP in peanut oil was found to be approximately 1 : 4 in monkeys and human subjects. L. E. GILSON (Chem. Abstr.).

Influence of Dimethylaminoethyl Benzhydryl Ether Hydrochloride (Benadryl) upon Normal Persons and Upon those Suffering from Disturbances of the Autonomic Nervous System. McGarvack, Thomas Hodge, Elias, Herbert, and Boyd, Linn J. (N.Y. Med. Coll., New York, N.Y.). [*J. Lab. Clin. Med.*, **31**, 560–74 (1946); *cf. Curtis and Oivens, Univ. Hosp. Bull., Ann Arbor*, **11**, 25 (1945); *Loew et al., C.A.*, **39**, 2571[8], 2812[5].]

The effects of dimethylaminoethyl benzhydryl ether HCl (I) were studied in normal persons and in those with widely diverse diseases, most of which were associated with some disturbance of the autonomic nervous system. Basal metabolism, circulation time, renal function, erythrocyte and leucocyte counts, hemoglobin, differential white counts, hematocrits, blood urea N, creatinine, glucose, proteins, cholesterol, alkaline phosphatase, icteric index, van den Berg reaction, and cephalin flocculation were not abnormally altered. Orthostatic hypotension was observed in some subjects and a slight elevation in pulse rate in others, although the majority showed no circulatory changes. Pupillary dilatation occurred when (I) was instilled into the conjunctival cavity. Vital capacity and respiratory rate were uninfluenced except in asthma. Capillary permeability was moderately decreased after prolonged treatment with large doses. In some subjects, mild transient reactions resulted from the intravenous injection of (I). Salivary secretion was not influenced, but both free and total gastric acidity were strikingly decreased. The mouth-anus time was not altered in normal subjects. Abdominal pain was relieved in 10 of 17 patients. The degree of reduction in the size of the histamine skin reactions was roughly proportional to the daily dose of drug administered. For a brief period after the drug was discontinued the response to histamine was increased. Definite therapeutic effect was obtained from the drug in certain gastro-intestinal neuroses, asthma, functional dysmenorrhea, and dermal allergy. Untoward reactions to (I) were of mild degree and of infrequent occurrence. They included dizziness, blurring of vision, weakness and somnolence. Each disappeared promptly upon discontinuing the drug or decreasing the dose.

L. KAREL (Chem. Abstr.).

General Systemic Actions of Diisopropyl Fluorophosphate (DFP) in Cats. Modell, Walter, Krop, Stephen, Hitchcock, Philip, and Riker, Walter, F., jun. (Cornell Univ. Med. Coll.). [J. Pharmacol., 87, 400–13 (1946).]

In cats DFP produces the following general effects: motor unrest, muscular twitching, tremors, ataxia, weakness, pilomotor stimulation, respiratory stimulation, salivation, defecation, diarrhea, convulsions, respiratory depression, and death. Thus the symptoms are both muscarinic and nicotinic. Death appears to result from a combination of respiratory and circulatory failure. In normal non-protected cats the duration of symptoms is usually brief, recovery or death occurring in a few hours. Cats which have received very large doses of DFP and have been protected by other agents against their acute lethal effects frequently develop a permanent injury with nicotine-like symptoms. The duration of action is only partly due to the persistence of the drug; cats which have received doses and are free of symptoms are sensitized to subsequent doses. Specimens of DFP vary in potency and lose potency fairly rapidly in aqueous solutions. The LD 50 of two specimens were 3·6 mgm./kgm. and 1·7 mgm./kgm. respectively. DFP increases the tone and the rate and amplitude of contractions of the gut—effects which are abolished by atropine and adrenaline. In large doses it sometimes slows the heart. It exerts no immediate direct action on blood pressure. Adrenaline produces its typical effects on heart and blood pressure after DFP. DFP markedly sensitizes the vasodepressor response to acetylcholine. It has no effect on red and white corpuscle count, hemoglobin, blood non-protein N, and blood creatine. It causes prolonged miosis after conjunctival application, and sensitivity to miotic stimuli after intravenous injection. Inactivation of cholinesterase is the major action of DFP, but there are other secondary actions which play a part in its toxic effects.

L. E. Gilson (Chem. Abstr.).

The Effect of Ethanol, Methanol, Paraldehyde and Acetone on the Pressure of the Cerebrospinal Fluid of the Dog. Bedford, T. H. B. (Manchester Univ.). [Brit. J. Pharmacol. Chemotherapy, 1, 62–4 (1946).]

These compounds have no direct effect on the cerebrospinal fluid pressure of the anesthetized dog, when given by inhalation or intravenously.

Wm. M. Govier (Chem. Abstr.).

Action of Veratrine Sulfate and of Sodium Thiocyanate on the Superior Cervical Sympathetic Ganglion of the Cat. Caldeyro, R., and Bacq, Z. M. (Facultad med. Montevideo). [Arch. soc. biol. Montevideo, 12, 253–60 (1945) (Pub. 1946).]

Veratrine sulfate (I) applied directly on the superior cervical ganglion of the cat has an inhibitory effect on the transmission of the nerve impulse. This action is reversible, and proportional to the concentration of (I). NaCNS has no effect under the same conditions, but after a series of quick stimuli (300 per minute) (I) and NaCNS block the ganglion partially for 3–4 minutes. This blocking is also reversible.

F. Fromm (Chem. Abstr.).

Stimulation of the Central Nervous System by Curare (Intocostrin). Cohnberg, Rosellen E. (Washington Univ., St. Louis, Mo.). [J. Lab. Clin. Med., 31, 866–77 (1946).]

Intocostrin injected subcutaneously, intramuscularly, intraperitoneally, or intravenously into rats, mice, guinea-pigs, rabbits or cats produced clonic convulsions and hyperexcitability in addition to partial curarization. Species in which the stimulatory action predominated (namely, rats, guinea-pigs, and mice) were killed by smaller doses than those in which curarization was the chief effect. Since d-tubocurarine was the active principle of intocostrin, experiments were also made with it. Injection of either drug into the lymph sacs of frogs produced muscular relaxation, but injection into the cerebrospinal canal produced convulsions. In all animals death was due to asphyxia, which in turn was due to a combination of a blocking of the neuromuscular junctions of the respiratory systems with a central stimulation. Sodium amytal and cyclopropane decreased convulsions caused by sodium amytal or d-tubocurarine. Sodium amytal, however, in combination with intocostrin was toxic to rats. Oxygen administration or artificial respiration decreased asphyxia, but did not control convulsions.

N. M. Payne (Chem. Abstr.).

Mechanism of Action of Convulsant Drugs. Robuschi, Luigi (Univ. Bologna, Italy). [*Boll. soc. ital. biol. sper.*, **16**, 557–8 (1941).]

L. E. GILSON (Chem. Abstr.).

A New Method for Determining the Relative Potency of Hypnotic Drugs. Simon, L. (Univ. Pisa, Italy). [*Boll. soc. ital. biol. sper.*, **16**, 561–2 (1941).]

The method consists of determining the maximum dose of the hypnotic (administered by any appropriate route) that will not save the life of a rabbit given one minimum lethal dose of strychnine nitrate (0·6 mgm./kgm.) subcutaneously.

L. E. GILSON (Chem. Abstr.).

Influence of Some Analeptics on the Sechenov Inhibition. Zakusov, V. V. [*Farmakol. i Toksikol.*, **8**, *No.* 5, 3–6 (1945).]

Pentamethylenetetrazole (corazole (I), coramine (II), $PhC(NH_2)Me_2$ sulfate (phenamine (III)), and strychnine (IV) may weaken, but do not halt, the Sechenov inhibition of cerebral stimuli in the central nervous system by crystallized NaCl. Neither does crystallized NaCl halt convulsions caused by (I), (II), (III) or (IV). Inactivity of (I), (II), (III) and (IV) toward the Sechenov inhibition is attributed to excessive stimulation of the thalamic centers of pain sensitivity. The tests were made with frogs, using 50–100 per cent. of the convulsion-inducing dose of (I), (II) or (IV). The dose of (III) which does not cause convulsions in frogs was 4 per cent. of the lethal dose. JULIAN F. SMITH (Chem. Abstr.).

Tetrazole Derivatives. I. Some Pharmacological Properties of Aliphatic Substituted Pentamethylenetetrazole (Metrazole) Derivatives. Gross, E. G., and Featherstone, R. M. (State Univ. of Iowa, Ames). [*J. Pharmacol.*, **87**, 291–8 (1946).]

The effects of the 25 compounds in experimental animals are described. Most of them exhibited pharmacological effects similar to those of the parent compound (metrazole) and none appeared to possess any advantages over metrazole.

II. Some Pharmacological Properties of 1,5-disubstituted Tetrazoles. [*Ibid.*, 299–305.]

Only TT 020, 21, 27, 79 and 18 had an analeptic action or produced convulsions. Some of the others were slightly sedative. The optimum structural factors for maximum stimulatory action appear to be the presence of a relatively large saturated cyclic or open chain aliphatic group in position 1 and a small group, preferably methyl, in position 5. L. E. GILSON (Chem. Abstr.).

Action of Metrazole, Associated with Eserine, Acetylcholine, and Adrenaline, on the Isolated Frog Heart. Cera, Brizio (Univ. Genova, Italy). [*Boll. soc. ital. biol. sper.*, **17**, 227–8 (1942).]

On the isolated frog heart metrazole in 0·1–1 per cent. concentration exerts a negative chronotropic action which is augmented by eserine or acetylcholine. Metrazole antagonizes the paralyzing action of pilocarpine and ergotamine. In the presence of very low concentrations of adrenaline metrazole still exerts its negative chronotropic action and also shows some positive inotropic action.

L. E. GILSON (Chem. Abstr.).

Action of Metrazole on Leech Dorsal Muscle. Cera, Brizio (Univ. Genova, Italy). [*Boll. soc. ital. biol. sper.*, **17**, 17–19 (1942).]

Metrazole alone has no action on untreated leech muscle, but in concentrations of 1 : 1000–1 : 10,000 it provokes contraction of eserinized muscle. It acts synergistically with acetylcholine. In rabbits pretreatment with eserine salicylate (0·03 mgm./kgm. given intravenously) markedly increases the convulsant action of metrazole, so that convulsions are produced by doses ordinarily too small to do so. L. E. GILSON (Chem. Abstr.).

Ergotamine and Convulsive Attacks. Robuschi, Luigi (Univ. Bologna, Italy). [*Boll. soc. ital. biol. sper.*, **17**, 175–7 (1942); *cf. C.A.*, **40**, 3181[8].]

In rabbits the injection of ergotamine tartrate diminishes or prevents the convulsant action of metrazole, esetone (Bayer), or NH_4Cl injected a few minutes later.

Vasomotor Activity and Convulsive Attacks. [*Ibid.*, 177–80.]

In rabbits acetylcholine with or without eserine does not inhibit the production of convulsions by metrazole. The injection of amyl nitrite prevents convulsions by metrazole injected 5 minutes later, but not 10 minutes later. The protective action is ascribed to vasodilation produced by the amyl nitrite. Acetylcholine, although it produces vasodilation, fails because of its other actions on the heart, respiration, etc.

Cholinesterase and Convulsive Attacks. [*Ibid.*, 180–2.]

Either metrazole or ergotamine or both together partially inhibit the action of the cholinesterase of guinea-pig brain *in vitro*. The relation of this action to their antagonistic action in respect to production of convulsions by metrazole is not clear. L. E. GILSON (Chem. Abstr.).

Barbituric Narcosis by Injection into the Bone Marrow. Pagliai, E., and Donatelli, L. (Univ. Firenze, Italy). [*Boll. soc. ital. biol. sper.*, **20**, 691–2 (1945).]

Injections of barbiturates into the bone marrow of guinea-pigs and rabbits showed this route to be as effective in producing narcosis as the intravenous route. HELEN LEE GRUEHL (Chem. Abstr.).

Influence of External Temperature on the Effect of Hypnotics. Sivadjian, Joseph. [*Compt. rend.*, **223**, 339–40 (1946).]

The increased metabolism incident to exposure to cold results in an increased resistence of rats to the action of barbiturates and consequently increases the narcotic dose. RACHEL BROWN (Chem. Abstr.).

Comparative Effects of Analeptics on some Functions of the Central Nervous System. I. Antagonism of Analeptics to Narcotics. Ya, S. [*Arbuzov. Farmakol. i Toksikol.*, **7**, *No.* 6, 31–6 (1944).]

Tests were made with metrazole (I), coramine (II), hexetone (III) and strychnine (IV) as to activity and as to antagonism to urethan (V) and medinal (VI) in male rabbits. The highest antisoporific action was shown by (I) against (V) (1 : 4); against (VI) it was only 1 : 1. Though much weaker in antisoporific effect, (II), (III) and (IV) had a paralytic action, especially when given with (VI). In large doses (I) also had a slight paralytic action when given with narcotics. As an emergency antidote for narcotic poisoning (I) is more effective than (II), (III) or (IV). For biological assays of analeptics against narcotics the method of latent reflex periods (flexor muscles) may be employed. The Zakusov technique (*C.A.*, **34**, 5541[2]; **36**, 2929[5]) was used in these experiments.

JULIAN F. SMITH (Chem. Abstr.).

Barbiturate Antagonism of Isonipecaine Potentiation of Barbiturate Depression. Way, E. Leong (George Washington Univ., Washington, D.C.). [*J. Pharmacol.*, **87**, 265–72 (1946).]

Barbital, phenobarbital, amytal, pentobarbital, and evipal, in $\frac{1}{8}$–$\frac{1}{4}$ LD 50 of the Na salt, aborted convulsions and usually prevented death in white mice and rabbits given an ordinary lethal dose of isonipecaine (demerol). But when the dose of each barbiturate was increased to $\frac{1}{2}$ or $\frac{3}{4}$ of its respective LD 50 and $\frac{1}{8}$ to 1 LD 50 of isonipecaine was given, the animals died of respiratory depression, without convulsions. Diphenyl-hydantoin did not act like the barbiturates in the above respects. It is apparent that the isonipecaine-barbiturates antagonize the lethal convulsant effects of isonipecaine, but isonipecaine potentiates the depressive properties of the barbiturates on respiration. L. E. GILSON (Chem. Abstr.).

Electrical Stimulation of the Vagi Increases the Narcotic Action of Magnesium Sulfate and Sodium Barbital. De Nito, Giuseppe (Univ. Naples). [*Boll. soc. ital. biol. sper.*, **15**, 1072–3 (1940).]

It has been shown previously that acetylcholine increases the narcotic action of $MgSO_4$ and Na barbital in rabbits. Electrical stimulation of both vagi in the neck has a similar effect, either through liberation of acetylcholine or by producing hypotension and decreasing the blood supply to the brain.

L. E. GILSON (Chem. Abstr.).

OBITUARY.

Joseph Shaw Bolton.

Professor Joseph Shaw Bolton, a Past-President of the Royal Medico-Psychological Association, died on November 12, 1946, at his home in Beaconsfield, where he had settled in 1933 on his retirement from the Chair of Psychiatry at Leeds University and the Medical Directorship of Wakefield Mental Hospital.

In the days when the cause of mental disorder was sought in the histopathology of the brain he was one of the most distinguished figures in British psychiatry, and in that sphere he deservedly had an international reputation. His work on localization of cerebral function by his own extremely delicate technique of micrometric measurement of the cortical cell laminae was a magnificent and most painstaking research, the fruits of which, perhaps, have not yet all been gathered.

His book, *The Brain in Health and Disease*, was published in 1914, when cerebral physiology was waning and interest was turning to the psychological approach; but there are signs that the needs of modern neuro-surgery may yet direct our studies back to Bolton's teaching.

Somewhat belated corroboration of his work appeared recently in this journal (October, 1946) in an epitome of "Recent Advances in the Study of the Brain as the Implement of the Mind":

> "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."

Thirty-three years ago Bolton wrote and elaborately proved—

> "The cerebral cortex consists of three primary cell laminae: (1) the outer or pyramidal, (2) the middle or granule, and (3) the inner or polymorphic.
>
> "The outer or pyramidal cell lamina is the cortex which subserves the associative, psychic, or educative, in contradistinction to the organic and instinctive function of the cerebrum. The latter are subserved by the inner cell-lamina, whereas the receptive functions are performed by the middle cell-lamina."

A main point of this research was a convincing demonstration of the association of sub-evolution of the outer or pyramidal layer of the prefrontal cortex with mental deficiency and certain psychotic syndromes.

Born at Whitby, Yorkshire, in 1867, Shaw Bolton began his medical training as an apprentice to a local doctor, and only after he had amassed a bank balance of £100, from such remunerative activities as coaching backward students and playing the organ in church, did his father, the late Isaac Bolton, give his approval to his sojourn at University College and University College Hospital. Already he had taken his B.Sc., and after a brilliant course as medical student he graduated M.B., B.S. Lond., with honours and gold medal in 1894, and one year later took his M.D. He won the Atchison Scholarship and Filliter Exhibition and was a Fellow of University College. His post-graduate academic record speaks for itself: M.R.C.P., 1902; F.R.C.P., 1909; D.Sc.Lond., 1912; Goulstonian Lecturer, 1910; Maudsley Lecturer, 1925; President, The Royal Medico-Psychological Association, 1928; Henderson Trust Lecturer, 1933; Emeritus Professor and Honorary D.Sc., Leeds, 1934; Lumleian Lecturer, 1935.

After some years in teaching and research, first in anatomy and then in physiology, he entered the service of the London County Council as a pathologist under the late Sir Frederick Mott, at Claybury. Subsequently he served on the staff of Hellingley and Rainhill Mental Hospitals, and in 1910 he succeeded Dr. Bevan Lewis as Medical Superintendent at Wakefield.

His energy was boundless, and the general tempo of his working hours was quite extraordinary. Despite his continued devotion to scientific medicine, he suc-

ceeded in keeping *au fait* with the work of every department of his large institution. His daily routine began at 8 a.m., and the morning interviews and correspondence were models of courteous alacrity and dispatch. It was thus that he was able to find time to spend both in his wards and his laboratory, and at the same time to be a recognized expert on poultry breeding, photography and radiology.

He was a great chief and a great friend, with a higher standard for his own conduct than that which he required from others. It is twenty-four years since the writer served under him, yet to-day he is aware of being conditioned in his reactions by Bolton's influence, and many of his former colleagues, now widely dispersed in the practice of psychiatry, gladly bear similar witness. He shunned publicity and social prominence, but a great unselfishness and generosity of spirit adorned his private life, and in his delightfully happy family circle he was the most genial and hospitable host.

Even after he left Wakefield his active work was not over, for he was asked and agreed to take over for a time the direction of the Bucks County Mental Hospital, where he carried out much needed re-organization until the appointment of the present Medical Superintendent.

For many months he suffered much and very patiently in a protracted illness, in which he was heroically nursed day and night by his devoted wife, who, with two sons and a daughter, survives him. J. IVISON RUSSELL.

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THE

JOURNAL OF MENTAL SCIENCE

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Part I.—Original Articles.

THE EFFECTS OF INTRAVENOUS INSULIN IN SAKEL'S HYPOGLYCAEMIC TREATMENT.

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[Received 10 May, 1947.]

THE use of intravenous insulin in Sakel's shock treatment as an alternative to intramuscular insulin was first reported by Ventriglia (1939), whose findings may be summarized as follows:

(1) Hypoglycaemic symptoms appear more quickly than with intramuscular insulin, so that the pre-shock period is shortened.

(2) The coma dose of insulin is reduced by 50 per cent. on an average, but may be reduced by considerably more.

(3) In some cases the hypoglycaemic symptoms are more abrupt and violent.

(4) There is a greater tendency to tonic-clonic spasms and convulsions generally.

Ventriglia's experience led him to prefer intravenous insulin to intramuscular, but apart from the saving of the insulin, he gives no reasons for this decision. No definition is given, either, of the standard of coma adopted. This is unfortunate, since the standard of coma adopted by different workers varies considerably and makes comparison of their results very difficult.

In the same year Bardenat and Leonardon (1939) administered insulin intravenously in an attempt to overcome the resistance to insulin not infrequently found in Sakel's usual treatment. They found that the pre-coma stage was shortened by about two-thirds, and that pre-coma excitement was almost entirely abolished, but their work did not enable them adequately to compare the results of the two methods of administration.

The next paper on the subject to appear was that of McGregor and Sandison (1940), who used intravenous insulin as a possible means of economizing its

use during wartime. They found that the intravenous "coma-dose" varied from 25 per cent. to 75 per cent. of the intramuscular coma-dose, the average for 8 patients being 53·4 per cent. This result is, therefore, in agreement with that of Ventriglia. Unfortunately, it is not possible to assess the validity of the authors' conclusions, as they do not mention (*a*) their standard of coma or (*b*) the exact circumstances under which the comas they refer to were induced. This latter point is an important one, for no patient has a constant "coma-dose." Once coma has been induced it is usually possible to induce it with progressively smaller doses on following days owing to the patient becoming sensitive to the insulin. Corwin (1939) pointed out this and it would be insufficient to determine a given patient's coma-dose with intramuscular insulin and then immediately switch over to intravenous insulin. On such a procedure the intravenous dose would almost certainly be less than the intramuscular one, but only because the decreased resistance to hypoglycaemia induced by the intramuscular insulin had been ignored.

It is very difficult to obtain standardized conditions for a comparison between the effects of intramuscular and intravenous insulin, as it is almost impossible to keep such factors as the body weight of the patients constant during the experiments. The method adopted in the experimental portion of this study would appear to be as valid as possible under the circumstances. By this method the *intramuscular* coma-dose of alternate patients was first ascertained and then the patients were "rested" for 14 days before their intravenous coma-dose was determined. The remaining patients were then taken and their *intravenous* coma-dose found, followed by 14 days' rest, after which their intramuscular coma-dose was ascertained.

A few weeks after the publication of the above paper Maxwell Jones (1940) published his findings in a series of seven cases. Unlike Ventriglia and McGregor and Sandison, this author found that the coma-dose was the *same* for intramuscular and intravenous insulin, but that the time before the onset of coma was shortened by an average of 45 minutes. Jones states that a patient was judged to be in a coma "when there was no voluntary response to external stimuli, extensor plantar response was present and the corneal reflex absent." This is the standard adopted in the present work and must be considerably "deeper" than McGregor and Sandison's standard, as they allowed their patients to remain in coma for 1½–2 hours, a procedure which would have resulted in a high proportion of prolonged comas had Jones's standard been followed.

In the same year Polatin, Spotnitz and Wiesel (1940*a* and 1940*b*), unaware of Ventriglia's work, used intravenous insulin in the treatment of mental disorder. They endeavoured to determine "whether hypoglycaemic shock itself, without prolonged coma, might be of benefit in the treatment of patients with mental disorder." The dose used varied between 27–90 units and no attempt was made to induce coma. It was found that no convulsions occurred and that spontaneous recovery was the rule. This, however, would probably have been the result had these comparatively small doses been used intramuscularly. The authors note one interesting point, that a biphasic or delayed reaction may occur with intravenous as with intramuscular insulin.

" These biphasic effects were also repeatedly seen after the injection of insulin intravenously. One patient, about one and a half hours after injection, was alert and drank dextrose, only to slip back within five minutes into a state of coma deeper than the primary reaction. About 30 minutes later she again recovered spontaneously." This suggests that as far as one of the complications of intramuscular insulin—the delayed reaction—is concerned, intravenous insulin has no advantage.

Horvath and Friedman (1941) gave up to 500 units of insulin intravenously, but their purpose was to observe the effect upon the blood sugar and blood lactate. Contrary to Damashek *et al.* (1935), who found that the intravenous injection of 8–80 units intravenously caused a definite increase in the blood lactic acid, these authors found that insulin did not affect the blood lactate except in resistant cases. They also noted that " the response to intravenous insulin was similar to that of intramuscular insulin, no ill effects were observed. The coma produced by intravenous insulin is, in general, much quieter than that induced by intramuscular insulin. Recovery was, in many cases, spontaneous after two hours and no recurrences of coma or convulsions were observed." A number of anomalous results were encountered. In one patient 20 units of insulin were as efficacious in lowering and keeping the blood sugar down, as were 100 or 160 units, and in another patient 160 units failed to lower the blood sugar to the same extent as 50 units had done previously.

Sherman, Mergener and Low (1941) observed the effects of intravenous and intramuscular insulin in 13 patients. Their method was to divide the cases into two sets. To the first set insulin was given subcutaneously in increasing doses until coma was reached and then " the dose was gradually diminished until coma was produced within a fairly constant time with what appeared to be a minimal dose." The patient was maintained on this dose for about 5–10 days, after which blood-sugar studies were made. Then the insulin was given intravenously and the dose increased or decreased, depending on whether coma was produced. The dose by this second method of administration was stabilized and blood-sugar studies made again. To the second set of patients the insulin was first given intravenously and, following the same procedure, was later replaced by subcutaneous insulin. This method of comparison is open to only one objection. It ignores the usual trend of a patient's coma-dose, which, following the initial reduction owing to " sensitization," usually increases as the treatment proceeds, and the second method of administration may have bee nadopted just when the patient would be requiring these larger coma-doses in any case. It would have been preferable to have found the sensitized coma-dose by either route and then, following an adequate rest period, to have started *de novo* with the alternative mode of administration and found the patient's sensitized coma-dose by that route.

The authors found that in every case the precoma time was shortened from a minimum of 24 minutes to a maximum of 90 minutes. As regards the coma-dose, 6 patients required the same by either route, 3 required more by the intravenous route and 2 required less by this route than subcutaneously. They conclude " that there is no appreciable difference in the coma-doses required between intravenous and subcutaneous insulin." They also found

that there was no significant difference in the incidence of complications and that spontaneous emergence from intravenously induced coma was rare.

Mention should be made of the authors' standard of coma, which was apparently a light one. "The patient was called loudly three times; if there were no verbal or facial response, he was pricked three times around the upper lips and nostrils. Failure to respond by some facial grimace or other protective movement suggested the presence of coma." This standard of coma is, of course, much lighter than that of Jones (1940).

In 1942 Sandison and McGregor amplified their results reviewed above on the basis of a year's experience with intravenous insulin. Their earlier work was confirmed, except that in the additional 24 patients treated the intravenous dose required to produce coma was 71·7 per cent. of the intramuscular dose compared with 53·4 per cent. in the earlier series. A number of the points raised in this paper will be discussed later, when the mode of action of intravenous insulin is discussed, but attention may be drawn to the method used of determining the coma dose for intravenous insulin. The patients apparently were first given intramuscular insulin until coma was induced. On the following days intravenous insulin was given, until the most satisfactory coma dose was found. As would have been expected, the intravenous coma dose was invariably the lower. Such a method of comparison is unsatisfactory as the patient would be developing sensitivity to insulin when on intramuscular insulin, the effect of which would be to lower the coma dose of intravenous insulin, since this followed immediately after the intramuscular doses. As mentioned earlier, the only adequate method of comparison is to find a patient's coma dose on intramuscular insulin, give seven to fourteen days' rest and then find the coma dose in intravenous insulin and compare the two. Even with this method, the results can only be approximate unless extreme care is taken to provide a diet with a constant carbohydrate content for the whole period of the experiment, since, as Himsworth (1939) has shown, sensitivity to insulin is directly proportionate to the absolute amount of carbohydrate in the diet.

In this paper Sandison and McGregor also refer to their definition of coma. It has already been pointed out that several workers on intravenous insulin have not specified the exact stage of unconsciousness which they designate as coma. Some authors regard a patient as being in coma as soon as he becomes unconscious. Sherman *et al.* (1941). Others, e.g. James, Freudenberg and Cannon (1938) state that coma is present when the patient is unconscious and the plantar responses are extensor. Still others, e.g. Maxwell Jones (1940), Mahoney and Herskovitz (1942) following Wilson (1937) adopt as criteria of coma, unconsciousness, a positive Babinski and absent corneal reflexes. The point is of considerable importance, as absence of the corneal reflex indicates a much "deeper" state of hypoglycaemia than does the presence of unconsciousness with a Babinski response and it is possible that the more quickly acting intravenous insulin might be able to produce the latter sooner than the more slowly acting intramuscular insulin, but that its action might not be sufficiently prolonged to induce the deeper state indicated by absent corneal reflexes. The conflicting reports which have already been noticed as to the

relative amounts of intravenous and intramuscular insulin required to induce coma may, therefore, possibly be accounted for by the different standards of coma adopted.

Sandison and McGregor (1942) state that " in all our work we have defined insulin coma according to Sakel's original description, that it to say, a condition in which the patient's normal responses to stimuli are lost. There is sweating, flushing of the skin and usually profuse salivation; the reflexes are all lost excepting the corneal reflex and the plantar response is extensor." In view of the importance of the definition of coma, Sakel's own description may be quoted. In the original German text (Sakel, 1935*a*) the following passage occurs (p. 9): " Diese konnen entweder mit einen profusen Schweissausbruch beginnen und dann in allmählich zunehmende Somnolenz, zeitweise auch unterbrochen durch psychotische Erregungen, und schliesslich in Koma übergehen. Dieses Koma kann nun eine verschiedene Tiefe erreichen. In der Somnolenz ist Patient noch weckbar, es ist aber kein Kontakt mehr möglich. Es bestehen noch sämtliche Reflexe, man kann noch durch sehr energisches Zurufen den Patienten zum reflektorischen Schlucken bringen. Allmählich nimmt das Koma an Tiefe zu. Es verschwinden alle Reflexe. In dieser Phase treten bereits pathologische Reflexe auf; Babinski, Oppenheim, Mendel-Bechterew u.a. Bei langerem Zuwarten kann das Koma eine solche Tiefe erreichen, dass sämtliche Reflexe, inklusiv Schluck, Corneal, und Kitzelreflexe, auch die in der früheren Stufe aufgetretenen pathologischen Reflexe, erlöschen. Also vollige Areflexis mit volliger Atonie der gesamten Muskulatur."

This is translated in the first and revised English translations (Sakel, 1935*b*, 1938) as: ". . . the shock starts with profuse perspiration and progressive somnolence and may be interrupted by psychotic excitement, but ends typically in coma. This coma may attain a varying depth. If the patient is merely somnolent he can be awakened, but contact is no longer possible. All the reflexes at this stage are still intact and energetic commands can rouse the patient's swallowing reflexes to the point where the patient will swallow food. But *as the coma deepens* the reflexes become pathological and finally disappear. The patient at first shows positive Babinski, Oppenheim and Mendel-Bechterev reflexes, but *later the coma may become so deep* that all the reflexes disappear, including the corneal and swallowing reflexes, as well as the pathological reflexes which had appeared in the preceding stage, so that we have a complete areflexia with complete atonia of the entire musculature."

It will be seen, therefore, that Sakel made no precise definition of the term " coma," but used it to cover all degrees of the effects of hypoglycaemia from somnolence to complete areflexia. Most British workers have adopted Wilson's (1937) standard of absent corneal reflexes, while the initial unconsciousness. from which the patient cannot be roused and in which the plantar response is frequently extensor is termed " sopor " (von Angyal, 1937). These criteria are adopted in the present paper.

Adopting Wilson's standard of coma, Mahoney and Herskovitz (1942) found that the treatment period was not shortened by intravenous insulin,

that about the same amount of insulin was required to induce coma when given intravenously or intramuscularly, but that the onset of coma occurred about half-an-hour earlier with the former type of administration. The same amount of glucose was required to bring the patient out of coma and one of their patients had 12 convulsions during the course of intravenous insulin. The authors conclude, " our findings indicate that this (intravenous) method of producing hypoglycaemia is not superior to the Sakel method and is not recommended."

Reznikoff and Scott (1942), using a solution of zinc insulin crystals, following Jones (1940) found that there was no economy in the amount of insulin required to produce coma intravenously compared with that needed intramuscularly. Four of their twenty patients developed convulsive seizures, but in general they found that the hypoglycaemia induced was quieter than that of intramuscular insulin. These authors gave up to 1,200 units intravenously to some insulin-resistant cases without producing signs of hypoglycaemia. No allergic reactions followed the use of the zinc insulin crystals. Hypoglycaemia was interrupted two hours after the injection of the insulin, so that complications such as protracted coma were not encountered.

Olsen (1942) followed up McGregor and Sandison's work (1940), but restricted himself to the use of intravenous insulin and glucose with potato starch as a means of preventing after-shock. Using larger quantities of glucose than the latter authors he found the method successful. Olsen does not compare the relative amounts of intravenous and intramuscular insulin required to produce coma.

Polatin and Spotnitz (1942*b*) followed up their earlier work and assessed their results in a series of 33 patients. These do not appear to have been any better than those obtainable with intramuscular insulin, but the authors found that when improvement occurred, it set in more rapidly. This they ascribed, probably correctly, to the more rapid onset of hypoglycaemic symptoms with consequently a greater degree of shock. Low doses with a normal maximum of 40 units were used and it was found that with higher doses "*a protracted coma . . . might ensue.*" It was confirmed that after-shock occurred repeatedly after the injection of insulin intravenously. Although no details are given, apparently a number of patients were allergic to intravenous unmodified insulin and these were switched over to zinc-insulin crystals. This is a point of some importance. Hinko, Fenton and Balberor (1941) record a case of anaphylactoid shock occurring in a patient receiving Sakel's treatment. Generalized pruritus, oedema of the face and cardiovascular collapse were marked and for some time the patient's condition was extremely grave. Later intradermal tests showed him to be definitely sensitive to insulin. Had this patient been given insulin intravenously a fatal outcome of the anaphylactoid shock would have been almost certain.

Goldfarb (1943) states, following his experiment with intravenous and intramuscular insulin, " the production of hypoglycaemic coma by the intravenous route requires essentially the same amount of insulin as the intramuscular route, but the onset of coma occurs earlier after intravenous glucose." This author gives no details of his standard of coma.

In the same year, Peterson and Lutz (1943) reported their findings in a series of cases treated in 1938. They do not compare the relative efficacy of intravenous and intramuscular insulin, but mention that several patients, treated intravenously, went into "after-shock" with low blood sugars when interrupted by nasal glucose. This was prevented by interruption with intravenous glucose. These authors' experience shows, however, that intravenous insulin can, under certain circumstances cause after-shock and that it is not an adequate safeguard by itself against this complication.

It will be seen from the above review of the literature that the effect and value of intravenous insulin in Sakel's treatment are both undecided, as the reports on its use conflict considerably. There is general agreement that the pre-coma time is shortened, but the following summary brings out the conflicting results observed by the various authors on other aspects of this mode of administration as compared with intramuscular injection.

TABLE I.

Authors.	Intravenous coma-dose compared with subcutaneous coma-dose.	Tendency to convulsions.	Coma quieter or not.	After shock.	Incidence of protracted coma.
Ventriglia (1939)	Reduced 50%	Increased	No quieter	—	—
Bardenot and Leonardon (1939)	—	—	Quieter	—	—
McGregor and Sandison (1940)	Reduced 52·4%	—	,,	—	—
M. Jones (1940)	Same	—	—	—	—
Polatin, Spotnitz and Wiesel (1940)	—	Reduced	—	Same	—
Horvath and Friedman (1941)	—	—	Quieter	Less	—
Sherman, Mergener and Low (1941)	Reduced (2), increased (3), same (6)	Same	Same	Same	—
Sandison and McGregor (1942)	Reduced 28.3%	—	Quieter	Less	—
Reznikoff and Scott (1942)	Same	Increased	,,	—	—
Olsen (1942)	—	—	—	Less	—
Mahoney and Herskovitz (1942)	Same	Increased	—	—	—
Goldfarb (1943)	,,	—	—	—	—

In particular, the effect of intravenous insulin on the encephalopathies which complicate intramuscular insulin, such as prolonged coma, have not been reported on, except very briefly by Polatin and Spotnitz (1942*a*) and the experimental work now to be described was undertaken in order to clarify the position as far as possible.

The first part of the experimental work may be outlined as follows:

Twelve patients, 8 male and 4 female, were given intramuscular and intravenous insulin and the coma dose for each method of administration determined. It was found that while the pre-coma time was shortened *all* the patients required larger doses intravenously than intramuscularly to produce coma. This is at variance with the results obtained by earlier authors, excluding Sherman, Mergener and Low (1941) and an explanation was sought. Three possible explanations suggested themselves:

(1) Some of the intravenous insulin might be excreted rapidly in the urine.

(2) Some of the intravenous insulin might be inactivated by an anti-body in the blood.

(3) While intravenous insulin produces a more rapid fall in the blood sugar than intramuscular insulin, this fact can only be achieved at the cost of considerably more insulin, which is, therefore, more rapidly used up. Despite the greater initial fall, therefore, the intravenous insulin might be unable to maintain the lowered blood-sugar level sufficiently long for coma to supervene unless it were given in greater amounts than when injected intramuscularly.

Experiments were designed to test these hypotheses and the last was found to be correct.

Details of Experimental Work.

I. *The Comparative Coma Doses of Intravenous and Intramuscular Insulin.*

(1) *Standard of Coma.*

A patient was adjudged to be in coma when he was unconscious, with Babinski plantar responses and absent corneal reflexes. This follows Wilson's (1937) standard and is mentioned in view of the varying standards of coma adopted by various authors. It is considerably deeper, for instance, than Sandison and McGregor's standard (1942) in which the corneal reflexes are present. The point is stressed because a given method of injection of insulin may be able to produce the earlier stages of unconsciousness sooner than another, but, through being exhausted by its more rapid action, it may be unable to produce the deeper stages, which are here designated as coma.

(2) *Method of Ascertaining Coma Dose.*

In general, all patients were given daily injections of insulin at 7 a.m. with one rest day a week. To commence, 4 male and 2 female patients were given 20 units intravenously and the dose increased by 20 units daily until "sopor" was obtained, after which the daily increment was reduced by varying amounts until coma was reached. Thereafter, with the onset of sensitivity the dose required to induce coma was found to be progressively less until a minimum was reached, below which the dose could not be reduced if coma were to result. The patients were then "rested" for 14 days and the process repeated with intramuscular insulin. It was found that the degree of sensitivity developed was approximately the same with both methods of administration (see Table III). This is contrary to Sandison and McGregor's (1942) findings, who found a greater sensitivity to intravenous than to intramuscular insulin. As there was no difference in the sensitivity induced by the two methods, it was concluded that it would be sufficiently accurate to determine only the dose required to induce the initial coma and this was done in a further 6 patients, making a total of 8 male and 4 female cases.

(3) *Blood-Sugar Estimations.*

In view of the findings of previous workers, e.g. Norgaard and Thaysen (1929) and Sherman, Mergener and Low (1941) that the lowest blood-sugar level following intravenous insulin is found from 25–40 minutes after injection,

the blood sugar was usually estimated at the following intervals after injection : 25, 30, 35, 40, 50, 60, 70, 90, 110, 130, 160, 180, 210, 240 and 270 minutes. The blood was drawn from the distal phalanx of the thumb, a small rubber tourniquet being wound around the thumb proximal to the site of puncture. This probably resulted in a certain amount of tissue exudation, but as with practice the withdrawal of the blood into the pipette could be done very quickly this factor does not appear of practical importance, especially as a more liberal quantity of blood was consistently available than could have been so with, say, non-pressure pricking of the lobe of the ear. The blood sugar was estimated by a modified method of Hagedorn and Jensen (1923) as follows :

One c.c. of 0·1 NaOH and 5 c.c. of 0·45 per cent. zinc sulphate solution were pipetted into a test-tube (15 × 150 mm.) ; 0·12 c.c. of blood was introduced from a capillary pipette and the mixture placed in a boiling-water bath for 3 minutes, following which it was cooled and diluted to 12 c.c. The blood protein which has been precipitated by the zinc hydroxide formed by the interaction of the sodium hydroxide and zinc sulphate was then filtered out on a funnel of 3–4 cm. diameter, prepared with a dry, acid-washed, No. 40 Whatman filter paper, following the assertion of Kramer and Steiner (1931), that the variable density of the cotton filter recommended by Hagedorn and Jensen gave rise to erroneous results. 10 c.c. of the filtrate, corresponding to 0·1 c.c. of blood were taken and neutralized with 0·30 of 0·1N sodium hydroxide in order to prevent changes in the alkalinity of Hagedorn-Jensen potassium ferricyanide reagent, 2 c.c. of which were then added to the 10 c.c. of filtrate. This mixture was then heated in a boiling-water bath for 15 minutes. After cooling, 3 c.c. of iodide-sulphate chloride solution ($KI + ZnSO_4 + NaCl$) and 2 c.c. of 3 per cent. acetic acid solution were added. The amount of the potassium ferricyanide reduced by the glucose was determined by finding the amount of iodine set free through titration with 0·005 N sodium thiosulphate using as an indicator 2 drops of 1 per cent. solution of soluble starch in saturated sodium chloride solution.

The principal reactions of the process are :

$$2H_3Fe(CN)_6 + 2HI = 2H_4Fe(CN)_6 + I$$
$$2K_4Fe(CN)_6 + 3ZnSO_4 = K_2Zn_3(Fe(CN)_4)_2 + 3K_2SO_4.$$

The reversal of the reduction process is prevented by the precipitation of the ferrocyanide formed as a zinc salt by the zinc sulphate.

Calculation.—(*a*) A blank was first obtained by carrying through the whole process, but without the addition of blood. This blank was never allowed to exceed 0·2.

(*b*) The thiosulphate burette reading was multiplied by the factor for the thiosulphate (2·00 c.c. thiosulphate required for 2 c.c. of 0·005 N potassium sulphate). This gives value (A). This value (A) was expressed for the unknown and for the blank by consulting tables provided. The glucose value of the blank was subtracted from the glucose value of the unknown to give the mgm. glucose in 0·1 c.c. of blood, from which the amount present in 100 c.c. of blood was calculated.

Interpretation of results.—The method of Hagedorn and Jensen for estimating the blood sugar was selected in preference to that of Folin and Wu, as it gives more accurate results in the very low blood-sugar levels encountered in Sakel's hypoglycaemic treatment. In addition to the glucose, the blood contains 20–30 mgm.—as glucose—per 100 c.c. of non-fermentable reducing substances, chiefly glutathione which is present in the red blood corpuscles. It is, however, incorrect to calculate the true glucose by deducting the amount of the non-fermentable reducing substances from the "enhanced-glucose" values because in different methods varying proportions of these non-fermentable reducing substances are included. In the Hagedorn and Jensen method 4 mgm. per 100 c.c. only are to be deducted, while in the Folin and Wu method 11 mgm. per 100 c.c. have to be deducted. If, therefore, the blood-sugar values obtained in this present study are reduced by 4 mgm. per cent., the resulting figures give an approximate true glucose value (Harrison, 1945).

(4) *Results Obtained.*

The blood-sugar values obtained in the 12 patients following the intramuscular and intravenous injection of insulin in increasing doses from 20 units to coma dose are set out in Table II.

From Table II the doses of insulin required initially to induce "sopor" and coma were abstracted and are set out in Table III, along with the doses needed to induce these states after the patients had become sensitized to the insulin.

The results summarized in the above table differ from those of previous workers except Sherman, Mergener and Low (1941), three of whose patients required more insulin intravenously than subcutaneously to induce coma. It will be seen that all of the 12 patients in the series required more intravenous than intramuscular insulin for the production of coma. The percentage difference has not been calculated, as such figures are unreliable under the non-standardized conditions of Sakel's treatment as usually practised, and especially in view of the variation in the response to insulin of individual patients. McGregor and Sandison (1940) found that the intravenous "coma dose" varied from 25 per cent. to 75 per cent. of the intramuscular coma dose. With such widely divergent figures, percentage averages are of little value unless very large numbers of patients are being considered. It will be noticed that while more intravenous than intramuscular insulin is needed to induce coma with areflexia, less is needed to induce "sopor" (unconsciousness). In Table II usually 20 units less is required, but the actual figure is probably lower than this, as the insulin at this stage of the experiment was being increased by 20 units daily, and had the increment been smaller, the patients would probably have gone into "sopor" on intramuscular insulin on a slightly lower dose. The figures for the differences between the sensitized "sopor" doses are probably more accurate, as these were arrived at over a period of some days. In view of the consistency of the above results, an explanation was then sought to account for the way in which they differ from those of earlier workers, who had found either a smaller or the same amount of intravenous insulin was

TABLE II.—*Blood-sugar Values Following Injection of Intramuscular and Intravenous Insulin in Increasing Doses from 20 Units to Coma Dose.*

The doses required to induce "sopor" are marked with †.
The doses required to induce coma are marked with an asterisk.
I.M. = intramuscular; I.V. = intravenous.

Units of insulin.	Fasting blood sugar.	Minutes after injection. 25.	30.	35.	40.	50.	60.	75.	90.	120.	150.	180.	210.	240.	270.
Patient 1—Male:															
20 I.M.	75		56				47		50	47	50	48	47	54	54
20 I.V.	83	38	29	31	25	30	38	45	53	66	72	81	81	83	83
40 I.M.	90		79				45		34	41	43	48	47	47	51
40 I.V.	81	34	30	32	29	32	33	35	39	48	59	70	78	79	79
60 I.M.	90		70				45		45	45	41	41	41	43	45
60 I.V.	78	42	37	35	32	37	38	42	47	54	64	66	76	78	78
80 I.M.	92		65				35		35	41	34	34	38	38	36
80 I.V.†	88	39	31	31	25	24	29	32	39	51	56	72	83	85	87
100 I.M.†	100		72				38		36	36	34	34	34	36	36
100 I.V.	92	35	27	23	23	22	29	31	33	41	45	47	56	67	71
120 I.M.	110		60				36		28	31	33	31	33	33	34
120 I.V.	88	24	24	22	20	24	27	25	29	29	36	38	45	56	64
140 I.M.*	80		72				33		21	23	23	25	26	28	28
140 I.V.	77	39	43	24	22	27	34	30	34	32	32	35	44	49	55
160 I.V.	74	48	46	43	27	24	31	27	36	39	36	37	42	43	41
174 I.V.*	83	56	35	32	25	19	18	20	24	26	28	29	30	29	28
Patient 2—Male:															
20 I.M.	111		86				65		56	50	54	72	77	83	80
20 I.V.	106	57	47	41	36	34	41	45	54	75	95	90	92	93	102
40 I.M.	104		84				50		43	43	43	47	52	59	65
40 I.V.	108	65	54	34	41	39	43	47	47	66	77	86	96	95	95
60 I.M.	88		64				41		36	41	45	43	50	43	47
60 I.V.	92	56	50	41	32	32	32	27	32	35	43	63	72	81	87
80 I.M.	98		70				39		41	50	48	52	47	45	48
80 I.V.†	97	56	45	38	31	32	36	32	32	38	46	55	61	75	83
100 I.M.†	101		70				43		41	39	36	41	36	38	38
100 I.V.	86	63	48	31	36	27	27	24	27	38	38	47	53	70	77
120 I.M.	95		54				42		38	36	36	29	25	38	39
120 I.V.	88	77	61	34	32	32	31	36	33	35	36	41	49	61	68
130 I.M.	96		61				45		35	33	29	29	24	31	35
130 I.V.	92	61	47	33	31	32	31	34	31	33	37	45	46	57	63
140 I.M.*	92		74				48		27	24	27	27	24	27	24
140 I.V.	102	72	66	59	45	34	34	32	31	34	38	42	48	52	57
160 I.V.	94	60	48	34	30	30	31	31	31	33	35	36	40	46	44
170 I.V.*	96	55	44	34	29	31	29	32	35	31	29	32	29	31	33
Patient 3—Male:															
20 I.M.	88		63				43		41	34	38	43	57	70	82
20 I.V.	75	32	27	25	25	27	29	27	34	55	63	75	83	80	79
40 I.M.	86		48				24		29	29	29	36	38	41	43
40 I.V.†	79	44	34	27	22	22	24	24	29	33	47	66	72	79	79
60 I.M.†	95		54				25		32	31	32	38	38	38	41
60 I.V.	92	32	28	24	19	19	22	27	25	30	43	54	63	74	88
80 I.M.	104		47				27		27	27	24	31	32	31	31
80 I.V.	95	36	29	29	19	19	19	25	24	24	29	36	47	68	74
86 I.M.	92		79				48		34	29	27	27	31	29	32
86 I.V.	89	45	31	30	22	21	20	22	23	23	26	37	46	57	69
92 I.M.*	97		60				29		27	27	27	25	27	29	27
92 I.V.	93	38	30	22	23	21	20	19	21	25	27	36	43	54	63
100 I.V.	101	36	32	24	24	24	19	19	20	22	27	36	39	47	50
110 I.V.	99	34	24	22	15	15	19	15	19	21	30	29	34	36	43
118 I.V.*	95	32	29	24	18	18	17	18	20	22	21	25	27	26	29

TABLE II—(*contd.*).

The doses required to induce "sopor" are marked with †.
The doses required to induce coma are marked with an asterisk.
I.M. = intramuscular; I.V. = intravenous.

Units of insulin.	Fasting blood sugar.	Minutes after injection.													
		25.	30.	35.	40.	50.	60.	75.	90.	120.	150.	180.	210.	240.	270.
Patient 4—Female:															
20 I.M.	106		81				59		53	57	56	57	54	57	57
20 I.V.	108	72	48	36	34	31	31	45	47	66	86	90	93	95	98
40 I.M.	99		90				65		39	39	45	38	39	38	45
40 I.V.	95	45	32	29	20	15	20	22	22	48	54	68	75	75	83
60 I.M.	90		70				36		31	28	31	31	35	45	50
60 I.V.†	90	36	27	24	20	25	27	22	34	47	55	58	59	71	83
80 I.M.†	92		72				31		19	19	19	23	31	32	39
80 I.V.	88	57	39	32	24	22	24	25	25	26	34	41	54	70	75
90 I.M.	97		76				39		24	17	18	20	25	27	35
90 I.V.	93	43	35	34	29	26	26	32	30	29	34	36	41	49	56
98 I.M.*	88		60				31		20	18	18	20	22	20	19
98 I.V.	101	60	54	33	32	25	24	31	29	23	33	36	38	41	41
110 I.V.	96	54	40	32	29	25	23	24	25	23	26	28	34	37	39
118 I.V.*	86	65	54	39	32	22	18	14	15	15	17	15	16	18	—
Patient 5—Male:															
20 I.M.	106		94				79		75	79	85	92	96	98	101
20 I.V.	94	62	56	54	56	60	68	72	78	89	90	91	90	92	91
40 I.M.	92		78				68		58	62	67	71	75	83	89
40 I.V.	97	63	52	52	50	56	67	75	81	90	95	93	96	96	96
60 I.M.	93		84				67		57	65	66	68	70	74	77
60 I.V.	99	58	47	43	47	53	59	69	78	87	95	94	94	96	95
80 I.M.	104		63				63		61	54	57	59	59	63	67
80 I.V.	93	54	43	31	41	49	54	63	72	81	86	85	87	89	87
100 I.M.	92		72				34		43	50	48	56	56	59	61
100 I.V.†	95	48	33	27	35	39	43	55	56	64	76	89	93	97	97
120 I.M.†	95		60				46		43	40	54	54	54	55	57
120 I.V.	89	40	31	23	28	32	35	51	64	69	74	78	83	85	85
140 I.M.	97		57				36		34	36	41	41	39	41	42
140 I.V.	96	55	41	25	19	21	30	34	45	54	59	63	69	69	68
152 I.M.	92		71				39		31	34	28	34	36	34	32
152 I.V.	86	43	35	26	18	19	25	29	27	35	39	47	46	49	54
164 I.M.	90		62				32		27	25	25	27	26	24	26
164 I.V.	99	52	39	23	20	22	23	19	26	30	34	38	40	43	42
176 I.M.	98		59				28		22	18	20	21	23	25	24
176 I.V.	93	49	43	27	17	18	20	25	27	23	29	33	35	35	36
188 I.M.*	88		52				24		20	17	19	20	22	22	23
188 I.V.	95	47	35	25	21	19	24	27	29	33	26	30	33	31	30
200 I.V.	89	39	26	29	19	17	23	25	27	29	31	29	33	33	28
212 I.V.	93	45	28	24	21	20	22	23	25	26	24	23	25	23	24
220 I.V.*	87	66	44	30	19	17	18	20	22	21	19	21	23	23	21
Patient 6—Female:															
20 I.M.	92		86				65		39	41	39	50	45	47	47
20 I.V.	95	43	31	29	31	24	26	31	38	47	59	80	93	93	94
40 I.M.	99		83				45		25	27	27	31	29	29	29
40 I.V.	99	34	32	29	31	31	36	41	41	43	54	71	78	87	93
56 I.M.	120		74				45		31	31	31	27	20	24	31
56 I.V.†	97	27	24	23	17	20	25	32	33	34	37	37	41	56	67
68 I.M.†	122		74				34		27	31	29	29	19	25	29
68 I.V.	102	43	30	25	20	27	25	28	33	31	34	36	40	45	52
80 I.M.	96		56				32		27	24	24	23	24	27	29
80 I.V.	115	34	31	27	25	23	25	36	31	34	39	38	41	41	43
92 I.M.*	113		47				29		25	21	19	22	22	22	25
92 I.V.	97	39	34	—	20	31	27	31	31	25	32	30	31	33	37
104 I.V.	108	34	31	25	24	19	25	27	25	26	29	31	29	33	33
114 I.V.*	96	27	29	25	22	27	25	24	22	21	23	25	22	20	20

TABLE II—(*contd.*).

The doses required to induce "sopor" are marked with †.
The doses required to induce coma are marked with an asterisk.
I.M. = intramuscular; I.V. = intravenous.

Units of insulin.	Fasting blood sugar.	Minutes after injection.												
		25.	30.	35.	40.	50.	60.	75.	90.	120.	150.	180.	210.	240.	270.
Patient 7—Male:															
20 I.M.	95		70				63		38	31	32	29	32	34	34
20 I.V.	108	48	39	25	32	27	32	33	36	43	50	74	87	93	97
40 I.M.	120		78				41		29	27	26	25	44	45	46
40 I.V.	106	57	45	39	27	29	24	25	27	31	61	72	83	95	92
60 I.M.	99		90				67		38	25	15	19	28	28	36
60 I.V.	106	50	39	29	29	29	27	31	24	34	52	63	75	89	94
80 I.M.	109		83				61		25	22	27	31	31	31	36
80 I.V.†	125	59	47	38	32	24	22	24	19	22	31	44	36	48	54
92 I.M.†	120		93				56		25	17	19	20	22	27	25
92 I.V.	111	48	31	24	24	19	15	20	20	27	36	32	36	36	43
100 I.M.*	119		81				39		22	20	19	20	19	21	23
100 I.V.	96	50	41	27	24	22	23	24	34	27	28	30	34	35	35
110 I.V.	112	43	29	25	29	31	25	22	25	32	29	32	34	29	29
118 I.V.*	101	45	20	19	19	17	20	19	19	20	22	25	24	28	30
Patient 8—Male:															
20 I.M.	98		74				34		36	27	27	37	38	39	50
20 I.V.	115	31	27	29	31	32	39	43	45	61	78	92	95	97	89
40 I.M.	95		72				36		32	32	29	38	32	36	38
40 I.V.†	100	29	23	24	23	24	22	18	25	41	43	50	65	72	87
52 I.M.†	93		56				32		29	29	31	27	33	35	34
52 I.V.	97	33	21	21	24	26	27	27	30	38	41	43	53	61	74
60 I.M.*	106		36				27		26	27	25	19	19	17	21
60 I.V.	95	34	19	24	25	32	29	27	25	35	38	41	45	49	54
68 I.V.	108	32	36	22	21	19	19	19	22	27	34	34	39	45	45
76 I.V.*	117	39	32	22	21	21	22	20	17	23	24	29	30	28	—
Patient 9—Male:															
20 I.M.	96		61				38		40	43	47	51	51	57	65
20 I.V.	94	56	39	32	33	35	39	45	46	57	73	81	87	88	87
40 I.M.	106		65				45		29	29	29	32	36	31	38
40 I.V.†	90	35	22	23	25	27	29	33	39	40	44	58	65	76	84
60 I.M.†	111		83				34		22	22	22	25	29	29	33
60 I.V.	99	31	21	19	19	23	26	27	30	36	42	51	55	61	67
72 I.M.	92		68				24		24	16	17	23	25	25	27
72 I.V.	98	37	21	18	19	23	21	25	25	29	35	41	46	55	59
80 I.M.*	95		66				18		18	17	15	17	17	20	21
80 I.V.	92	36	24	20	20	23	23	24	24	30	32	33	38	42	53
88 I.V.	98	32	22	18	19	18	22	24	25	27	30	31	35	35	33
96 I.V.	90	40	21	20	18	19	20	19	20	25	23	24	30	29	31
104 I.V.*	99	32	24	20	17	17	16	15	17	19	20	19	24	23	24
Patient 10—Male:															
20 I.M.	98		61				39		38	42	47	51	54	53	57
20 I.V.	93	33	27	30	31	34	37	40	42	57	72	82	88	89	88
40 I.M.	96		56				31		31	38	31	31	29	34	36
40 I.V.	92	34	29	27	29	32	29	31	32	41	67	77	84	84	86
60 I.M.	93		54				41		34	34	32	32	33	33	35
60 I.V.†	97	43	38	26	25	26	27	28	30	35	45	64	70	70	72
72 I.M.†	88		61				38		27	31	32	31	31	30	29
72 I.V.	100	39	29	25	22	20	29	29	29	24	34	43	54	63	69
84 I.M.	97		58				31		23	25	27	25	26	29	28
84 I.V.	90	43	32	25	27	29	26	19	22	24	28	32	41	53	56
94 I.M.*	92		54				25		20	19	23	20	19	21	20
94 I.V.	98	38	26	24	19	22	23	21	22	22	28	32	38	47	46
106 I.V.	93	32	22	22	19	22	24	22	24	20	26	26	35	36	38
114 I.V.*	100	52	33	32	31	19	20	23	23	24	22	22	21	23	26

TABLE II—(*contd.*).

The doses required to induce "sopor" are marked with †.
The doses required to induce coma are marked with an asterisk.
I.M. = intramuscular; I.V. = intravenous.

Patient 11—*Female:*

Units of insulin.	Fasting blood sugar.	Minutes after injection.													
		25.	30.	35.	40.	50.	60.	75.	90.	120.	150.	180.	210.	240.	270.
20 I.M.	81		59				47		47	45	45	45	45	47	54
20 I.V.	79	45	36	25	31	36	36	41	47	60	72	74	75	74	76
40 I.M.	90		74				43		39	38	38	39	36	41	47
40 I.V.	86	25	19	27	27	27	33	36	40	45	54	63	63	72	81
60 I.M.	90		65				41		41	45	43	39	45	39	38
60 I.V.	93	59	41	36	31	41	38	52	47	46	45	48	59	68	74
80 I.M.	92		70				36		32	32	36	41	36	39	34
80 I.V.†	86	41	29	25	24	29	32	36	43	39	41	47	52	63	74
100 I.M.†	88		59				34		32	32	31	36	32	31	30
100 I.V.	86	43	34	29	24	32	34	32	36	37	41	50	51	52	63
120 I.M.	101		57				39		32	32	36	38	32	39	35
120 I.V.	90	52	38	31	30	27	32	32	32	34	38	43	45	49	54
132 I.M.	86		56				38		30	29	30	31	33	33	35
132 I.V.	93	41	32	27	29	30	31	33	32	30	36	38	39	41	45
144 I.M.*	86		43				29		27	24	24	27	25	29	30
144 I.V.	99	41	29	24	19	22	24	31	32	34	36	37	39	43	47
156 I.V.	90	39	34	31	25	22	28	30	30	31	33	35	34	38	43
168 I.V.*	91	38	31	26	22	22	24	24	24	27	29	27	31	29	33

Patient 12—*Female:*

20 I.M.	96		81				76		69	67	67	72	75	79	79
20 I.V.	91	65	49	38	44	58	64	65	64	67	77	89	91	89	90
40 I.M.	89		67				55		52	55	59	57	63	61	65
40 I.V.	82	69	26	22	27	36	38	38	49	53	67	73	81	81	83
60 I.M.	97		59				47		40	43	46	47	48	51	53
60 I.V.	92	38	32	36	32	29	34	43	45	47	52	52	63	72	71
80 I.M.	95		65				42		41	39	37	37	41	43	45
80 I.V.	83	45	34	29	24	30	39	39	39	41	43	49	57	65	65
100 I.M.	89		53				43		45	43	43	39	43	47	45
100 I.V.†	90	47	32	27	23	29	38	37	36	39	45	45	51	55	59
120 I.M.	95		67				38		37	39	38	40	43	41	41
120 I.V.	97	46	33	31	29	27	34	42	42	39	38	43	45	47	51
140 I.M.†	91		63				32		35	35	33	35	36	34	37
140 I.V.	101	47	36	25	23	24	31	35	37	42	39	37	41	45	47
160 I.M.	93		68				37		33	31	33	34	34	35	34
160 I.V.	96	37	32	21	23	21	27	33	33	35	39	41	43	43	45
172 I.M.	88		63				30		27	28	30	31	30	29	31
172 I.V.	93	36	28	23	21	24	25	25	27	31	35	31	33	34	37
184 I.M.	97		58				21		24	23	22	23	24	26	26
184 I.V.	95	40	27	25	23	22	22	25	28	30	33	36	34	33	35
196 I.M.*	93		54				22		19	17	16	20	22	21	21
196 I.V.	89	29	26	19	23	23	21	23	25	27	29	33	35	35	33
208 I.V.	91	36	24	20	21	24	22	23	23	21	25	27	25	27	29
220 I.V.	83	31	27	23	17	19	20	23	23	25	26	24	25	26	27
232 I.V.*	96	32	28	21	19	17	20	19	18	21	20	19	21	21	22

TABLE III.

Patient number.	Sex of patient.	Units of insulin required to produce— Initial sopor. I.M.	Initial sopor. I.V.	Sopor following sensitization. I.M.	Sopor following sensitization. I.V.	Initial coma. I.M.	Initial coma. I.V.	Coma following sensitization. I.M.	Coma following sensitization. I.V.
1	M.	100	80	74	62	140	174	98	130
2	M.	100	80	66	52	140	170	94	112
3	M.	60	40	42	30	92	118	70	88
4	F.	80	60	42	32	98	118	64	78
5	M.	120	100	92	78	188	220	150	166
6	F.	68	56	38	32	92	114	56	72
7	M.	92	80	—	—	100	118	—	—
8	M.	52	40	—	—	60	76	—	—
9	M.	60	40	—	—	80	104	—	—
10	M.	72	60	—	—	94	114	—	—
11	F.	100	80	—	—	144	168	—	—
12	F.	140	100	—	—	196	232	—	—

required to produce coma as compared with intramuscular insulin. Three hypotheses to explain the present findings suggest themselves as follows:

(1) *Excretion of intravenous insulin in the urine.*—The sudden injection of a large quantity of insulin directly into the blood stream might lead to some of the urine being excreted in the urine, and so have no effect upon the level of the blood sugar.

(2) *Destruction of the intravenous insulin by circulating substances in the blood.*—Substances circulating in the blood stream might neutralize part of the large amounts of insulin injected intravenously, and so reduce the efficacy of the insulin in maintaining the blood sugar at low levels for a sufficient period for coma to ensue.

(3) *Rapid but not prolonged action of intravenous insulin.*—Most drugs which can be given intravenously and subcutaneously or intramuscularly have a more rapid but less prolonged action when given by the former as compared with the latter routes. *A priori*, one would expect this to be true also of insulin, so that while it would be possible to produce the milder results of hypoglycaemia, such as perspiration, "sopor," etc., more rapidly with intravenous than with subcutaneous insulin, the action of the drug given intravenously would not be sufficiently prolonged to produce the much deeper hypoglycaemic state of coma with complete areflexia unless it was given in increased doses.

These hypotheses were then put to experimental proof:

(1) *Excretion of Intravenous Insulin in the Urine.*

The possibility that some of the insulin injected intravenously may be excreted quickly by the kidneys follows from the work of Fisher and Noble (1923), who were able to recover from a dog's urine 35 out of 40 units of insulin which had been given intravenously in divided doses of 10 units at hourly intervals under veronal anaesthesia. This work was confirmed by Bruger and Friedman (1938). Recordier and Andrac (1935) found that the hypoglycaemic action of insulin administered to dogs intravenously was consistently prolonged after bilateral nephrectomy. Goadby and Richardson (1940) injected 40 units of insulin into rabbits, and then injecting samples of blood withdrawn at varying intervals found that the blood-sugar level of the latter

animals became depressed, and ascribed the hypoglycaemic effect to the insulin still in the blood of the first animal. Normally the hypoglycaemic effect could be induced if the blood were withdrawn within 90 minutes of the original injection, but if the kidneys were excluded from the circulation, the hypoglycaemic activity lasted considerably longer.

It would thus appear fairly certain that in animals insulin injected intravenously is partly excreted in the urine. The fact that it appears in the urine in a form capable of producing hypoglycaemia (Bruger and Friedman, 1935) indicates that it has been excreted before it has exercised its full hypoglycaemic effects, and it may therefore be that more insulin would be required to produce given results when administered intravenously than subcutaneously owing to its being excreted more rapidly when given by the former route.

The evidence for the excretion by the kidneys of insulin in normal and diabetic human subjects has been very conflicting. The literature is reviewed by Cutting (1942), who also devised a method by which 0·25 units insulin per 100 ml. urine, added *in vitro*, could be detected. She found that no insulin could be detected in normal urine, and that, if present, it must be there in amounts of less than 0·25 unit/100 ml.

Cutting's method consisted of adding 0·5 ml. of rabbit plasma to 100 ml. of urine which had been adjusted to a pH of 5·0 (isoelectric point of insulin). 32 gm. of crystalline ammonium sulphate was added to half-saturate the solution, and the mixture was stirred and kept in a warm place in order that the resulting precipitate which contained the insulin should flocculate. The precipitate was filtered out, dried and ground up in a mortar with 10 ml. of a borate buffer solution at pH 8·0. Some of the precipitate which did not dissolve was removed by centrifuge. The supernatant liquid which contained the insulin was then injected into test animals, and the blood-sugar curves estimated by the Hagedorn and Jenson method.

Dr. C. H. Gray kindly undertook the examination of the urine of 4 patients (2 male and 2 female) who were each given intravenous injections of 500, 750 and 1,000 units of insulin on successive days. The male patients were instructed to empty their bladders immediately before injection, and the female patients were catheterized. In order to ensure diuresis the patients were given 1 pint of plain water to drink immediately after the injection. Half an hour after injection the male patients emptied their bladders as far as possible spontaneously, while the female patients were catheterized. This was repeated one hour after the injection. Each patient was then given 250 c.c. of 33 per cent. glucose intravenously to abort or prevent the onset of hypoglycaemia, and this together with adequate sugar by mouth was found sufficient despite the large doses of insulin given.

The insulin was given in the large doses of 500, 750 and 1,000 units, because it was felt that if no insulin could be detected in the urine following such doses there was little point in attempting to find it using the usual doses necessary in Sakel's method (approximately 60–300 units).

Results.—Two specimens of urine, one at 30 minutes and the other at 60 minutes after the intravenous injection of 500, 750 and 1,000 units in each of 2 male and 2 female patients, were examined. All the tests were negative.

In view of the delicacy of the test by which insulin in the proportion of 0·25/100 ml. could be detected, the very large amounts of insulin injected, 500–1,000 units, and the unequivocal nature of the results, it must be concluded that no part of insulin injected intravenously in man is excreted in the urine.

(2) *Destruction of Intravenous Insulin by Circulating Substances in the Blood.*

The injection into the blood stream of the quantities of insulin given in the experiments (20–232 units) represents a very large increase over the minute quantity of insulin normally present, and it is possible that some of it may be neutralized by substances, such as adrenaline, which are already circulating in the blood. The large quantities injected make it unlikely that all the insulin would be destroyed in this way, but sufficient might be thus neutralized to account for the more temporary nature of the action of insulin administered intravenously, as compared with the more prolonged action of insulin given by the subcutaneous and intramuscular routes. To test whether this is so, the following experiment was carried out:

Experiment.—Four patients (2 male and 2 female) were selected and given no insulin for a fortnight. Each was then given 2 units of insulin daily for 24 days under the following conditions:

(*a*) On the first and succeeding *odd* days (1, 3, 5, etc.) 2 units of soluble insulin were given intravenously in the usual way and the blood-sugar levels charted during the following 150 minutes, by which time the blood sugar had returned to normal.

(*b*) On the second and succeeding *even* days (2, 4, 6, etc.) 100 c.c. of the patients' blood were removed from an ante-cubital vein, and to it were added 2 units of insulin, with very gentle mixing to ensure the even distribution of the insulin throughout the blood. The blood was then kept at 37° C. for 60 minutes and then injected into the patient intravenously. It was injected under pressure from a reversed Wolff's bottle, and the average time taken for the injection was 45–60 seconds. The blood-sugar level was then charted at intervals for the next 150 minutes. At the end of the 24 days there had been obtained for each of the 4

TABLE IV.

(A) 2 units of insulin intravenously.
(B) 2 units of insulin mixed with 100 c.c. of the patient's blood, kept at body heat for 1 hour and then injected intravenously.

	Fasting blood sugar.	Minutes after injection.											
		10.	15.	20.	25.	30.	35.	40.	50.	60.	75.	90.	120.	150.
Patient 1 (M.):														
(A)	99	75	70	61	62	55	57	61	67	73	80	88	94	95
(B)	94	74	63	60	56	53	55	60	70	75	81	88	94	99
Patient 2 (M.):														
(A)	94	76	72	69	66	62	63	69	77	82	87	91	94	94
(B)	95	76	71	69	66	63	65	69	78	85	86	93	94	95
Patient 3 (F.):														
(A)	91	73	66	58	48	49	51	58	64	71	76	85	90	90
(B)	92	73	65	57	50	49	51	56	64	71	76	84	90	91
Patient 4 (F.):														
(A)	89	66	59	52	46	46	47	53	58	68	76	82	88	89
(B)	92	67	59	52	46	44	46	53	60	75	75	82	88	90

TABLE V.—*Blood-sugar Values Following (A) the Intravenous Injection of 2 Units of Insulin and (B) Intravenous Injection of 2 Units of Insulin Mixed with 100 c.c. of the Subject's Blood and Kept at Body Heat for 60 Minutes.*

Day of experiment.	Fasting blood sugar.	Minutes after injection.											
		10.	15.	20.	25.	30.	35.	40.	50.	60.	75.	90.	120.	150.
Patient 1:														
1 (A)	97	70	63	54	54	57	61	65	67	68	76	81	95	96
2 (B)	101	75	68	57	53	45	53	62	71	73	79	83	98	99
3 (A)	93	72	66	61	56	56	57	59	65	68	73	79	91	94
4 (B)	97	70	61	59	52	55	57	61	67	72	77	85	99	98
5 (A)	92	74	69	63	56	54	57	65	67	74	77	82	88	90
6 (B)	89	69	63	56	55	53	59	63	69	77	75	81	89	92
7 (A)	97	75	65	61	56	57	59	68	70	73	76	80	91	93
8 (B)	93	79	69	63	59	57	61	61	68	69	77	83	92	89
9 (A)	89	74	66	61	66	66	61	65	75	79	86	89	88	89
10 (B)	99	72	65	64	59	59	59	61	73	75	77	81	95	96
11 (A)	98	76	66	64	57	59	57	63	75	81	89	95	99	99
12 (B)	91	71	52	57	52	51	49	55	67	77	85	87	89	86
13 (A)	99	82	76	70	65	52	56	53	66	72	83	93	96	96
14 (B)	87	78	68	59	57	57	56	62	69	81	87	89	89	89
15 (A)	91	75	70	63	52	52	54	54	59	66	79	87	89	89
16 (B)	96	76	67	62	58	55	57	65	69	76	81	89	94	95
17 (A)	102	75	68	59	58	57	58	61	70	76	81	93	99	101
18 (B)	93	73	61	63	55	53	57	63	67	71	75	87	92	93
19 (A)	108	76	68	64	61	59	59	56	68	75	87	99	104	104
20 (B)	97	77	63	67	59	53	54	61	71	77	81	95	96	94
21 (A)	91	71	61	56	52	45	54	61	65	78	84	89	90	90
22 (B)	95	75	68	55	54	44	49	57	67	82	87	97	96	91
23 (A)	92	74	65	55	49	45	54	52	56	63	72	85	93	93
24 (B)	95	71	65	59	56	49	47	49	59	73	79	93	93	96
Average blood-sugar levels:														
(A)	98	75	70	61	62	55	57	61	67	73	80	88	94	95
(B)	94	74	63	60	56	53	55	60	70	75	81	88	94	99
Patient 2:														
1 (A)	102	84	73	69	68	63	65	72	77	82	89	96	102	102
2 (B)	91	75	69	68	64	61	62	67	75	81	90	91	92	92
3 (A)	98	78	69	66	64	61	63	69	76	89	92	94	94	93
4 (B)	97	79	71	66	66	64	64	71	81	85	87	91	98	98
5 (A)	90	76	73	71	69	65	66	73	81	85	89	92	93	93
6 (B)	97	81	72	72	70	65	67	69	77	86	91	98	99	99
7 (A)	93	81	73	68	63	63	63	67	74	79	85	89	91	91
8 (B)	96	74	69	67	64	61	64	73	79	87	87	93	96	95
9 (A)	89	72	65	64	59	57	57	63	76	81	86	89	90	88
10 (B)	93	69	61	65	64	62	61	66	81	85	89	90	89	89
11 (A)	91	73	73	71	70	68	67	74	79	83	87	87	90	91
12 (B)	99	77	71	69	67	67	69	70	77	85	89	98	99	99
13 (A)	97	75	68	67	65	59	65	69	77	84	86	89	95	95
14 (B)	97	81	77	73	65	63	64	68	75	86	86	93	95	98
15 (A)	95	79	73	71	67	61	63	67	84	87	85	91	96	96
16 (B)	93	73	71	71	70	76	70	74	81	86	89	91	92	93
17 (A)	96	81	74	69	63	59	59	66	77	83	89	93	93	93
18 (B)	97	78	76	73	65	63	63	69	81	79	85	94	94	96
19 (A)	96	82	76	74	68	65	65	69	76	81	87	89	93	95
20 (B)	99	78	72	71	65	61	64	68	77	83	91	102	98	98
21 (A)	94	77	69	67	65	61	63	69	74	79	79	89	92	92
22 (B)	91	74	73	70	67	57	65	69	79	89	89	90	91	91
23 (A)	99	79	73	71	68	63	65	71	71	81	87	99	98	99
24 (B)	91	72	72	68	63	61	61	68	75	85	89	90	89	89
Average blood-sugar levels:														
(A)	94	76	72	69	66	62	63	69	77	82	87	91	94	94
(B)	95	76	71	69	66	63	65	69	78	85	86	93	94	95

TABLE V.—(*Contd.*)

Day of experiment.	Fasting blood sugar.	Minutes after injection.											
		10.	15.	20.	25.	30.	35.	40.	50.	60.	75.	90.	120.	150.
***Patient* 3:**														
1 (A)	89	74	65	59	55	54	55	60	62	68	74	79	87	87
2 (B)	94	71	67	57	53	53	49	57	67	69	75	78	91	91
3 (A)	93	72	63	55	48	48	53	59	63	67	73	81	89	92
4 (B)	87	68	65	51	51	47	49	61	64	65	69	77	87	87
5 (A)	87	71	68	55	45	46	48	55	61	69	76	84	89	90
6 (B)	91	75	61	56	51	43	47	47	59	71	78	90	91	90
7 (A)	91	75	67	58	49	48	49	56	65	72	77	89	90	90
8 (B)	95	69	67	61	44	47	51	57	67	69	78	87	94	94
9 (A)	92	73	64	59	54	56	59	63	69	73	75	86	85	85
10 (B)	89	71	61	53	51	51	61	65	67	71	71	79	86	87
11 (A)	94	69	64	54	47	48	47	57	64	71	79	87	94	93
12 (B)	91	73	65	57	51	49	55	55	61	69	76	84	90	90
13 (A)	90	75	67	58	51	51	53	58	67	67	75	84	89	89
14 (B)	93	74	65	57	56	47	46	54	63	71	77	84	87	87
15 (A)	89	76	66	59	52	52	52	59	69	72	78	89	88	89
16 (B)	93	70	59	60	49	49	47	57	71	78	81	90	94	94
17 (A)	94	71	66	62	48	47	46	54	58	68	73	85	90	93
18 (B)	91	67	71	57	43	49	48	53	54	71	76	84	90	90
19 (A)	91	73	64	59	51	52	51	57	63	69	75	83	92	91
20 (B)	92	74	67	57	53	53	53	53	59	67	71	79	91	95
21 (A)	92	74	67	62	45	44	48	55	64	71	77	87	90	90
22 (B)	97	74	71	64	49	51	51	56	59	69	79	87	95	97
23 (A)	95	76	65	57	46	49	53	58	67	69	78	91	93	96
24 (B)	89	73	61	57	45	44	49	61	71	78	83	86	89	90
Average blood-sugar values:														
(A)	91	73	66	58	48	49	51	58	64	71	76	85	90	90
(B)	92	73	65	57	50	49	51	56	64	71	76	84	90	91
***Patient* 4:**														
1 (A)	84	63	57	47	42	41	43	48	55	67	74	83	86	86
2 (B)	87	65	63	55	48	43	42	47	57	68	69	77	81	83
3 (A)	90	69	60	53	46	45	44	51	60	71	77	85	92	93
4 (B)	86	67	59	52	47	45	44	52	59	67	81	89	89	89
5 (A)	88	65	56	47	43	41	44	47	54	67	76	89	87	87
6 (B)	87	67	55	46	43	43	43	52	63	70	77	84	86	85
7 (A)	91	71	57	50	49	49	49	54	59	65	79	85	90	90
8 (B)	93	63	59	52	45	42	47	55	57	68	79	87	92	93
9 (A)	87	65	58	52	51	50	54	59	63	69	81	87	86	85
10 (B)	94	66	57	51	46	46	47	54	64	71	78	89	93	93
11 (A)	90	63	55	52	47	45	48	54	59	70	78	89	93	94
12 (B)	95	71	61	56	51	43	47	59	63	65	80	88	96	90
13 (A)	91	67	55	50	46	46	47	55	61	72	80	83	86	89
14 (B)	89	65	59	53	41	41	44	57	59	67	75	65	90	92
15 (A)	93	70	59	52	50	51	51	53	57	64	73	85	90	92
16 (B)	89	67	53	48	46	47	48	49	63	68	79	90	92	91
17 (A)	87	71	67	56	47	48	49	52	58	67	68	77	82	87
18 (B)	93	64	59	52	49	49	49	55	63	69	72	85	85	93
19 (A)	88	65	65	57	43	46	49	53	59	67	70	70	86	86
20 (B)	94	68	57	51	47	43	54	57	58	65	61	74	87	90
21 (A)	90	61	62	49	49	48	48	56	61	68	77	76	84	90
22 (B)	95	71	59	49	49	46	45	51	59	69	79	79	85	93
23 (A)	91	63	60	53	41	43	44	49	55	66	73	73	89	92
24 (B)	87	66	63	55	45	38	39	50	59	70	73	77	81	88
Average blood-sugar values:														
(A)	89	66	59	52	46	46	47	53	58	68	76	82	88	89
(B)	92	67	59	52	46	44	46	53	60	75	75	82	88	90

patients 12 blood-sugar charts following the injection of 2 units of insulin which had been previously mixed with 100 c.c. of the patient's blood at body heat for one hour.

Results.—The results obtained are set out in detail in Table V, but the average readings of the blood-sugar levels obtained with the two kinds of injections may be summarized in Table IV.

It will be seen from Table IV that the blood-sugar values obtained in both groups, (A) and (B), are identical within the limits of the experiment. The effect on the blood sugar after 2 units of insulin have been incubated with 100 c.c. of the patient's blood at body heat for 60 minutes is of the same order as when this quantity of insulin is injected by itself. Taking the average blood volume in the adult to be 6 litres (Samson Wright, 1945), 2 units per 100 c.c. is equivalent to 120 units for the total blood volume, and were there any circulating substances in the blood ready to destroy injected insulin, it is probable that there would have been a definite neutralization of some at least of the insulin during the hour it was incubated with the blood at 37° C., with a consequent reduction of its effect upon the blood sugar following re-injection. No such diminution in activity could be found, however, as the blood-sugar values are practically identical with those obtained after the intravenous injection of 2 units of insulin in the usual way.

Conclusion.—It must, therefore, be concluded that the more temporary action of intravenous as compared with intramuscular insulin is not due to the neutralization of part of the intravenous insulin by substances already circulating in the blood stream. This conclusion, of course, does not exclude the possibility that, after insulin has been injected intravenously, a neutralizing substance might not then be poured into the blood stream to neutralize part of it, but it was not found possible in the time available to design experiments to test this possibility.

(3) *That a Portion of Intravenous Insulin is Used Up in Producing its Rapid Action on the Blood Sugar, so that Insufficient is Left to Prolong the Hypoglycaemia as is the Case with Intramuscular and Subcutaneous Insulin.*

It is well known that insulin given intravenously produces a more rapid fall in the blood sugar than when it is administered subcutaneously or intramuscularly. Sandison and McGregor (1942) also claim that patients become more easily sensitized to intravenous insulin, while several authors, e.g. Bardenat and Leonardon (1939), Reznikoff and Scott (1942) find that coma induced in this way is quieter than coma induced by the other parenteral routes. The question, therefore, arises whether there is any fundamental difference in the action of insulin when it is administered in different ways. Experiments were devised to see whether any such difference exists.

Experiment : Rate of absorption of insulin into the blood following injection.—One difference between intravenous and intramuscular injection is that by the first route all the insulin enters the blood stream almost instantaneously, whereas by the second route, a deposit of insulin is formed in the tissues, from which it is probably absorbed into the blood at a much slower rate. The

difference in action between intravenous and intramuscular insulin may, therefore, be entirely a question of *the rate at which the substance is absorbed into the blood stream.*

To test this hypothesis two patients were given insulin under the following conditions:

Increasing doses of insulin (20–132 units and 20–120 units) were added to three pints of isotonic saline and injected by intravenous drip over a period of 240 minutes. The injections were given at intervals of four days to avoid sensitization of the patient to the insulin, and blood-sugar estimations were made at 30, 60, 90, 120, 150, 180, 210, 240 and 270 minutes after the commencement of the intravenous drip. The blood-sugar results are set out in detail in Table VI, from which it will be seen that *although the insulin was given intravenously, the blood-sugar curve resembles that obtained after an intramuscular injection*, with the blood sugar reaching its lowest level in about 120 minutes after the commencement of the injection. This would seem to indicate that the apparent difference in the action of intravenous and intramuscular insulin is entirely due to the different rates at which the insulin enters the blood stream, since if insulin enters the blood by the intravenous route at a sufficiently slow rate, a blood-sugar curve of the intramuscular and not the intravenous type is produced.

To test the hypothesis further, each of three patients were then given 60, 40 and 20 units of insulin respectively as follows:

On the first morning the quantity of insulin (60, 40 or 20 units) was mixed with three pints of normal saline and given by intravenous drip over a period of 240 minutes. The patient given 60 units was therefore receiving insulin intravenously at the rate of 0·25 units per minute. The blood sugar was estimated at intervals of 15, 20, 25, 30, 35, 45, 60, 90, 120, 150, 180, 210, 240 and 270 minutes (Table VII). It was again found that although the insulin was given intravenously, the blood-sugar curve obtained was of the same type as that produced by intramuscular or subcutaneous insulin. The blood sugar reached its minimum level in 90 minutes as opposed to the usual 20–35 minutes,

TABLE VI.—*Blood-sugar Values Following Varying Doses of Insulin Given in Saline by Intravenous Drip Over 240 Minutes.*

Units of insulin.	Fasting blood sugar.	Minutes after commencement of intravenous drip.								
		30.	60.	90.	120.	150.	180.	210.	240.	270
Patient 1:										
20	76	65	56	54	38	37	39	38	38	36
40	79	48	42	36	36	36	39	39	36	39
60	81	65	43	32	34	27	29	32	32	36
80	90	43	38	29	27	25	27	27	27	27
100	101	61	39	36	27	31	29	26	26	25
120	90	55	27	31	27	26	27	31	29	27
132	92	47	31	29	22	24	20	19	20	24
Patient 2:										
20	92	81	74	68	63	59	54	57	54	50
40	86	65	61	59	55	52	36	31	39	48
60	98	74	60	58	56	45	34	28	28	36
80	88	72	56	54	48	45	32	27	25	29
100	92	74	57	43	32	32	27	25	27	34
120	90	72	54	38	32	29	27	29	30	31

TABLE VII (A).—*Blood-sugar Values Following* 60 *Units of Insulin Given in Saline by Intravenous Drip Over Varying Periods of Time at Intervals of Four Days.*

Column (1): Length of time in minutes over which drip was given.
Column (2): Fasting blood sugar.

Column (1).	Column (2).	Minutes after commencement of intravenous drip.												
		15.	20.	25.	30.	35.	45.	60.	90.	120.	150.	180.	210.	240.	270.
240	98	84	80	77	72	68	63	52	26	24	24	29	25	25	32
210	95	77	75	70	68	64	60	46	37	27	30	29	25	27	39
195	92	73	69	63	58	56	49	38	38	32	29	29	22	25	41
180	93	75	67	54	62	58	50	34	31	31	31	31	33	36	59
150	92	71	68	62	58	55	49	34	33	32	32	32	32	42	57
120	88	70	65	58	52	48	42	29	31	33	34	34	43	59	70
90	86	70	66	59	49	52	45	31	27	29	43	50	52	66	70
60	88	69	63	53	52	48	40	24	27	31	36	43	59	68	81
45	86	61	54	46	38	34	28	17	22	31	43	63	74	79	75
35	84	57	50	43	34	28	26	24	29	29	39	52	70	79	83
20	88	62	53	54	37	32	28	29	41	49	59	63	72	79	83
15	92	63	55	49	35	31	29	34	34	47	57	67	77	83	89
7	92	62	53	47	39	34	28	29	31	41	50	61	74	79	83
3	96	66	57	50	38	31	32	32	34	50	52	65	68	78	86
0	98	67	59	51	34	34	32	32	32	42	53	59	72	74	81

TABLE VII (B).—*Blood-sugar Values Following* 40 *Units of Insulin Given in Saline by Intravenous Drip Over Varying Periods of Time at Intervals of Four Days.*

Column (1): Length of time in minutes over which drip was given.
Column (2): Fasting blood sugar.

Column (1).	Column (2).	Minutes after commencement of intravenous drip.											
		25.	30.	35.	45.	60.	90.	120.	150.	180.	210.	240.	270.
240	92		58			33	31	27	25	27	28	28	30
210	88		70			41	35	29	33	34	33	31	34
180	97		65			41	29	31	31	36	35	43	51
150	92		59			46	37	36	33	33	34	36	47
120	95		56			33	36	36	35	37	41	46	54
90	96		58			36	31	33	41	49	52	54	65
60	89		54			31	33	34	37	54	58	71	83
45	97		45			27	28	33	45	67	73	84	89
30	92	54	39	30	25	27	33	41	53	58	76	85	89
20	98	46	37	31	30	30	43	57	67	77	82	89	95
15	93	39	38	29	30	31	45	51	59	71	86	89	94
7	95	41	33	34	26	27	33	43	61	79	91	94	93
3	91	37	34	31	29	29	37	45	56	73	79	83	87
0	92	34	23	29	29	33	41	43	57	65	74	81	89

TABLE VII (C).—*Blood-sugar Values Following* 20 *Units of Insulin Given in Saline by Intravenous Drip Over Varying Periods of Time at Intervals of Four Days.*

Column (1): Length of time in minutes over which drip was given.
Column (2): Fasting blood sugar.

240	102		66			38	36	29	28	25	32	34	38
210	92		75			54	41	32	34	31	34	31	41
180	86		70			57	34	32	32	39	36	39	54
150	92		61			51	47	42	36	34	36	38	46
120	93		59			46	43	38	38	43	41	41	56
90	97		61			49	41	39	40	39	34	38	51
60	99		63			39	35	39	41	50	62	75	89
45	101		69			42	34	36	47	72	81	89	96
30	110	53	45	39	34	36	39	51	66	68	84	95	104
20	91	47	42	41	35	36	49	64	87	91	89	90	92
15	95	42	39	39	33	37	46	67	79	89	89	93	93
7	95	53	42	40	31	35	47	71	85	92	96	95	96
3	98	49	43	39	36	37	43	69	89	89	95	98	99
0	94	56	45	41	36	39	51	74	83	87	91	91	90

and this level was maintained until the intravenous drip was stopped after 240 minutes.

In order to minimize the effect of sensitization through daily injections of insulin, the patients were then rested for three days, and on the fourth day the experiment was repeated, but the insulin in saline was given over a period of 210 minutes. On succeeding fourth days the period over which the drip was given was progressively shortened through the following periods: 195, 180, 150, 120, 90, 60, 45, 35, 20, 15, 7, 3 and 0 minutes. At the same time the amount of normal saline with which the insulin was mixed was gradually reduced from three pints to *nil*, as the period over which it was given became progressively shorter. ***It was found that as the period over which the insulin in saline was injected became shorter, so the character of the blood-sugar curve changed gradually from a typical subcutaneous curve to a typical intravenous curve.*** The latter was found when 20 minutes or less were taken over the injection.

From the above results it appears that there is no fundamental difference in the action of insulin, whatever the parenteral route used to administer it. The character of the blood-sugar curve produced depends solely upon the rate at which the insulin enters the blood stream, since if intravenous insulin is given in small quantities over a long period (about 240 minutes) the blood-sugar curve is of the subcutaneous and not the intravenous type.

It remains to inquire into the mode of action of insulin injected rapidly by the intravenous route in the usual way. Why is it that intravenous insulin is unable to prolong the fall in the blood sugar, in the way that subcutaneous insulin does, so that, as we have seen, it is relatively inefficient in producing the signs of hypoglycaemia? Blood-sugar curves following intravenous insulin differ from those obtained with subcutaneous insulin mainly in the more rapid and profound fall in the blood sugar. Whereas with subcutaneous insulin the maximum fall in the blood sugar occurs about 90 minutes after the injection, with intravenous insulin the maximum fall is reached in 20–35 minutes, the exact time depending on the amount of insulin injected. In addition, the fall after intravenous insulin is always more profound than that after intramuscular insulin, although this fall cannot be maintained.

We have, therefore, to consider the relationship between the amount of insulin injected and (1) the *extent* of the fall in the blood sugar and (2) the *rate* of this fall.

If the curve of the graph of the relationship is a *rectangular hyperbole*, as shown below, then, since $xy = c$, small doses of insulin will cause a considerable initial fall in the blood sugar, but further decreases can only be achieved by the expenditure of increasingly large doses of insulin until a point is reached when further increases in the amount of insulin, no matter how large, are unable to reduce the blood sugar any further. Considerably more insulin will be required to produce the more intense falls in the blood sugar. ***A portion at least of the insulin would be used up in producing the intense fall, and would be unavailable for prolonging the fall in the blood sugar which is necessary for the development of the more pronounced signs of hypoglycaemia, so that a greater quantity of insulin would be required to produce these pronounced effects than would be required by the intramuscular or subcutaneous route.***

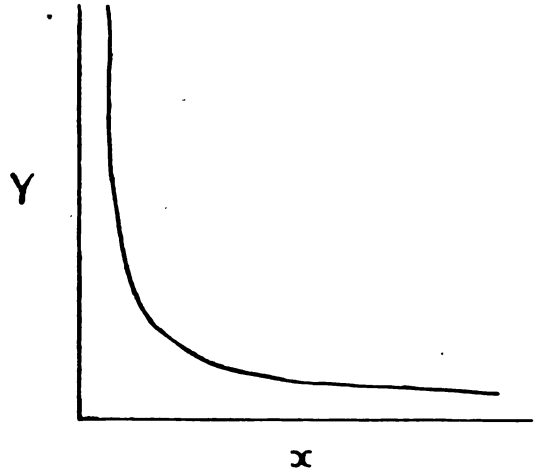
Experiments were then designed to find the relationship between the amount of insulin injected and the extent and rate of the fall in the blood sugar.

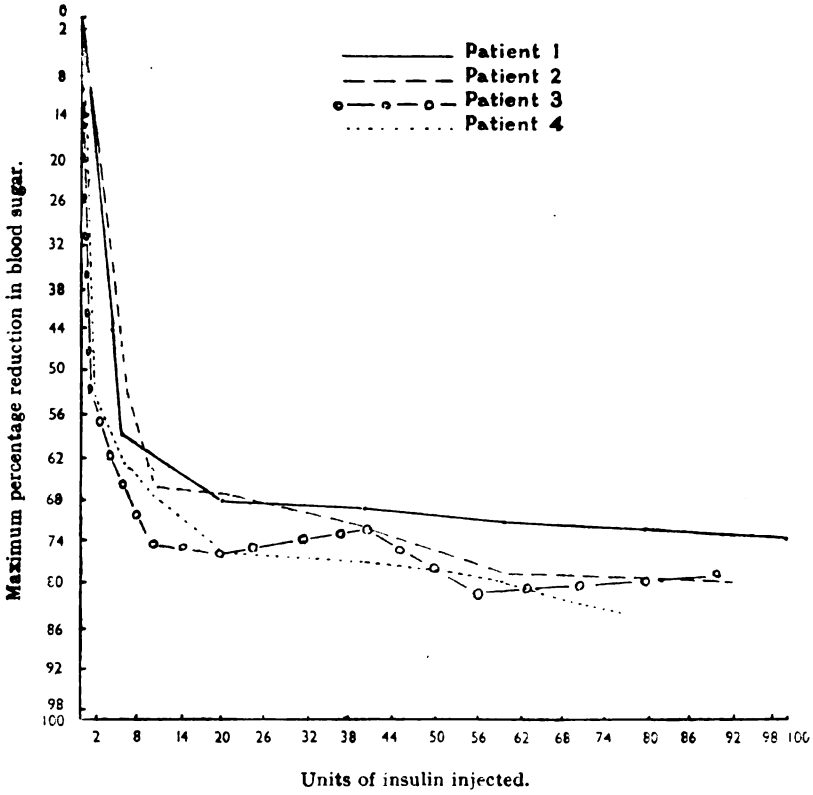
(1) *The Relationship Between the Amount of Insulin Injected and the Extent of the Consequent Fall in the Blood Sugar.*

Four patients were given increasing doses of insulin from 2–170 units at 4-day intervals to avoid sensitization, and the minimum blood value obtained with each dose was noted. From this value the percentage fall in the blood sugar was calculated. The results are given in detail in Table VIII, and from this a graph (Graph 1) was prepared for each patient in which the percentage fall in the blood sugar (ordinate (y)) was placed against the number of units of insulin injected (abscissa (x)). The graph has to be interpreted in the light of the conditions of the experiment, especially that of the patients' diet, which did not have a constant carbohydrate content as the patients ate as much as they wished (Himsworth, 1939). It will be seen, however, that the general form of the curves of the graph resembles that of a rectangular hyperbole. In Patient 4, for instance, 2 units of insulin produced an initial fall of 52 per cent. in the blood sugar, but 6 units (3 x) produced a fall of only 62 per cent. (1·2 x); 10 units (5 x), a fall of 67 per cent. (1·3 x); and 20 units (10 x), a fall of 75 per cent. (1·4 x). In general, the maximum fall of 70–80 per cent. was achieved by 10 units, after which the curve almost completely flattened out, so that high multiples of the original 2 units, which produced an initial fall of 52 per cent., were eventually required to produce a fall of a few milligrams per cent.

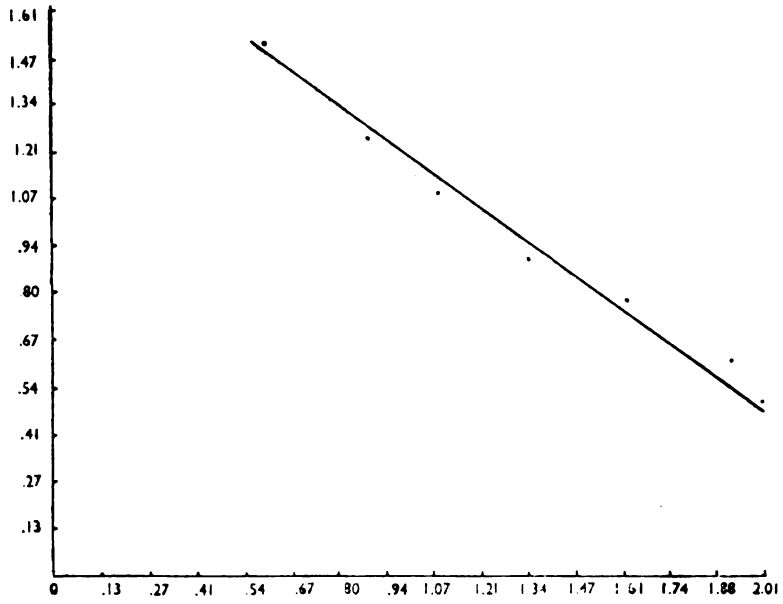
TABLE VIII.—*Minimum Blood-sugar Values Obtained with Increasing Doses of Intravenous Insulin.*

Units of insulin.	Fasting blood sugar.	Minimum blood sugar obtained.	Percentage reduction in blood sugar.	Units of insulin.	Fasting blood sugar.	Minimum blood sugar obtained.	Percentage reduction in blood sugar.
Patient 1:				*Patient* 2:			
2	97	54	44	2	94	63	33
6	101	41	59	6	89	42	55
10	95	36	62	10	91	31	66
20	106	34	68	20	75	25	67
40	108	34	69	40	79	22	72
60	92	27	71	60	92	19	79
80	97	27	72	80	95	19	80
100	99	27	73	86	89	21	76
120	88	23	74	92	93	19	80
140	102	28	73	100	101	19	81
160	94	25	73	110	99	15	85
170	96	25	74	118	95	17	82
Patient 3:				*Patient* 4:			
2	97	46	53	2	98	47	52
6	94	31	67	6	93	35	62
10	101	27	74	10	97	32	67
20	95	24	75	20	115	29	75
40	99	29	72	40	100	23	77
56	97	17	82	52	97	21	78
68	102	20	80	60	95	19	80
80	115	23	80	68	108	19	82
92	97	20	79	76	117	17	85
104	108	19	82	—	—	—	—
114	96	21	78	—	—	—	—

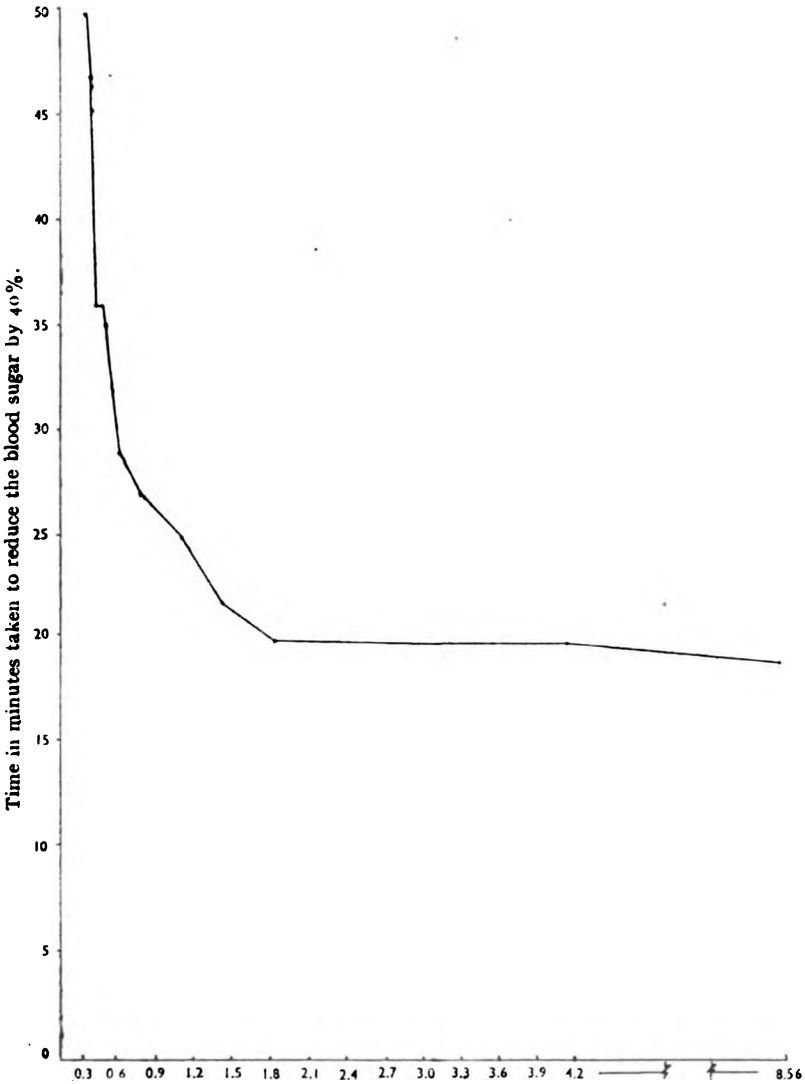




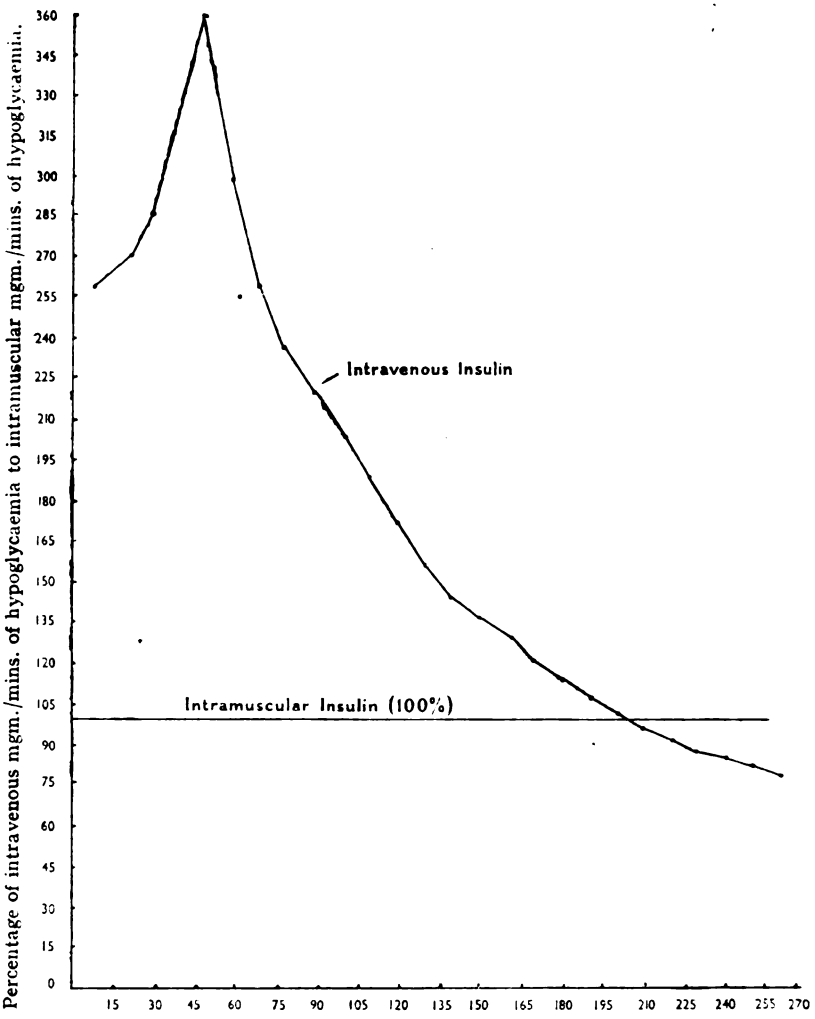
GRAPH I.—Relationship between the amount of insulin injected and the extent of the fall in the blood sugar. (Compiled from Table VIII.)



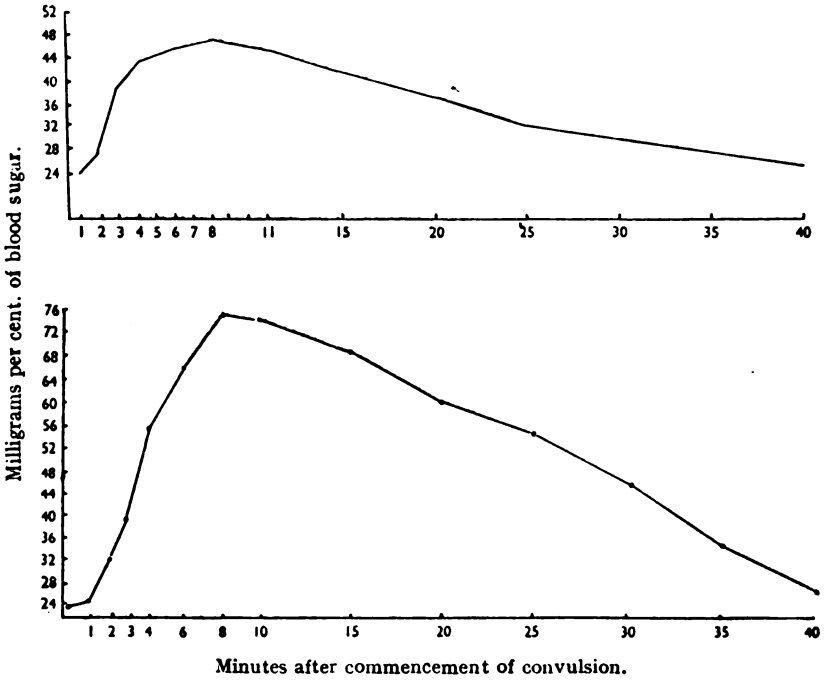
GRAPH 2.—Curve of the graph of log $(x + a)$ against log $(y - b)$.



GRAPH 3.—Times taken by varying amounts of intravenous insulin to reduce the blood sugar by 40%. (Compiled from Table X.)



GRAPH 4.—Mgm./mins. of hypoglycaemia at varying times after intravenous injection of insulin expressed as the percentage of mgm./mins. of hypoglycaemia produced by intramuscular insulin at the same times after injection. (Compiled from Table XI.)



GRAPH 5.—The upper figure shows the behaviour of the blood sugar following a spontaneous insulin convulsion; the lower figure shows the behaviour of the blood sugar following a phrenazol convulsion induced during hypoglycaemia.

Taking the curve of Patient 1 in detail, the following table can be constructed:

$x =$ 2	6	10	20	40	60	80	100
$y =$ 44	59	62	68	70	71	72	73

Changing y into 100-y so as to make both axes start at zero, we get—

$x =$ 2	6	10	20	40	60	80	100
$y =$ 56	41	38	32	30	29	28	27

$xy = c$ can also be rendered $\log (x + a) + \log (y - b) = C$. If there is any relationship of this latter form in the above table, i.e. if the original curve is a rectangular hyperbole, the curve of the graph of $\log (x + a)$ against $\log (y - b)$ would be a straight line.

For this particular curve it is reasonable to make $a = 2$ and $b = 24$. This leads to the table:

$x + 2 =$ 4	8	12	22	42	62	82	102
$y - 24 =$ 32	17	14	8	6	5	4	3

Expressing this table in logarithms we get:

$\log (x + 2) =$ ·60	·90	1·08	1·34	1·62	1·79	1·91	2·01
$\log (y - 24) =$ 1·51	1·23	1·15	·90	·78	·70	·60	·48

This is plotted in Graph 2 and the fit of the observed points to the line is good.

Owing to the difficulty in giving a biological meaning to the variables in the fitting of a hyperbolic curve, it is not claimed that the above curve shows anything more than consistency with the view that profound falls in the blood sugar can only be achieved by the use of disproportionately large doses of insulin *which are used up in producing the fall.* This result is in agreement with Himsworth's (1939) conception of the "head of pressure" nature of the blood sugar. The more profound the fall in the blood sugar, the more serious is the effect upon the metabolism of the tissues. A 10 per cent. fall from an already low blood sugar of 40 per cent. to 30 per cent. has much more serious effect on the tissues than an equal fall from 80 per cent. to 70 per cent. Therefore the more profound the fall the greater will be the activity of the anti-insulin mechanism to prevent any further fall, so that the more the blood sugar is reduced, the greater the amount of insulin required to reduce it still further.

(2) *The Relationship Between the Amount of Insulin Injected and the* RATE *of the Consequent Fall in the Blood Sugar.*

This relationship was deduced from the results obtained by injecting 60 units of insulin in saline over varying periods from 240–0 minutes (Table VII). Owing to the variation in the fasting blood levels, the blood-sugar values obtained in this experiment were recalculated as percentages of the fasting blood-sugar values, and these percentages are set out in Table IX. From this table was then calculated the *time*, in minutes, taken by increasing doses of insulin (0·25–8·56 units of insulin per minute) to reduce the fasting blood sugar

by the arbitrarily chosen amount of 40 per cent. The results of the calculation are given in Table X and in graph form in Graph 3. It will be seen that as with the relationship between the amount of insulin injected and the *extent* of the fall in the blood sugar, so the relationship between the amount of insulin and the *rate* of the fall in the blood sugar is of the rectangular hyperbole type. From the graph we find that 0·25 units of insulin will reduce the blood sugar by 40 per cent. in 50 minutes. To reduce it to this figure in 25 minutes (2 x) not 0·5 units, but 1·0 units (4 x) is required. To reduce it in 20 minutes (2·5 x), 1·71 units (7 x) are required. After 1·71 units per minute the curve flattens out, so that very large increases of insulin are required to reduce the blood sugar by 40 per cent. in 19 minutes (8·56 units per minute), after which further increases, however large, are unable to reduce the time beyond this minimum. It follows, therefore, that increase in the rate at which the blood sugar is reduced can only be achieved by the expenditure of *disproportionately large quantities of insulin which are used up in the production of the increased rate of fall.*

The relationship between the amount of insulin injected and the *extent* and *rate* of the consequent fall in the blood sugar have been considered separately, and the graphs of both relationships have been shown to be of the rectangular hyperbole type. In practice, of course, the relationships cannot be so separated, since the amount of insulin injected influences both the extent and rate of the fall in the blood sugar simultaneously; but the fact that the graph of each relationship is of the rectangular hyperbole type indicates that when the extent and rate are influenced simultaneously, still more disproportionately large amounts of insulin will be required to, say, double the percentage fall in the blood sugar in half the time.

From the above experiments and calculations it follows that as a proportion of insulin injected intravenously is used up in producing the rapid, profound fall in the blood sugar which follows this mode of administration, insufficient insulin is left to prolong the hypoglycaemia at a sufficiently low level for coma to ensue. In this connection it may be pointed out that as long ago as 1930 Nordsted, Norgaard and Thaysen (1930) found a lag between the fall in the blood sugar and the development of even mild hypoglycaemia symptoms. Signs of hypoglycaemia could even develop as the blood sugar was returning to normal. This time lag is due, of course, to the fact that the tissues themselves have to be deprived of glucose before the signs of hypoglycaemia can develop, and this deprivation does not occur immediately the blood sugar falls, but some time afterwards. Freudenberg (1938) and Freudenberg and Fine (1940) pointed out that the blood sugar had to be maintained below 30 mgm. per cent. for about 90 minutes before unconsciousness would ensue, and for about 200 minutes before the corneal reflexes would disappear. In assessing the efficacy of any method of administering insulin in the production of hypoglycaemic symptoms it is necessary, therefore, to have regard as much to the time during which the level of the blood sugar can be depressed as to extent and rate of the initial fall in the blood sugar, since unless a profound and rapid initial fall can be maintained for a sufficient length of time, hypoglycaemic symptoms will be less than with a smaller, less rapid fall maintained for a longer period.

TABLE IX.—*Percentage Reduction in Blood Sugar Following 60 Units of Insulin Given in Saline by Intravenous Drip Over Varying Periods of Time at Intervals of Four Days. (Compiled from Table VII (A).)*

Column (1): Units of insulin injected per minute during intravenous drip.
Column (2): Length of time in minutes over which drip was given.
Column (3): Fasting blood sugar.

Column (1).	Column (2).	Column (3).	Minutes after commencement of intravenous drip.												
			15.	20.	25.	30.	35.	45.	60.	90.	120.	150.	180.	210.	240.	270.
0·25	240	98	16	18	21	26	30	35	47	73	75	75	70	74	74	67
0·29	210	95	19	23	26	28	33	·37	51	61	71	68	69	73	71	59
0·31	195	92	21	25	31	37	39	47	58	58	65	68	68	76	73	55
0·33	180	93	19	28	31	32	38	46	63	67	67	67	67	65	61	37
0·40	150	92	23	26	32	37	40	47	63	64	65	65	65	65	54	38
0·50	120	88	20	26	34	41	46	52	67	65	63	61	61	51	33	20
0·67	90	86	18	23	31	46	40	48	64	69	66	50	42	39	23	19
1·00	60	88	22	28	39	41	45	55	73	69	65	59	51	33	23	8
1·33	45	86	29	37	47	56	61	67	80	74	64	50	27	14	8	13
1·71	35	84	32	40	49	60	67	69	71	66	66	54	38	15	6	1
3·00	20	88	29	40	39	58	64	68	67	53	44	33	28	18	10	5
4·00	15	92	31	40	47	62	66	68	63	63	49	39	27	16	10	3
8·56	7	92	32	42	48	58	63	70	68	66	55	46	34	20	14	10
20·00	3	96	31	41	48	60	68	67	67	65	48	46	33	29	20	10
60·00	0	98	32	31	48	65	65	67	67	67	47	46	40	27	24	17

TABLE X.—*Length of Time Taken by Varying Amounts of Insulin to Reduce the Blood Sugar by 40 mgm. per cent. Calculated from Table IX above.*

Column (1): Units of insulin injected per minute.
Column (2): Length of time taken by given amount of insulin to reduce the blood sugar by 40 mgm. per cent.

Column (1).	Column (2).	Column (1).	Column (2).
0·25	50	1·0	25
0·29	47	1·33	22
0·31	36	1·71	20
0·31	36	3·00	20
0·40	35	4·00	20
0·50	29	8·50	19
0·67	27	20·00	19

The hypothesis that a portion of insulin given intravenously is used up in producing the rapid and profound fall in the blood sugar indicated by the above experiments on the relationship between the amount of insulin injected and the extent and rate of the fall in the blood sugar would, therefore, be confirmed if it could be shown that the total amount of hypoglycaemia produced by a given quantity of intravenous insulin is less than that produced by the same quantity of intramuscular insulin.

It is necessary, therefore, to determine the power of intravenous and intramuscular insulin to produce hypoglycaemia in relation to the time over which it is produced, since the duration of the action is as important as its intensity. Unfortunately, there is no unit of "the degree x the duration of hypoglycaemia" available, and it is usual to express this quantity in terms of milligram/minutes of hypoglycaemia. If the same dose of insulin is injected first intramuscularly and then intravenously on separate occasions, from the blood-sugar curves obtained following the injection it is possible to calculate the milligram/minutes of hypoglycaemia produced over any desired period, and the two methods of injection can be compared with respect to the total milligram/minutes of hypoglycaemia produced before the blood sugar returns to normal.

Experiment.—The blood-sugar curves obtained from Patient 1 (Table II) following the injection of 20 units of insulin intramuscularly and intravenously were investigated and the total milligram/minutes of hypoglycaemia produced after 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260 and 270 minutes from the time of the injection was calculated. The results are set out in detail in Table XI, from which it will be seen that for some time after the injection, intravenous insulin produces very many more milligram/minutes of hypoglycaemia, but that later it fails to hold this lead, and ultimately is surpassed by the intramuscular insulin. For example, after 10 minutes intravenous insulin has produced 255 per cent. more milligram/minutes of hypoglycaemia than the intramuscular insulin. This preponderance reaches its highest level at 360 per cent. after 50 minutes, following which it steadily declines, so that each method has produced approximately the same number of milligram/minutes of hypoglycaemia after 210 minutes, and after 270 minutes the intramuscular insulin has actually produced 21 per cent. more than the intravenous. As Sakel's treatment is not usually given for longer periods than about five hours each day, the experiment was terminated at 270 minutes, before the blood sugar following intramuscular insulin has returned to normal. Had the experiment been continued until the intramuscular blood sugar had returned to normal, the superiority of intramuscular over intravenous insulin in terms of total milligram/minutes of hypoglycaemia would have been even more striking.

From the percentages of " intravenous milligram/minutes of hypoglycaemia to intramuscular milligram/minutes of hypoglycaemia " given in Table XIV, the graph of Graph 4 has been contructed. This brings out the conclusion noted above that intravenous insulin is more efficient for some time after the injection, but less efficient later on than intramuscular insulin in terms of production of milligram/minutes of hypoglycaemia. From this early superiority of intravenous insulin, it follows that insulin given in this way may be more efficient than intramuscular insulin in producing the milder degrees of hypoglycaemia, such as sweating, pallor, etc., but its later inferiority shows that it will be less efficient in producing the more pronounced degrees of hypoglycaemia, such as coma according to Wilson's (1937) standard. It has already been pointed out that different authors have varying standards of coma, and it is possible that some authors, e.g. Sandison and McGregor (1942), have found that a smaller dose of intravenous as compared with subcutaneous insulin would induce coma because their standard of coma has been a light one, whereas, had they adopted Wilson's (1937) standard of complete areflexia, they would have found that a larger dose was required. That this is probably so is shown by Table III, from which it will be seen that slightly smaller doses of intravenous than intramuscular insulin will induce " sopor " (unconsciousness), whereas considerably larger doses are required to produce coma with Babinski plantar responses and absent corneal reflexes.

The conclusions which may be drawn from the experimental work described so far will be summarized fully later. It may be stated briefly here that the value of intravenous insulin in Sakel's hypoglycaemic coma depends upon the depth of coma which the therapist wishes to produce. If it is desired only to

produce hypoglycaemic unconsciousness, the intravenous insulin is preferable to intramuscular as a smaller dose is required, and with the more rapid return of the blood sugar to normal the danger of post-hypoglycaemic coma developing is diminished. If, however, the considerably deeper hypoglycaemic state

TABLE XI.—*Milligram/Minutes of Hypoglycaemia Produced by 20 Units of Intramuscular and Intravenous Insulin.*

Blood-sugar curve (Table II, Patient 1):

	Fasting blood sugar.	Minutes after injection.													
		25.	30.	35.	40.	50.	60.	75.	90.	120.	180.	10.	210.	240.	270.
I.M.	75		56				47		50	47	50	48	47	54	54
I.V.	83	38	29	31	25	30	38	45	53	66	72	81	81	83	83

Minutes after injection of insulin.	Total milligram/minutes of hypoglycaemia produced:— Intravenously.	Intramuscularly.	Percentage of intravenous mgm./mins. of hypoglycaemia to intramuscular mgm./mins. of hypoglycaemia.
10	88	35	262
20	361	133	272
30	810	280	289
40	1348	479	282
50	1864	516	360
60	2353	781	300
70	2781	1056	262
80	3158	1321	239
90	3486	1576	220
100	3762	1831	206
110	3986	2094	191
120	4074	2367	172
130	4132	2640	157
140	4271	2905	147
150	4389	3160	139
160	4481	3413	131
170	4544	3670	124
180	4577	3937	116
190	4597	4207	109
200	4617	4482	103
210	4637	4760	97
220	4654	5025	93
230	4665	5272	89
240	4668	5296	87
250	4668	5506	85
260	4668	5716	82
270	4668	5926	79

of coma with areflexia is required, then intravenous insulin has no advantage over intramuscular insulin, as a larger dose is required to maintain the blood sugar at a sufficiently low level for the long period necessary, and the possibility of prolonged coma developing remains the same. In view of this it was decided to determine whether any of the "prolonged" insulins, such as protamine insulin and protamine zinc insulin, had any advantage over ordinary soluble insulin when given intravenously.

Intravenous Protamine and Protamine Zinc Insulin.

Polatin and Spotnitz (1942*a*) found that there was less tendency for patients to develop after-shock on protamine zinc insulin intravenously than on ordinary soluble insulin given by the same route, and Hinko *et al.* (1941) found that intradermal sensitivity tests were less marked with protamine zinc insulin than with soluble insulin in a patient who had previously developed an anaphylactic shock following subcutaneous injection of soluble insulin. Longwell

and Ravin (1936) in animal experiments could find no difference in the action of soluble insulin and protamine insulin when these were given intravenously. Protamine zinc insulin was used intravenously in Sakel's treatment by McGregor and Sandison (1940) and Sandison and McGregor (1942), who found that there was neither particular advantage nor particular danger in its use.

Protamine insulin and protamine zinc insulin have not been given intravenously more frequently, probably owing to the fact that they are suspensions and that, therefore, the possibility of embolism cannot be overlooked. Hagedorn *et al.* (1936) showed that protamine insulin is soluble in serum to the extent of 50 units per c.c. of serum, and attributed the solubility to the presence of protein. The solubility in water or salt solution is very much less—about 0·5 unit per c.c. The danger of embolism on intravenous use does not, therefore, arise. No work, however, appears to have been published on the solubility of protamine zinc insulin, and so before this type of insulin was given intravenously, the following experiment was carried out:

Experiment.—10 c.c. of blood were collected from each of six patients and 2 c.c. of the serum from each specimen were separated and placed in a test-tube. Protamine zinc insulin was then added to the serum and was found to dissolve in it. The upper limit of solution was about 50 units per c.c. of serum, beyond which a slight turbidity developed. It will be seen, therefore, that the solubility of protamine zinc insulin in serum is of the same order as that of protamine insulin. The exact chemistry of the solution of protamine insulin has not been worked out, but the chemistry of the solution of protamine zinc insulin is almost certainly the same, and is probably analogous to the protective effect of protein on colloidal suspensions (Trevan, 1941, 1946). As 50 units of protamine zinc insulin per c.c. of serum is roughly equivalent to 300,000 units for the 6 litres of total blood in the body, it is obvious that no danger of embolism is likely to arise from the doses usually used in Sakel's treatment.

In view of the results of the above experiments and of the work of Hagedorn *et al.* (1936), 6 of the patients who had previously been given comparative doses of intravenous and intramuscular insulin (Table II) were divided into two groups. The first 3 were given the same doses of protamine insulin intravenously as they had previously received of soluble insulin intravenously. In the case of the remaining 3 patients protamine zinc insulin was given under similar circumstances in place of the protamine insulin. The blood-sugar values obtained following the injections are set out in detail in Tables XII and XIII, from which it will be seen that both protamine and protamine zinc insulin have the same effect on the blood sugar as ordinary soluble intravenous insulin has. There was also no difference between the patients' clinical response to the various kinds of insulin. The delayed action insulins, therefore, do not appear to possess any advantage over soluble insulin when given intravenously.

Summary of Conclusions from Experimental Work.

(1) More intravenous insulin than intramuscular insulin is required to induce the profound hypoglycaemic state of coma with areflexia in Sakel's treatment.

TABLE XII.—*Blood-sugar Values Following (A) Increasing Doses of Soluble Insulin Intravenously and (B) Increasing Doses of Delay (Protamine) Insulin Intravenously to Test their Comparative Effects.*

Units of insulin.	Fasting blood sugar.	Minutes after injection.													
		25.	30.	35.	40.	50.	60.	75.	90.	120.	150.	180.	210.	240.	270.
Patient 1:															
20 (A)	83	38	29	31	25	30	38	45	43	66	72	81	81	83	83
20 (B)	90	51	42	30	30	29	40	47	57	67	75	85	87	87	88
40 (A)	90	34	30	32	29	32	33	35	39	48	59	70	78	79	79
40 (B)	86	47	34	33	30	30	30	34	41	46	57	70	79	79	78
60 (A)	78	42	37	35	32	37	38	42	47	54	64	66	76	78	78
60 (B)	88	36	31	30	33	35	40	40	41	49	63	70	77	75	74
80 (A)	88	39	31	31	25	24	29	32	39	37	56	72	83	85	87
80 (B)	91	51	43	43	32	32	28	29	30	43	57	68	75	83	84
100 (A)	92	35	27	23	23	22	29	31	33	41	45	47	56	67	71
100 (B)	87	32	32	26	27	27	25	34	34	38	38	38	49	62	68
120 (A)	88	24	22	22	20	24	27	25	29	29	36	38	45	56	64
120 (B)	91	39	21	19	22	26	26	26	30	29	29	36	47	60	69
140 (A)	77	39	43	24	22	27	34	30	34	32	32	35	44	49	55
140 (B)	83	51	34	22	23	23	24	24	37	39	39	41	41	47	58
160 (A)	78	44	46	43	27	24	31	27	36	39	36	37	42	43	41
160 (B)	85	36	36	32	19	25	27	27	33	35	36	38	40	41	41
174 (A)	83	56	35	32	25	19	18	20	24	26	28	29	30	29	28
174 (B)	81	39	31	23	23	20	18	21	25	25	23	26	26	27	27
Patient 2:															
20 (A)	106	57	47	41	36	34	41	45	54	75	95	90	92	93	102
20 (B)	98	47	41	37	34	35	38	46	55	73	88	94	94	94	96
40 (A)	108	65	54	34	41	39	43	47	47	66	77	86	96	95	95
40 (B)	99	45	44	31	37	41	41	43	45	61	69	84	89	90	90
60 (A)	92	56	50	41	32	32	32	37	32	35	43	63	72	81	87
60 (B)	97	75	63	34	34	33	34	32	32	31	38	65	75	83	90
80 (A)	97	56	45	38	31	32	36	32	32	38	46	55	61	75	83
80 (B)	102	61	34	42	36	33	33	39	39	41	48	48	59	63	76
100 (A)	86	63	48	31	36	27	27	24	27	38	38	47	53	70	77
100 (B)	93	47	45	33	31	30	30	30	30	21	32	39	49	61	72
120 (A)	88	77	61	34	32	32	31	36	33	35	36	41	49	61	68
120 (B)	95	56	45	31	33	35	35	37	35	35	35	35	39	54	54
140 (A)	102	72	66	59	45	34	34	32	31	34	38	42	48	58	64
140 (B)	95	56	47	45	43	31	35	35	36	37	37	37	45	61	67
160 (A)	94	60	48	34	30	30	31	31	31	33	35	36	40	46	44
160 (B)	98	70	55	49	31	28	28	30	35	34	33	35	39	39	47
170 (A)	96	55	44	34	29	31	29	32	25	31	29	32	29	31	33
170 (B)	97	47	32	20	19	17	28	28	32	31	27	25	20	27	28
Patient 3:															
20 (A)	75	32	27	25	25	27	29	27	34	55	63	75	83	80	79
20 (B)	81	56	35	29	30	27	30	33	37	49	59	79	80	84	86
40 (A)	79	44	34	27	22	22	24	24	29	33	47	66	72	79	79
40 (B)	83	49	41	33	25	21	21	21	30	31	39	54	69	76	76
60 (A)	92	32	28	24	19	19	22	27	25	30	43	54	63	74	88
60 (B)	88	35	33	22	20	18	19	25	23	25	39	57	57	67	79
80 (A)	95	36	29	29	19	19	19	25	24	24	29	36	47	68	74
80 (B)	87	45	20	25	22	22	27	29	32	32	32	32	44	59	69
86 (A)	89	45	31	30	22	21	20	22	23	23	26	27	46	57	69
86 (B)	92	51	35	35	27	29	30	29	29	30	36	45	54	61	72
92 (A)	93	38	30	22	23	21	20	19	21	25	27	26	43	54	63
92 (B)	92	41	29	21	19	18	23	24	22	23	23	31	39	57	—
100 (A)	101	36	32	24	24	24	19	19	20	22	27	36	39	47	59
100 (B)	95	33	27	21	21	25	23	23	23	23	24	29	38	49	54
110 (A)	99	34	24	22	15	15	19	15	19	21	30	29	34	36	43
110 (B)	98	43	31	23	20	19	17	19	21	23	27	27	26	39	47
118 (A)	95	32	29	24	18	18	17	18	20	22	21	25	27	26	29
118 (B)	97	31	35	21	20	18	17	20	23	24	24	23	23	27	31

(2) Less intravenous insulin than intramuscular insulin is required to produce the milder hypoglycaemic symptoms, such as perspiration and unconsciousness.

(3) Insulin given intravenously in Sakel's treatment is—

(*a*) Not excreted by the kidneys.

(*b*) Not neutralized by circulating substances in the blood.

TABLE XIII.—*Blood-sugar Values Following* (*A*) *Increasing Doses of Soluble Insulin Intravenously and* (*B*) *Increasing Doses of Protamine Zinc Insulin to Test their Comparative Effects.*

Units of insulin.	Fasting blood sugar.	Minutes after injection.													
		25.	30.	35.	40.	50.	60.	75.	90.	120.	150.	180.	210.	240.	270.
Patient 1:															
20 (A)	108	72	48	36	34	31	31	45	47	66	86	90	93	95	98
20 (B)	98	67	51	34	33	32	34	46	51	67	79	88	94	98	99
40 (A)	95	45	32	29	20	15	20	22	22	48	54	68	75	75	83
40 (B)	97	51	34	32	22	19	22	23	24	44	57	71	79	86	86
60 (A)	90	36	27	24	20	25	27	22	34	47	55	58	59	71	83
60 (B)	93	43	31	26	21	23	23	24	29	41	56	56	60	72	79
80 (A)	88	57	39	32	24	22	24	25	25	26	24	41	54	70	75
80 (B)	91	51	40	28	25	22	26	28	30	31	31	38	51	67	72
90 (A)	93	43	35	34	29	26	26	32	30	29	34	36	41	49	56
90 (B)	95	55	50	30	28	24	23	24	31	34	36	38	38	52	59
98 (A)	101	60	54	33	32	25	24	31	29	23	33	36	38	41	41
98 (B)	94	43	42	28	29	28	27	32	34	34	36	36	38	45	44
110 (A)	96	54	40	32	29	25	23	24	25	23	26	28	34	37	39
110 (B)	96	50	32	29	27	26	26	27	24	24	27	27	31	36	41
118 (A)	86	65	54	39	32	22	18	14	15	15	17	15	16	18	—
118 (B)	93	55	41	27	27	24	20	18	21	17	18	19	17	17	17
Patient 2:															
20 (A)	95	43	31	29	31	24	26	31	38	47	59	80	93	93	94
20 (B)	93	56	44	31	29	26	28	33	41	46	57	73	81	85	89
40 (A)	99	34	32	29	31	31	36	41	41	43	54	71	78	82	93
40 (B)	91	43	37	30	28	28	41	45	45	49	56	69	77	77	87
56 (A)	97	27	24	23	17	20	25	32	33	34	37	37	41	56	67
56 (B)	98	39	22	24	20	26	19	27	27	36	39	40	47	63	65
68 (A)	102	43	30	25	20	27	25	28	33	31	34	36	40	45	52
68 (B)	97	51	41	29	27	23	29	31	35	39	41	43	51	51	49
80 (A)	115	34	31	27	25	23	25	36	31	34	39	38	41	41	43
80 (B)	98	37	29	26	27	25	25	29	29	35	36	37	38	38	39
92 (A)	97	39	34	—	26	31	27	31	31	25	32	30	31	33	37
92 (B)	100	51	41	27	26	24	23	23	29	36	29	28	28	33	35
104 (A)	108	34	31	35	24	19	25	27	25	26	29	31	29	33	33
104 (B)	94	76	34	23	18	18	24	23	27	27	27	27	32	35	36
114 (A)	96	27	29	25	22	27	25	24	22	21	23	25	22	20	20
114 (B)	97	41	28	20	19	18	17	23	25	24	23	23	23	21	22
Patient 3:															
20 (A)	108	48	39	25	32	27	32	33	36	43	50	74	87	93	97
20 (B)	101	72	41	23	25	26	34	35	38	45	46	67	77	81	93
40 (A)	106	57	45	39	27	29	24	25	27	31	51	72	83	95	92
40 (B)	103	49	43	38	30	24	26	29	32	39	55	69	79	93	93
60 (A)	106	50	39	29	29	29	27	31	24	34	52	63	75	89	94
60 (B)	99	51	37	27	26	25	33	35	34	37	49	65	73	87	91
80 (A)	105	59	47	38	32	24	22	24	19	22	31	44	36	48	54
80 (B)	106	44	34	31	39	27	27	25	23	23	29	39	47	51	56
92 (A)	111	48	31	24	24	19	15	20	20	27	36	32	36	36	43
92 (B)	98	61	35	21	33	20	21	21	24	25	34	37	37	39	41
100 (A)	96	50	41	27	24	22	23	24	34	27	28	30	34	35	35
100 (B)	104	46	27	26	20	23	25	27	27	29	29	33	33	33	37
110 (A)	112	43	29	25	29	31	25	22	25	32	29	32	34	29	29
110 (B)	107	72	33	31	23	23	23	27	25	26	27	35	37	37	34
118 (A)	101	45	20	19	19	17	20	19	19	20	22	25	24	28	30
118 (B)	105	51	31	21	23	19	16	17	17	23	24	24	23	24	26

(4) The varying efficiency of intravenous insulin in producing the different degrees of hypoglycaemia is due to the fact that the rapid, profound fall in the blood induced by intravenous insulin cannot be maintained, as the slower, less profound fall which follows the subcutaneous injection of insulin can be. A portion of insulin given intravenously is used up in producing the rapid, profound fall in the blood sugar, and so ultimately the total milligram/minutes of hypoglycaemia produced by intravenous insulin, following an early superiority, is less than that produced by intramuscular insulin.

(5) (*a*) The curve of the graph of the relationship between the amount of insulin injected and the *extent* of the consequent fall in the blood sugar is a rectangular hyperbole.

(*b*) The curve of the graph of the relationship between the amount of insulin injected and the *rate* of the consequent fall in the blood sugar is also a rectangular hyperbola.

Therefore the rapid, profound fall in the blood sugar following intravenous insulin can only be produced by the using up of a portion of the insulin, which is, therefore, unavailable for the maintenance of the blood sugar at the necessary low level for the required period of time for coma to be induced.

(6) The varying nature of the conclusions reached by previous workers on the relative efficiency of intravenous and intramuscular insulin in producing coma has been probably due to the different standards of coma adopted by the authors.

(7) There is no *a priori* reason, following the above experimental work, why intravenous insulin should reduce the incidence of post-hypoglycaemic encephalopathies in Sakel's treatment of the deeper hypoglycaemic states, such as coma with areflexia, are induced.

(8) If, however, only the milder effects of hypoglycaemia are required, intravenous insulin is preferable to intramuscular as less insulin is required intravenously for these effects, and there is consequently a greater likelihood of the patient spontaneously awakening.

Results Obtained During a Trial Period with Intravenous Insulin in Sakel's Treatment.

Fifteen patients were given a full course (approximately 50 comas) of Sakel's treatment using intravenous insulin. The standard of coma adopted was that of unconsciousness with Babinski plantar responses and absent corneal reflexes.

The following general conclusions were drawn at the end of this trial period :

(1) Differences found in Sakel's treatment using (*a*) intravenous and (*b*) intramuscular insulin are :

(i) More insulin is required intravenously than intramuscularly.

(ii) The total period of hypoglycaemia each day is about 20–30 minutes shorter with intravenous insulin, but this is not of practical importance, since the blood sugar has to remain below 30 mgm. per cent. with both forms of administration for about 200 minutes before coma with areflexia can be produced. It is this long period of low blood-sugar values which

produces post-hypoglycaemic phenomena, and not the short period of mild hypoglycaemia which precedes it and which is shortened by the use of intravenous insulin.

(iii) There is a greater tendency to the spontaneous development of major epileptiform convulsions with intravenous insulin.

(2) Apart from the above differences, the effects appear to be the same for the two forms of administration. Coma is no quieter, after-shock as common and "arousal from coma" times no shorter with intravenous than with intramuscular insulin. Of the 15 patients, one developed a definite post-hypoglycaemic coma. This incidence of prolonged coma of 1 in 15 with intravenous insulin compares with 4 cases out of 146 treated by the author with intramuscular insulin. While the comparison cannot be exact with a small series of 15 cases, the figures indicate that intravenous insulin is at least as likely to be followed by prolonged coma as is intramuscular insulin.

Two of the points mentioned above will now be dealt with more fully:

(1) The case of post-hypoglycaemic coma following intravenous insulin.

(2) The greater tendency to spontaneous major epileptiform convulsions with intravenous insulin.

(1) CASE REPORT.—Patient 5; female; aged 31.

Condition on admission (Banstead L.C.C. Hospital).—The patient is a paranoid schizophrenic whose illness is of 9 months' duration. She is able to give a fair account of herself, but shows marked blockage of thought. She believes that some other women have conspired against her because she has not had a baby, although she has been married for four years. These women have combined to form an organization which has installed an electrical machine in the hospital grounds. This machine generates songs which play upon her day and night. She is aurally hallucinated, and hears accusatory voices coming over the wireless and from underneath the bed at night. There is some incongruity between thought and mood, but she

Course of Insulin Hypoglycaemic Therapy.

Day of treatment.	Dose of insulin.	Duration of sopor.	Duration of coma.	Interruption by—
1	20	—	—	Drank glucose
2	40	—	—	" "
3	50	—	—	" "
4	60	—	—	" "
5	70	—	—	" "
6	80	—	—	" "
7	90	35 mins.	—	Nasal "
8	96	44 "	—	" "
9	100	53 "	—	" "
10	106	68 "	—	" "
11	112	75 "	—	" "
12	118	92 "	5 mins.	" "
13	118	104 "	—	" "
14	118	116 "	10 mins.	" "
15	118	112 "	20 "	" "
16	112	118 "	30 "	" "
17	104	126 "	30 "	" "
18	100	115 "	30 "	" "
19	100	98 "	25 "	" "
20	96	120 "	30 "	" "
21	96	132 "	30 "	" "
22	96	126 "	30 "	" and I.V. glucose.

is occasionally impulsive in behaviour. Her personality is fairly well preserved, but she has no insight into her mental state. The statement that she has not had a baby is itself a delusion, as she has three children alive.

Response to insulin.—As will be seen from the above record, there was nothing remarkable about the patient's response to insulin. She had been in coma nine times before the coma which became prolonged occurred on the 22nd day of treatment. On each occasion she had awakened normally on interruption with nasal glucose. During the afternoon of the day of the prolonged coma her temperature rose to 103° F., she showed marked myotonic spasms, but these were controlled by intravenous hexobarbitone. Vitamin B_1 was given subcutaneously without effect, and on the evening of the first day she was given a transfusion of one pint of blood. Although the bloods had been cross-matched, she developed an intense rigor shortly after the transfusion had been completed. She became extremely collapsed, the pulse could not be obtained, and she appeared to be dying. Coramine was given and she slowly revived. Fortunately her general condition was good when the transfusion was started, otherwise a fatal outcome would have been almost certain. The patient was a multipara, and it is probable that she was an Rh-negative subject who was transfused with Rh-positive blood. She remained unconscious for a total period of 46 hours after the initial interruption of coma and in the course of a few days recovered completely physically. There was no change in her mental state as a result of the prolonged coma, and later the course of insulin therapy was completed with moderately beneficial results.

(2) *The Greater Tendency to Spontaneous Major Epileptiform Convulsions with Intravenous Insulin.*

As has been mentioned previously, the term " convulsion " has been used in the literature on Sakel's treatment to cover both the intense myotonic spasms which are frequently seen in the deeper stages of hypoglycaemia and the typical major epileptiform seizures which closely resemble those seen in idiopathic epilepsy, and which are frequently marked by an initial cry, followed by a typical tonic stage which passes into an equally typical clonic stage, the whole convulsion lasting about 40–50 seconds. This section refers only to convulsions of the latter kind.

Incidence of convulsions.—Seven of the 15 patients who were given the full course of treatment with intravenous insulin developed major epileptiform convulsions. This is a very high proportion, and although the series is a small one, the proportion is probably significant when compared with the 14 patients who developed such convulsions in the author's series of 146 patients treated with intramuscular insulin. This would seem to be confirmed by the experience of 2 of the 7 patients who developed convulsions with intravenous insulin. Both of these patients would have a fit after each dose of insulin if the dose exceeded 440 units in the one case and 190 in the other. If, however, these doses of insulin were given intramuscularly no fits resulted. Ventriglia (1939), Reznikoff and Scott (1942) and Mahoney and Herskovitz (1942) also found a greater tendency to convulsions with intravenous insulin, although Polatin, Spotnitz and Wiesel (1940) found the same incidence and Sherman, Mergener and Low (1941) a reduced one. The greater frequency of convulsions with intravenous insulin can probably be ascribed to the more rapid, profound fall in the blood sugar causing a greater disturbance of the equilibrium of the motor cortex of predisposed patients than is the case with the more slowly acting intramuscular insulin.

Finiefs (1938) regarded spontaneous epileptiform convulsions occurring in

Sakel's treatment as beneficial, and likely to enhance the value of the treatment. The chief disadvantage of their spontaneous development is that the number of fits cannot be controlled or the time of onset. They may appear at any stage of hypoglycaemia, and while convulsions early in the period of hypoglycaemia may have no adverse effect, they are certainly undesirable in the deeper stages of hypoglycaemia, when the patient's general condition may be such that it ought not to be subjected to the extra strain imposed by a severe convulsion. If convulsions are deemed desirable in Sakel's treatment it is much better to induce them under controlled conditions by electrical means or by cardiazol. This opinion is confirmed by the experience of one of the patients given intravenous insulin. Following a spontaneous convulsion he complained of pain in the back, and on being X-rayed was found to have a compression fracture of the 5th dorsal vertebra. Had this fit been induced by chemical or electrical means the fracture might have been avoided, since, as Furst (1940) has pointed out, the placing of a small pillow under the mid-thoracic vertebra so as to extend the spine will reduce the incidence of vertebral fractures in convulsive therapy. The convulsions in the present series occurred usually between 90–110 minutes after the injection of the insulin, the time incidence being remarkably constant for any given patient. One patient had a number of convulsions on different days after a period of approximately 200 minutes of hypoglycaemia.

Opportunity was afforded by the frequent occurrence of major convulsions after the injection of intravenous insulin to study the behaviour of the blood sugar during and after the fit, and to compare the results with those obtained during and after fits induced by cardiazol (phrenazol) during hypoglycaemia. The blood sugar had been previously estimated every 30 minutes after the injection of the insulin, and the level of the blood sugar at the previous estimation was taken to be the level at the time of the onset of the fit. The blood sugar was estimated at intervals of 1, 2, 3, 4, 5, 6, 8, 10, 15, 20, 25, 30, 35 and 40 minutes after the onset of the fit, and a word of thanks is due to the members of the nursing staff, whose watchfulness enabled these times to be adhered to. The behaviour of the blood sugar during and after 12 spontaneous and 12 phrenazol-induced convulsions is set out in the following charts and table. The convulsions occurred in 8 patients.

TABLE XIV.—(1) *Blood-sugar Values During and After Spontaneous Insulin Convulsions.*

Number of convulsion.	Minutes after commencement of convulsion.													
	0.	1.	2.	3.	4.	6.	8.	10.	15.	20.	25.	30.	35.	40.
1	24	24	27	38	43	45	47	46	41	37	32	28	25	25
2	28	28	31	39	46	50	50	48	42	37	31	27	26	26
3	27	28	32	41	52	50	50	49	44	40	33	28	29	28
4	24	25	29	37	37	46	47	45	41	35	30	26	25	24
5	24	24	27	37	43	43	48	44	38	34	34	28	27	28
6	25	24	26	35	42	45	47	42	38	33	27	24	24	22
7	29	29	32	40	41	45	48	47	42	38	33	28	28	28
8	31	32	34	44	47	51	53	51	45	39	33	33	32	33
9	26	26	29	37	43	48	49	48	44	40	40	32	28	28
10	27	29	32	38	44	49	52	51	46	41	36	28	27	27
11	26	25	27	34	44	46	49	45	40	36	30	25	24	20
12	28	28	31	41	46	49	51	47	41	36	37	29	30	30

(2) *Blood-sugar Values During and After Phrenazol-induced Convulsions During Hypoglycaemia.*

Number of convulsion.	Minutes after commencement of convulsion.													
	0.	1.	2.	3.	4.	6.	8.	10.	15.	20.	25.	30.	35.	40.
1	24	25	32	39	55	66	75	74	68	60	55	46	37	37
2	24	24	31	37	48	56	56	52	44	37	30	25	26	25
3	27	26	33	38	46	54	62	63	58	47	35	29	26	26
4	26	26	31	41	54	69	73	69	62	56	50	41	33	29
5	20	22	32	40	32	68	68	63	60	51	45	38	29	24
6	23	23	30	39	53	64	60	55	51	43	34	28	35	25
7	23	22	28	37	44	52	59	59	51	45	45	34	28	28
8	25	25	31	42	59	71	69	65	61	56	53	42	33	27
9	26	28	32	45	69	69	65	53	54	45	33	27	27	26
10	31	28	37	46	55	63	61	54	46	37	33	29	30	30
11	29	29	33	41	52	61	72	69	63	57	50	42	33	30
12	22	24	29	41	58	58	54	49	45	37	34	31	29	27

From the foregoing charts and table it will be seen that—

(1) *In Spontaneous Hypoglycaemic Convulsions—*

(*a*) All 12 convulsions occur when the blood sugar is between 20–30 mgm. per cent.

(*b*) The blood sugar starts to rise immediately the convulsion is over and reaches the highest point in 6–10 minutes, after which it begins to decline until it reaches the pre-convulsive level in about 40 minutes.

(2) *In Phrenazol-induced Convulsions During Hypoglycaemia—*

The post-convulsive increase in the blood sugar is not nearly as constant as it is after the spontaneous convulsions, varying as it does from 30–50 mgm. per cent. This is probably due to the fact that the patients were unlikely to be given the exact convulsive dose of phrenazol, and any additional phrenazol over the necessary minimum would result in a more severe convulsion with a greater increase in the blood sugar.

As an explanation of the post-convulsive behaviour of the blood sugar it is suggested that the convulsion results in the depletion of glycogen in the muscles, which is replaced by the formation of glucose from glycogen in the liver under the influence of adrenaline. The newly formed glucose raises the blood level as it travels from the liver to the muscles for reconversion into muscle glycogen.

Conclusion.

The following conclusions emerge from the experimental work described and from a study of the literature reviewed :

(1) *The Value of Intravenous Insulin in Reducing the Incidence of Post-hypoglycaemic Encephalopathies in Sakel's Hypoglycaemic Treatment.*

This depends entirely upon the depth of hypoglycaemic coma which it is desired to produce during the treatment.

(*a*) If the production only of unconsciousness is desired, intravenous insulin is of value as a smaller dose is required than that of intramuscular insulin, and the more rapid return of the blood sugar to normal with the doses of insulin

required to induce this state diminishes the possibility of the patient remaining sufficiently long in coma for post-hypoglycaemic encephalopathies to develop.

(*b*) If the considerably deeper state of unconsciousness with positive Babinski reflexes and absent corneal reflexes is desired, intravenous insulin has no advantage over intramuscular or subcutaneous insulin since a larger dose is required. The use of these larger doses, necessary to maintain the blood sugar at a sufficiently low level for the required period of time, prevents the blood sugar from spontaneously returning to normal until sufficient time has elapsed for post-hypoglycaemic encephalopathies to develop.

(2) *Disadvantages of Intravenous Insulin in Sakel's Treatment.*

(*a*) Greater frequency of uncontrolled spontaneous major epileptiform convulsions.

(*b*) The possibility of anaphylactoid shock occurring in patients sensitive to insulin.

(*c*) More insulin is required to induce the deeper hypoglycaemic states.

(3) *Advantages of Intravenous Insulin in Sakel's Treatment.*

(*a*) The time occupied by the treatment is reduced by about 30 minutes each day.

(*b*) The milder hypoglycaemic states can be induced with less insulin with a greater possibility of spontaneous awakening of the patient.

Reviewing the subject as a whole, it may therefore be said that intravenous insulin offers insufficient advantages over intramuscular insulin in Sakel's treatment to justify its use.

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THE PSYCHO-SOMATIC SEXUAL LIFE OF THE FAMILY: A PSYCHO-SOMATIC STUDY OF SUCKLING AND COITUS.

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THIS is a field of knowledge which has been neglected unduly and which, should prove fruitful in view of the recognized importance of sex in psychology.

Pearse and Crocker (1944*a*), in their study of the family, that unit with which is associated suckling and coitus, leave out psychology, saying there is no normal psychology described.

Ellis (1928*a*) described fully the anomalous association of love and pain, but he does not attempt to analyse it further than speaking of the " joy of emotional expansion " aroused by love and pain. He wishes to avoid " a somewhat speculative and metaphysical region " ; yet a theory to account for the many known facts of sex is needed.

Flugel (1921), writing on the family, admits that he has little to say on the relationship of the husband and wife ; yet that relationship is the foundation of the family.

" Pleasure and ' pain ' cannot," says Freud (1924*a*), " be referred to a quantitative increase or decrease of something which we call stimulus-tension, although they clearly have a great deal to do with this factor. It seems as though they do not depend upon this quantitative factor, but upon some peculiarity in it which we can only describe as qualitative. We should be much farther on with psychology if we knew what this qualitative peculiarity was."

Van De Velde (1931*a*), speaking of sexual hostility in marriage, says : " If we refer to books by experts on the subject, we find a great number of analytical descriptions of cases where a hatred between the sexes appears to be the primary focus of the phenomenon, but we look in vain for a definite, fundamental and comprehensive attitude towards the problem."

It is the object of this paper to make a contribution to a " definite fundamental and comprehensive attitude " which shall depend on a " qualitative " factor.

It is proposed to put forward a theory for the psycho-somatic understanding of suckling and coitus. Social and religious aspects of sex will only be referred to in this paper where it is necessary to illuminate the theory of suckling and coitus, which are not essentially social or religious but family functions. Some clinical implications of the theory will be referred to in general terms, but a detailed exposition of the theory applied to clinical material is left for another

paper, and the initial statement of the theory together with the evidence and comments will be given now.

I propose to deal with the subject as follows :

A. Psycho-somatic facts of suckling and review of previous explanations.
B. Psycho-somatic facts of coitus and review of previous explanations.
C. A psycho-somatic theory.
D. Comment on the theory.
E. Conclusion.
F. Bibliography.

A. Psycho-somatic Facts of Suckling and Review of Previous Explanations.

The psycho-somatic facts of suckling are the mother-baby love relationship implicit in the physical act of lactation.

(a) *Animal Identification.*

The understanding of suckling is, however, linked with the idea of the mother being identified with an animal. Psycho-analysts describe as occurring in the " oral stage " of the child an idea of " being devoured by some fierce monster." There are many examples in the literature ; thus Klein (1929) reports the case of a boy, aged 4½, who made her, during the psychoanalysing, play the part of a " fairy-mamma " who " used to heal with a magic wand all the wounds which the boy's harsh parents had inflicted on him ; then he and she together killed these harsh parents in some cruel way." He would also imagine he was attacking a mother-lioness or that he was the lioness, or he made the analyst enact the lioness and then change back into a helpful " fairy-mamma."

The myths and folk-lore which children love abound in such stories as Red Riding Hood in danger of being devoured by a wolf in the guise of her grandmother. Freud (1940), following Rank, describes an " abridged myth " of peoples for their national heroes, in which the hero as a child is cared for and even suckled by an animal.

The idea is extremely old, for totemism is based on the idea of the tribe being descended from the totem animal.

(b) *Ambivalence.*

There is apparently a contradiction in the love between parents and their young. In the totem ceremonies is found the killing and eating of the parent, who is also mortally feared.

It has also been reported that fear and anger are keenly felt by the baby at the mother's breast. The baby is described as experiencing acute anxiety at the earliest oral or " cannibalistic " stage (Abraham, 1927 ; Middlemore, 1941*a*). Melanie Klein (1932*a*) reflects that " The idea of an infant from 6 to 12 months trying to destroy its mother by every method at the disposal of its sadistic tendencies . . . presents a horrifying, not to say an unbelievable, picture to our minds. And it is difficult, as I know from my own experience, to bring oneself to recognize that such an abhorrent idea answers to the truth,

but the abundant force and multiplicity of the imaginary cruelties which accompany these cravings are displayed before our eyes in early analyses so clearly and forcibly that they leave no room for doubt." This does not apply to abnormal children only. "Analytic experience of healthy children of various ages has convinced me that even though their ego reacts in a normal way they too have to face great quantities of anxiety, severe unconscious guilt and deep depression, and that in some cases the only thing that distinguishes their difficulties from those of the neurotic child is that they are able to deal with them in a more confident and active manner (Klein, 1932*b*).

This anxiety in the baby appears to be matched by aggressiveness in the mother. Lashley (1915), in describing the reaction of a colony of terns to the introduction of a strange chick, says, "The sight of the strange chick calls out movements of attack" by one or more adult birds, but "when the attacked chick forces its way under the body of the aggressive adult, thus inhibiting the aggression and stimulating a brooding response," it is apparent that the aggression has been converted into a brooding response.

Middlemore (1941*b*) draws attention to the belief of the medical school of Douai that "mother's milk was supposed actually to poison children and breast feeding was forbidden." She also describes (1941*c*) the fear of some normal mothers "that their babies would die at the breast" should they there fall asleep.

"As well as her love for her child then," says Groddeck (1935*a*), "there exists in every mother an aversion for the child. Man lives under the law: Where love is, there is also hate; . . . The authority of this law is inviolable, and even mothers are no exceptions."

McDougall (1940*a*) describes the parental instinct in terms of the "tender emotion," yet Freud (1925*a*) states tenderness masks aggression and fear.

Middlemore (1941*d*) refers to the eighteenth-century tendency of doctors to believe "that the mother's strength drained away during nursing." She listened (1941*e*) to the spontaneous remarks of normal mothers suckling their children. "One mother complained of 'gnawing pain,' although her baby did not gnaw the nipple at all. Another felt her strength 'drain away' as the child sucked; the inference was that he drained it. A third used a curious expression: 'He seems to wring me'." As a result of watching suckling Middlemore (1941*f*) states, "I had the impression that active babies with a habit of biting would not have succeeded so well unless their mothers had actually enjoyed it." Another mother "made comical gestures of withdrawal and drew in her breath with a hiss of pretended fear when she was nipped." It was noticed that if the mother could not enjoy or tolerate being bitten by the baby, suckling was impeded or ceased. One mother who tried to feed her first baby, "a wild, restless suckling," gave no sign of fear, but developed exophthalmos: "she lost her milk quite suddenly on the evening of the fourth day, and by next morning there was no sign of exophthalmos either." She remarked later by chance that she had feared her obligation to feed the baby.

When mental illness opens the floodgates of the unconscious mind a lactating woman will often describe a belief that her milk has been poisoning her

baby, or she will make, or feel urged to make, violent and murderous assaults on her baby. The consequent early weaning of the baby often uncovers suicidal wishes in such a lactating woman.

Previous Explanations.

(a) *Animal Identification.*

Riviere (1936*a*) says these animal ideas derive from stories of wild beasts or experiences with animals, and adds " the other and, of course, even more significant source of such phantasies of animals and monsters within is the ' totemic ' mechanism, the effort to substitute for the parents, as objects of all the aggressive and sadistic impulses, animals whom one may and possibly can legitimately kill (and eat) without the most terrible consequences."

" It is the father," says Freud (1924*b*), " who is regarded as the totem animal and is thus feared by the baby in ' the primitive oral stage of libido-organization '." Flugel (1945*a*) repeats the belief, saying, " At the most primitive or oral stage, masochism will show itself in the fear of being devoured by some fierce beast, ogre, or monster—ultimately a father figure." Similarly Klein (1932*c*), referring to infantile animal phobias, speaks of " displacement on to an animal of the fear felt of the real father."

These explanations of ideas of identification of human parents with animals are somewhat inadequate. Groddeck's self-analysis always brought in the wolf in his repressions, but he had to say to himself (1935*b*), " It is always coming up anew, however much you analyse yourself, and never do you find the answer."

(b) *Ambivalence.*

Freud often regards aggression in the baby as a primary instinct.

Suttie (1935) says, " I am suggesting that in animals born or hatched in a state of nurtural dependency the whole instinct of self-preservation, including the potential dispositions to react with anger and fear, is at first directed towards the mother." He regards the baby's aggression towards the mother as " the maximal effort to attract attention " aroused by separation from the mother. He lays emphasis on the purpose of attracting the mother. Middlemore (1941*g*) says that the baby's phantasies of fear and aggression towards the breast " express something of the child's tension of hunger and his struggle for food."

Dollard, Miller, Doob, Mowrer and Sears (1939), writing on frustration and aggression, state that " aggression is always a consequence of frustration." This is the view taken often by the psychoanalytic school. Klein (1932*d*) speaks of sadism of the baby " against its mother's frustrating breast." The origin of anxiety in the baby is said by Freud (1936*a*) to be due to the danger it feels when the mother does not gratify its needs.

The baby's fear is said to be anxiety, due to its " cannibalism," or it is said to feel threatened by its own aggressiveness towards the breast; thus Riviere (1936*b*) says, " I suggest that such helplessness against destructive forces within constitutes the greatest psychical danger-situation known to the

human organism; and that this helplessness is the deepest source of anxiety in human beings."

Aggression of the baby is frequently described as being the cause of its own fear. Klein (1932*e*) admits this, but also describes aggression as arising from fear: "It would appear that he (the child) displaces the full burden of his intolerable fear of instinctual dangers on to his object, thus exchanging internal dangers for external ones. From these external dangers his immature ego then seems to protect itself by destroying his object." No doubt anger may turn to fear and fear to anger, but the mechanism throws no light on the origin of both. In view of these limited explanations it is no wonder that Freud (1933*a*), discussing anxiety and the instinctual life, says, "The question of the stuff out of which anxiety is made loses interest for us."

The child is also considered to project its own aggressiveness on to the mother in phantasy that she will in her turn destroy the child; there is a "fear of retaliation" for sadistic phantasies (Klein, 1932*f*). Similarly, the mother's fears are attributed to projection (Middlemore, 1941*h*): "Unconsciously she expects him (the baby) to attack her breast as strongly as ever, in fantasy, she attacked her mother's breast."

The real difficulty is not, as is said often, that the psychoanalytic theories have been based on neurotic patients, but that the theories take unfortunate situations for their basis. Thus aggression of the baby in suckling is ascribed to separation from the mother, or to frustration. Fear is ascribed to projection in phantasy of the child's "wrongful" aggression on to the mother: fear of castration by the father is punishment for an incest wish.

The psychoanalysts regard the relationship between the mother and the baby as being free from fear and aggression until the baby or the mother or the father does wrong or is imagined by the baby to do wrong. It is to this wrong, duly repressed, that fear and aggression are ascribed.

Jones (1938*a*) says "children come to the world with potential trends and desires which are innocent enough at an early age, but which are of such a kind that the gratification of them is highly unacceptable to adult standards." He goes on to say that the thoughts and wishes for primitive egotistic enjoyment and concern with certain bodily functions are repressed and become "invested with painful and guilty feeling." Ambivalence is, therefore, regarded as acquired and not essentially biological. Since so much of psychoanalytic theory is concerned with ambivalence, it is understandable that some should say that it is not a normal psychology but psycho-pathology of the family which is described.

B. Psycho-somatic Facts of Coitus and Review of Previous Explanations.

(a) *Animal Identification.*

The belief in human transformation into animals which is associated with suckling is also found in connection with coitus. The idea of transformation into animals to effect coitus is well known in mythology. Coitus was practised also in association with totem-animal ceremonies; and in primitive magic,

rites of sexual significance are associated with representations of animals (Roheim, 1930*a*; 1934).

Neurosis and psychosis provide numerous examples of ideas of animals in association with erotic emotions.

(b) *Ambivalence.*

Love is also found and described associated with anger and fear in coitus as it is in suckling. Husbands and wives quarrel all too easily, sometimes apparently with some satisfaction; at other times love too frequently turns to hate between the partners. "This is the matter to be determined," says Van De Velde (1931*b*): "Does there exist in addition to hatred, as opposed to love, or to sexual repulsion as opposed to sexual attraction . . . a primary genuine sexual hostility? However much I may deplore the fatalistic inferences which, apparently, to some extent at least, must be deduced from this, I find myself compelled to answer the question in the affirmative."

The theme of love with anger and fear will be traced from animals to primitive people, children, adolescents and adults.

Animals.—Ellis (1928*b*), says "Among very varied species wounding and rending normally take place at or immediately after coitus; if we go back to the beginning of animal life in the protozoa sexual conjugation itself is sometimes found to present the similitude, if not the actuality, of the complete devouring of one organism by another." He observes that "Every animal in some degree owes its survival to the emotional reaction of anger against weaker rivals, to the emotional reaction of fear against stronger rivals. To this cause we owe it that these two emotions are so powerfully and deeply rooted in the whole zoological series to which we belong. But anger and fear are not less fundamental in the sexual life." Ellis (1928*c*) also refers to Darwin —"Darwin himself said that nothing is commoner than for animals to take pleasure in practising whatever instinct they follow at other times for some real good. These manifestations are primarily for the sake of producing sexual tumescence . . ."

Tillier (1889) pointed out that there is a normal coexistence of combat and courtship.

Hamilton (1914) says "at least two, and possibly three, different kinds of hunger, or needs of individual satisfaction, normally impel the macaque towards the manifestation of sexual behaviour, viz., hunger for sexual satisfaction, hunger for escape from danger and, possibly, hunger for access to an enemy."

Zuckerman says that Bingham (1928) has shown that the sexual presentations of chimpanzees at times when they were fed had "unmistakable roots" in previously exhibited behaviour connected with fear and rage.

Zuckerman (1932*a*) described "the transition of the aggressive attitude of a monkey to one of sexual interest when it is presented with a sexual stimulus by the animal whose activities have aroused its aggression." Describing the communal life of the baboon, which is based upon a system of dominance, he says: "Sometimes an overlord may suddenly draw the aggression of his neighbours for no obvious reason . . . at such times, and at others when the

overlord has evoked the combative activities of his fellows, his female or females usually and immediately assume a copulatory position and crowd round him —in a monogamous party, the male mounting his female as he threatens his attackers."

Ellis (1928*d*) remarks that " In animals the connection between love and anger is so close that even normally, as Gross points out, in some birds the sight of an enemy may call out the gestures of courtship."

Primitive people.—Crawley (1902), referring to primitive marriage by capture, speaks of " a ceremonial use of force, which is half real and half make-believe."

Roheim (1930*b*) refers directly to the attitude of primitive people to coitus: " The equivalence of coitus and death is certainly the unconscious concept that is at the bottom of animism and magic. . . . Going to war seems to be regarded as another form of coitus, or coitus as another shape of death or murder."

Children.—Children evidently have similar ideas. Klein (1932*g*) says, " The death wishes he (the child) feels against them (the parents) during the primal scene or in his primal phantasies are associated with sadistic phantasies which are extraordinarily rich in content and which involve the sadistic destruction of his parents both singly and together. The child also has phantasies in which his parents destroy each other by means of their genitals. . . . These phantasies have important effects and are very numerous, containing such ideas as that the penis, incorporated in the mother, turns into a dangerous animal . . . or that her vagina, too, becomes a dangerous animal, or some instrument of death . . ." Speaking of the sexual development of the girl, Klein (1932*h*) says, " Her fear of the sexual act is thus based both on the injuries she expects to receive from the penis, and on the injuries she will herself inflict on her partner."

Adolescents.—Marro (1898) is referred to by Havelock Ellis on this subject: " With the epoch of the first sexual relationship, Marro points out, awakes the instinct of cruelty, which prompts the youth to acts which are sometimes in absolute contrast to his previous conduct, and leads him to be careless of the lives of others as well as of his own life."

Adults.—The instinct having awoken, matures. Nietzsche (1911) does not soften the blow: " Have people had ears to hear my definition of love? It is the only definition worthy of a philosopher. Love, in its means, is war; in its foundations, it is the mortal hatred of the sexes." Weininger (1906*a*) makes the aphorism, " Love is murder."

Freud (1933*b*) supposes that " there are two fundamentally different kinds of instincts, the sexual instincts . . . and the aggressive instincts"; although " the instincts of aggression are never alone, they are always alloyed with the erotic ones." Freud (1924*c*) also says that the association in general between the sexual instinct and the emotions of fear and dread is a very intimate one.

Jones (1931*a*) stresses the sexual significance of the nightmare and describes amongst the " cardinal features of the malady " a helplessness and an " agonizing dread." It is the experience of the present writer that these same features

are also found with evidence of sexual significance in the terrifying hallucinations found in melancholia and other mental illness.

The evidence, then, is very strong that there is an association of sex with aggression and fear.

Apparently both anger and fear are the roles played by each sex; thus the well recognized sexual perversions of sadism and masochism are found in both sexes (Krafft-Ebing, 1934; Hirschfeld), and Flugel (1945*b*) says that "to regard masochism in general and any type of masochism in particular as specifically feminine is no more justified than is the long-since discarded theory that hysteria is a specifically feminine disease."

In courtship it is normally the male who is aggressive; as Howard (1940) says of the water hen species, "pecking and chasing belongs to the cock." The sexually aggressive male is well recognized.

On the other hand, it would appear that at the orgasm the roles played by the male and female reverse, so that the female is then aggressive and the male is subjected. Ellis (1928*e*) says "the tendency to bite at the climax of sexual excitement is so common and widespread that it must be regarded, when occurring in women, as coming within the normal range of variation in such manifestations."

Willey, Vander and Fisher quote the dictum of the Roman physician Calenus that "every animal is depressed after coitus, except the woman and the cock," and these authors confirm that "men are very frequently morose after the sexual act."

Associated in the unconscious mind with ideas of sex are found ideas of castration. "The fundamental dread of primitive man," says Roheim (1930*c*), "seems to be the dread of castration, or, what amounts to the same thing, from the unconscious point of view, the dreaded expenditure of semen."

Similarly in some species of the insect world the male dies literally at the end of the act of coitus, the case of the bee being well known. Maeterlinck (1902) describes this "hostile madness of love. Most creatures have a vague belief that a very precarious hazard, a kind of transparent membrane, divides death from love, and that the profound idea of Nature demands that the giver of life should die at the moment of giving. Here this idea, whose memory lingers still over the kisses of man, is realized in its primal simplicity. No sooner has the union been accomplished than the male's abdomen opens, the organ detaches itself, dragging with it the mass of the entrails, the wings relax, and, as though struck by lightning, the emptied body turns and turns on itself and sinks into the abyss."

Previous Explanations.

(a) *Animal Identification.*

Jones (1931*b*) speaks of "the idea that a human spirit can pass into the body of another person or of an animal and that the reverse process can also happen. This was and is one of the most widely-spread superstitions of the world." He attributes the belief to dreams, and especially to nightmares in which people turn into animals. He says (Jones, 1931*c*), "the malady known as nightmare is always an expression of intense mental conflict centreing about

some form of 'repressed' sexual desire." The nightmare may include in women ideas of sexual assault and in men seminal emissions. Jones has also traced the same factors of sex and animal transformation in the medieval erotic beliefs in witches, vampires, werewolves and the devil.

The fact of the connection between sex and ideas of animal transformation is clear, but it is not an adequate explanation to say that this is so because sex is expressed in dreams with animal transformation, unless one can give the reason for animals being pictured in sexual dreams. Jones (1938*b*) says that "if a person's conduct or appearance resembles in some way that of a lion or bull, he may masquerade in a dream in the form of the animal."

Jones (1938*c*), in writing of the genesis of symbolism, gives three factors which "are operative in this general primitive tendency to identification": the first is that "the primitive mind very often does not discriminate" one object from another due to "mental incapacity"; the second is that "when the primitive mind is presented with a new experience it seizes on the resemblances, however slight, between it and previous experiences"; and the third factor is that "the appreciation of resemblances facilitates the assimilation of new experiences." He elaborates these factors to "throw some light on one of the most puzzling phenomena of symbolism—namely, the extraordinary predominance of sexual symbols."

(b) *Ambivalence.*

Huxley (1930) finds it to be a general rule that the method of courtship in different species of birds is related to the respective roles taken by male and female "in the reproductive duties of building the nest, sitting on the eggs, and feeding and guarding the young."

Marro (1901) says that the frequent presence of force in the courtship of savages is to allow the female to test the man's virility, for in the struggle for life violence is the first virtue.

Zuckerman (1932*b*), describing the transition in a monkey from an aggressive attitude to sexual interest when presented with a sexual stimulus, says "it is possible that these liberated sexual responses are socially conditioned from flight reactions stimulated by fear. . . . The monkey's presentation in social situations of this nature is then all that is left of its original reaction of flight from the environment of fear and discomfort."

Ellis (1928*f*) says that in the playing of the hunter and the hunted in courtship "is attained in both male and female that charging of nervous energy, that degree of vascular tumescence, necessary for adequate discharge and detumescence in an explosion by which sperm-cells and germ-cells are brought together for the propagation of the race."

Psychoanalysis has usually explained anxiety in the adult, which is associated unconsciously with sex as being due to regression, to primordial life, or to birth, or to childhood.

Ferenczi seeks the explanation in the beginnings of all living matter. Thus the anxiety of sex is believed by him to be the survival of the archaic multiplication by fission; the propagation of the species is regarded as the death

of the individual. Otto Rank attributes the anxiety of the anxiety neuroses to the anxiety-experience of birth.

Freud's (1933*c*) explanation is by regression to childhood, and he attributes sexual anxiety in the male to fear of castration by the father for an incest wish and in the female to fear of loss of love.

Jones (1938*d*) and the psychoanalysts in general also speak of a regression to a level at which erotic and aggressive and fearing elements are more intimately related or fused.

There is, however, a psychoanalytic theory which relates sexual anxiety to current events. Freud (1924*d*) believes that anxiety neurosis is due, for example, to coitus interruptus, for he regards "a series of injurious conditions (noxae) and influences within the sexual life as important factors in aetiology." Thus the psyche "develops the neurosis of anxiety when it feels itself unequal to the task of mastering (sexual) excitation arising endogenously." He does sometimes, therefore, relate adult anxiety to adult coitus, but only to an unsatisfactory sexual life.

Roheim (1930*d*), on the other hand, relates these sexual emotions to the future, and regards them apparently as a sop for worse to come. He says, "Compared to death itself, the idea of death as a coitus, even of castration, is merely a substitute, a consolation offered by the unconscious."

The present writer suggests that the explanations which have been given hitherto for the facts of coitus are unsatisfactory and are incomplete.

He sets out therefore his thesis on the two components of sexuality under consideration; the one is the first activity of the newborn with its mother, and the other is the instinctive portal to the beginning of a new generation.

C. A Psycho-somatic Theory.

Suckling.—The act is a primitive one and its emotions, too, are assumed to be primitive. The primitive animal has to learn to kill and to escape death, for without this teaching it would surely die in its wild environment.

The instincts of pugnacity and of flight are present at birth, but in the immature mammalian young who need suckling these instincts are reinforced and developed by the parents. At the romping stage the primitive mother is well known to give the young practice in these instincts, and it is unlikely that in the stage of lactation, between instinctual heritage and romping, there is no corresponding emotional rapport between the mother and its young.

The mother is to its young an environment which, it is assumed, must reflect at all stages the environment which the young will later experience when adult.

It is postulated, therefore, that by the emotions of suckling the mother plays the part of the inferior species of animal which must in due course be hunted for food by the baby, and she also plays the part of the superior species of animal which must be mortally feared by the baby.

The mother therefore "kills" the baby by whom she is "killed."

The emotions of the lactating mother and the baby are symbolic of the life of the jungle, to which the primitive young must eventually go. The mother

in loving lactation arouses in the baby the emotions of its livelihood, for which it must kill and avoid death.

Coitus.—The description of the psycho-somatic manifestations of coitus is based on the theory that in the physical procedure is implicit a demonstration by the female that she can and will provide the emotional background already described as necessary for rearing the primitive young, and a demonstration by the male that he can and is willing to risk death in pursuit of food for them.

It is, in general, essential that the primitive male and female co-operate in this way if procreation is to be brought to a successful conclusion in a new adult generation.

It is convenient to describe three stages of coitus—that of courtship, of the act up to orgasm, and of orgasm itself.

Courtship consists of the female taking the part of the member of an inferior species which is innocent of impending danger, becomes alarmed as it senses the approach of the attacker, objects to being killed, attempts to escape in fear, but is caught by the killer.

In the second stage, that of the act up to orgasm, the " victim " is " killed " by the male. The male thus pledges his ability to kill prey as food for the family. The female is partly reassured by this pledge. She, by acting the death of the victim, pledges her ability to do the same for their baby, that it may learn. But the parties are not yet satisfied.

In nature the male on going out to kill his prey risks death from a member of a superior species. In the orgasm the female acts the superior species which kills the male, eviscerates and eats him. The evisceration of the male is portrayed by his emission, and she tests his willingness to do his duty even unto death, if that be the need. He meanwhile is reassured that she, by acting the superior species, will make a mother who is capable of educating their young in the dangers ahead of them.

Thus coitus is a symbol of what shall be. It is postulated that not only are the young conceived through coitus, but that also in the mating couple is conceived that relationship of duties as the result of which the young will thrive.

The couple in coitus witness the one to the other by their act, and in the act test each other in their respective parental duties.

D. Comment on the Theory.

General.—It is clear that the theory gives a standard by which the significance in life of suckling and coitus may be assessed.

The theory is intended to explain the norm of reproduction where there has been differentiation of the sexes. No attempt is made here to follow up the variations on the norm which are consequent on environment affecting the evolution of reproduction in various species.

It is not supposed here that animals, or even necessarily human beings, have conscious knowledge of the meaning of suckling or coitus as described in the theory of this paper. The operation of an instinct is being described and an instinct once aroused tends to progress towards its fulfilment, apart from

conscious recognition of its mechanism or meaning. It would be more correct to say that in general only species whose sex life has in some form enshrined these principles have survived.

The theory is founded on the unfailing providence for the next generation which, even in animals, rises to something akin to a devoted, selfless love. The primitive purpose of sex is the survival of the species, and for this, which will continue " for ever " when they are dead, mated animals live. Lovers whisper over their kisses that it shall be " for ever " ; and religion, in its own sphere, stressing the importance of such immortal thoughts, declares the relative unimportance of the passing physical life except as part of eternity.

It is true that coitus is not now confined to times of female rut, is often not practised, or when practised, is often not necessarily intended for procreation ; physical contraception is added to the mental hope of at least episodic sterility and the act then loses its primitive purpose. No one, however, who is endowed with the primitive apparatus of sex, used naked or sublimated, can, without frustration of the instinct itself, ignore combining also with others in a purpose which lives after them.

Suckling has been over-sentimentalized, and coitus has been regarded disproportionately as an expression of " the pleasure principle," and a means of " gratification " ; the psycho-somatic theory of this paper conforms on the other hand to Huxley's general rule for birds that the method of courtship is related to reproductive duties. According to the psycho-somatic theory of sex, suckling performs the duty of emotional education of the young, and by coitus the respective duties of each parent are pledged. This physical symbolization of moral values is not confined to coitus. Clausewitz says of war that " fighting is a trial of strength of the moral and physical forces by means of the latter " (Greene, 1945). The same relationship of a physical act enshrining moral values is recognized and applauded in games ; and is reverenced in religious practices. Freud grasped this principle in the psycho-pathology of conversion hysteria, and psycho-somatic medicine has the same foundation. It will be made evident that, according to the psycho-somatic theory of this paper, many moral values which are generally accepted in society are found in the primitive family, and that they are expressed implicitly in suckling and coitus.

The principles described in the theory of this paper are an elaboration of the dictum of Pearse and Crocker (1944*b*) that the family is the " instrument for the cultivation of functional efficiency." As Alverdes (1927) says, " even though a chicken will develop into an ordinary fowl without imitating the mother bird, its instinctive activities come into play earlier and with greater certainty when it has the opportunity of doing so . . . young beasts of prey reared in isolation would doubtless develop predatory methods similar to those of animals which had enjoyed the advantage of parental instruction ; but theirs would probably be found to lack polish."

It is the theory of this paper that in suckling the instincts of the baby are given their first parental cultivation, and that the instincts of the parents to care for the young are pledged in coitus.

This is in accordance with the best traditions we know, but these primitive

acts of suckling and coitus use means which, compared with civilized customs, contain an anomaly and a paradox. The anomaly is the identification of women with animals; and the paradox is the ambivalent expression of love by the rehearsal of killing and death in acts of suckling and coitus.

Before *Homo sapiens* evolved away from the insecure jungle he required the jungle characteristics of sex, but although he has changed and developed in many ways, his sex apparatus remains relatively unchanged. Thus it is the purpose of this paper to show that, though reckoning himself above the beasts, mankind still shares the sexual emotions of the jungle (ambivalence), and the female of the human species plays the part of timid and savage animals of other species (animal identification).

The intrinsic presence of animal identification and ambivalence within normal suckling and the normal sexual act explains therefore the presence in civilized people of the archetypes of Jung.

Psycho-therapy, therefore, has to deal with normal primitive psychology which has been given psycho-pathological expression instead of expression in acceptable forms. This view of a normal primitive psychology in sex follows from the psycho-somatic theory of sex of this paper. Psychoanalysis, on the other hand, has accepted the material of the unconscious mind as predominantly pathological. Thus Jones (1938*e*) says, "The mode of action of the treatment, in a word, is that the overcoming, by means of psychoanalysis, of the resistances that are interposed against the making conscious of the repressed unconscious material gives the patient a much greater control over this pathogenic material . . ."

Some of the mechanisms of the unconscious mind described by the psychoanalysts and others exist also within the normal sexual acts of suckling and coitus.

Animal identification and ambivalence will be considered, therefore, from the point of view of normal psychology and of psycho-pathology.

Animal Identification.

(a) *Normal Psychology of Animal Identification.*

That which has been called animal identification is necessary primitively. This is because the female, in order to train the young in the nature of its future environment and to be able to assure the male in coitus of her ability to do so, has not, in suckling and coitus, the use of elaborate language. When she wishes to portray the environment she must act it. She thus introduces the first elaboration of perhaps the earliest of all sign-languages. The baby in suckling and the male in coitus use the simplest sign language—they just express their feelings. But the female takes the next step in this primitive language. She expresses not herself but the environment for which the baby is being educated, and in which the male must work when he puts into practice the hunting he is expressing to her. (It follows that in herbivora she must convey to her young what it will be like to eat vegetable matter, but for the ease of explaining this theory the case of carnivora which hunt smaller animals is considered.)

She therefore acts the part of the inferior hunted species and of the superior feared species. We have here a primitive basis for the familiar mechanism of identification.

This mechanism of animal identification involves dissociation and depersonalization. The women is self-effacing, and dissociates her own personality from what she expresses sexually. Dissociation, in spite of the well known pathological forms of it, is therefore an aspect of normal primitive sexuality. The normal primitive personality is expressed by hunting and avoiding death, but woman does not thus express sexually her personality; sexual depersonalization, therefore, takes place, and she expresses the characteristics of the animals with which her family come in contact.

Animal identification in sex also gives a fundamental and biological explanation for the ideas of human transformation into animals for suckling and coitus found in mythology and folklore, and also explains why rites of sexual significance should be practised in the primitive ritual of the totem animal.

It is perhaps significant that at the time humanity was first placing a taboo on incest, it should also have established a ritual of sexual significance with an emblem which denoted parenthood, for primitive man believed he was descended from the totem animal. Man thus made his first primitive sublimation to help him keep his first repression.

The totem animal appears in some myths to have been regarded as originating from woman, for Frazer (1910*a*) speaks of " myths in which a human ancestress is said to have given birth to an animal of the totem species." It is now suggested that this myth is derived from the sexual identification of woman with animals of other species.

Primitive man also considers himself as being one with his totem, just as a member of a family identifies himself with the family. Thus " the relation between a man and his totem is one of mutual help and protection " (Frazer, 1910*b*).

It is also known that " the totem gives his clansmen important information by means of omens " (Frazer, 1910*c*), as similarly it has been described in the psycho-somatic theory that suckling gives the infant " important information " in teaching it the rudiments of anger and fear.

Frazer (1910*d*) says, moreover, that " one at least of the functions of a totem clan is to provide a plentiful supply of its own totem animal or plant to be used as food by the other members of the tribe," which is precisely what the psycho-somatic theory says is implicit in the emotions of suckling and coitus, for the female is described as playing the part of the animal which the young must learn to kill for food and which the male meanwhile must obtain " in plentiful supply " for the young.

Suckling and coitus have been described by the psycho-somatic theory as having a straightforward primitive meaning, just as " Totemism is a thoroughly practical system designed to meet the everyday wants of the ordinary man in a clear and straightforward way " (Frazer, 1910*e*).

It is of interest that in totemism the animal from which the tribe believed it was descended was ceremoniously killed yet was held in mortal fear. This

ritual resembles closely that of suckling and coitus as described in the theory of this paper.

It is now propounded that the totem ceremonies were the first primitive, unconsciously motivated attempt at a symbolic sexual life for the community. The tribe as a unit, and not as a collection of families, has no sex life of its own to express the love of one member of the unit for another, and borrowed in symbolic form the womanly identification with animals, around which to form its ritual. There was thus acquired for the tribe the sexual symbol of the woman of a family, and around this symbol was dramatized the powerful instinct of the herd. In so far as totem ceremonies developed into the sacrifice of animals in religion, the same emotions and symbolic significance may be discerned also in the latter.

Children also recognize a value in animal identification, and their enthusiasm for stories and pictures of animals masquerading with human speech and clothes is similarly understandable. The atmosphere provided by their mothers in suckling is thus preserved for them. The mother therefore is to the child those animals with whose behaviour the child must at one time become familiar, and within her sheltering tuition the little child is safe. This aspect of the child's relationship to its mother is therefore similar to the prophecy of Isaiah —" The wolf also shall dwell with the lamb, and the leopard shall lie down with the kid ; and the calf and the young lion and the fatling together ; and a little child shall lead them."

Hall concludes, says Ellis (1928*g*), that the fear and love of fur in children, in some cases appearing as early as the age of 6 months, " are so strong and instinctive that they can hardly be fully accounted for without recourse to a time when association with animals was far closer than now . . ." That this feeling for fur should still be prominent, after such long evolution, in the human child of six months can be attributed to the mother playing the part in suckling of this primitive furry animal of another species, and thus stimulating the " instinct " in the child for animals. It is presumed that the mother also carries this atmosphere of suckling into her motherhood of the child after weaning.

It is evident, therefore, that the idea of animal identification is embedded so deeply in human minds that it is of value to have a simple explanation for it in suckling and coitus, as given in the psycho-somatic theory of this paper.

The first sublimation by the child of animal identification is on to the father. That animal ideas should be interpreted as " father figures " is a transfer of affect from the mother. It is a tribute to the domestication of the father. In consequence with the popular view of the father as a strong man who exerts discipline, it is usually he that is thought to be the fierce animal of the superior species.

Klein (1932*i*) says that " In his paper, ' Nach dem Tode des Urvaters' (1923), Roheim argues that through having devoured the corpse of their primal father his sons came to look on him as the nourishing mother. In this way, he thinks, they transferred the love which they had hitherto felt for their mother alone to their father as well." Evidently the same acceptable con-

clusion of transfer of the attachment of a portion of affect from mother to father, but derived from a pathological premiss!

It may be inferred from the psycho-somatic theory that the baby is wishing to share with the father that love which primitively was for the mother. The boy and girl fear the father, pretending he is a member of a superior species, and are aggressive towards the father, pretending he is a member of an inferior species, and thus the children come some way towards loving him as they do their mother, in terms of the educative influence of animal identification.

We have the same normal identification with animals of women when they are called by the numerous endearing pet names of animals and birds. The same displacement made by the child of its identification of the mother with an animal to identifying its father with an animal is made in common parlance by people of all ages when men, by courtesy, are likened affectionately to animals.

Primitively there is no anomaly in the animal identification of women. It is a primitive means to a primitive end. When the primitive child and primitive man identifies the woman with an animal, it is in order to learn and demonstrate respectively a vital primitive concern with those animals. Although our sexual life is primitive, civilization is far from being primitive, and the animal identification of women therefore appears anomalous from the civilized point of view and is sublimated. A civilized mother identifies herself, therefore, with the civilized interests of her husband and children. The animal identification is thus sublimated to conform with the normal interests of civilized families. The more complicated the interests of the children and husband are, the more complicated is the woman's identification with the objects of their interest.

(b) *Psycho-pathology of Animal Identification.*

The psycho-pathology of animal identification occurring in human beings consists of the confusion of the animal itself with the person who is identified with the animal. The objects to be killed and mortally feared in primitive reality are the animals of the inferior and superior species, and these objects are confused with the object to be loved, which is the woman, who, for the benefit of the children in suckling and the husband in coitus, portrays the family's primitive interest, namely, animals of other species.

This confusion in apprehension of the object to be killed is present in the literature on sex, and also in many well-recognized examples of human folly.

The subject will be considered in animals, children, adults and nations.

Animals.—Ellis spoke of anger and fear against weaker and stronger "rivals" respectively, but he did not differentiate clearly the difference between the "rival" to the family's life of a member of another species and the rival to mating of another member of the same herd: the former is the fundamental situation portrayed in sex, the latter when ending in killing is a primitive example of confusion of the object to be killed, and is the antecedent of much inter-human strife.

Children.—Klein (1932*j*) makes this statement:

"As the work of analysis proceeds we find that the child's relation to reality,

at first so feeble, gradually gains in fullness and strength. The small patient will begin, for instance, to distinguish between his pretence mother and his real one, or between his toy brother and his live one. He will insist that he only meant to do this or that to his ' doll ' brother, and that he loves his real brother very much. Only after very strong and obstinate resistances have been surmounted will he be able to see that his aggressive acts were aimed at the real, human object. But when he has come to understand this, young as he is, he will have made a very important advance in his adaptation to reality." It would be more understandable to say that by uncovering a desire to kill the real human object, the way is left clear for a very important retreat from murder in his adaptation to reality. It would appear from the psycho-somatic theory of this paper that the boy was right when he insisted that he only meant to do this or that to his " doll " brother, and that the psychoanalyst was wrong in not recognizing the essential value of the boy's insistence. It is no part of normal reality actually to wish to kill one's brother or mother. It is " reality " to wish to kill a member of an inferior species and to practise this on a " pretence mother " or, as a surrogate, on a " toy brother." When this instinct is turned on to the " real mother " or " real brother " it is a perversion, a racial suicide, and it is not a normal biological reality for the human race. For the bee, with its particular specialized society, the actual death of the male in coitus is established biology, but murder has always held an uneasy place in the human race. It would appear that the " pretence brother " is at times unfortunately confused with the real brother, but that to recognize the folly of such confusion is " a very important advance."

The confusion of the object for anger and fear is found in the oedipus complex. One admits the child loves the parent of the opposite sex, that this love is sexual is very natural, and it is, therefore, inescapable that this primitive love is felt in terms of killing and fear of death. That is normal, if primitive, psychology; but when the anger and fear is attributed to a desire to kill or avoid death from the jealous parent of the same sex we are dealing with a rationalization.

The confusion of thought is clarified by the psycho-somatic theory. The normal and fundamental dissociation of psychology is the woman's expression in sex of her identifications, instead of expressing her own personality. But there would appear to be a pathological tendency to dissociate the woman's identifications from her sexual loving and to displace her identifications to another human being's personality. Thus, in the oedipus complex the boy wishes to kill and fears mortally the real father, instead of the mother's identifications. In the electra complex the girl fears the mother will kill her father, instead of accepting these tendencies of fear and killing in other animals as those of her identifications, assumed in sexual pretence for expressing her love to her father. These incest wishes must needs be repressed, but psychoanalysis has shown that with the repression there is often an oedipus or electra complex, which may be interpreted by the psycho-somatic sexual theory as based on pathological dissociation of the animal identifications of woman.

The normal sexual dissociation of woman occurs by her depersonalization and her sexual identifications. The abnormal dissociation occurs when she

or others expect her to express her own personality sexually and regard the animal characteristics as dissociated from her to another person, who is regarded as being actually vengeful, as in the oedipus and electra complexes.

If the sexual depersonalization of a boy's mother is misunderstood by him as an unwillingness for her to love him or an inability for him to love her, there is present within him a pathological premiss from which he may conclude unconsciously the rationalizations of the oedipus complex. Similarly with the awakening within the girl of love for her father; if she mistakes her sexual depersonalization for an abnormality, she may fear a loss of love which she may attribute quite mistakenly to a malevolence of her mother.

Adults.—Here also the principle of animal identification is too often misunderstood. Van de Velde is correct when he speaks of sexual hostility between man and woman, but the hostility is not, as he says, "primary," for it is secondary to the hostility felt for other species; nor is the hostility between man and woman "genuine" normally, for it is merely the portrayal within the family of its relationship to the environment. When the sexual hostility is misunderstood in marriage, the partners regard each other with a "genuine" psycho-pathological hostility and a marital quarrel ensues.

Woman misunderstands the value of the anomaly when she does not like the sexual act discussed, and when, in order to rid herself of recognition of her bestial sexual identification, she is so ready in projection to call the man a beast. Perhaps it has been on account of her bestial identification that she has in times past been most curiously denied as having a soul, for a soul has been regarded as the exclusive possession of human beings.

Weininger (1906*b*) says that woman has no mind; in so far as he is referring to the personality of a woman he is incorrect, but in so far as he means that woman does not express her personality sexually he is in agreement with the psycho-somatic theory for, according to this theory her sexual part lies in conveying to her young the nature of the environment and to her mate her ability to do so. She thus encourages her young and charges her husband to address themselves to the environment.

When animal epithets are used as terms of abuse it is presumably to point out an alleged wrongful use of animal identification. It is not that the animal identification is wrong, but that someone is alleged to be misusing it.

A serious failure in the use of the anomaly is found in psychotic patients, who at times have pathological ideas of animals associated with symptoms of unconscious sexual significance; the animal ideas are declared frankly or are projected in hallucinations.

Nations.—The confusion in the use of the anomaly is found amongst nations, for in war mankind is killing his own species instead of an inferior one, and fearing his own species instead of a superior. The sexual dramatization of the enemy is confused in its real fulfilment with others of the human race, who are regarded as "the enemy," "inhuman," and fit to be treated only as being of another species. If the psycho-somatic theory be true, animal identification is intended only for the purposes of love and friendly intercourse, and identification of another nation with an animal should serve the purpose

of identifying it with the objects of one's own civilized interests. War is therefore a psycho-pathological form of the anomaly.

It behoves us to know what we are doing in sex and to understand the animal identification contained therein.

Ambivalence.

(a) *Normal Psychology of Ambivalence.*

The psycho-somatic theory is an explanation for the finding of the co-existence of primitive emotions and sex by many investigators, of whom have been mentioned Ellis, Darwin, Tillier, Hamilton, Bingham and Zuckerman in animals, Crawley and Roheim in primitive people, Klein in the phantasies of children, and Nietszche, Weininger and Freud in adults.

Freud, however, does not appreciate the portrayal of the aggressive instinct as an essential primitive element of the sexual instinct, for where aggression is present in sex he appears to regard it as a combination of an aggressiveless sex instinct with the aggressive instinct.

Freud (1933*d*) has said that when "the efforts of the pleasure-principle come to nothing," which he styles a "traumatic" factor, that the libido is turned into anxiety. This is a half-truth, for the sexual libido is itself a demonstration of anxiety which is not noticed unless there be a "traumatic" factor. It is not just that "what one fears is obviously one's own libido," but also that the sexual libido expresses anxiety and is, itself, fearing.

Freud's (1936*b*) later explanation was further still from that of the psycho-somatic theory, for he said that "anxiety never arises from repressed libido," but that it is the ego which feels the anxiety. He retracted his earlier statement that there is a direct transformation of libido into anxiety; according to the psycho-somatic theory of this paper Freud's first thoughts were correct, but he could not pursue them and retracted them, for he had not analysed the nature of the libido, nor discovered its qualitative factor.

"And now the instincts in which we believe," says Freud (1933*e*), "separate themselves into two groups; the erotic instincts, which are always trying to collect living substance together into ever larger unities, and the death instincts which act against that tendency, and try to bring living matter back into an inorganic condition." The death instinct of Freud is not here discussed, except to note that although he separates it from the erotic instincts, there is a portrayal of death by all concerned in suckling and coitus. In this sense the "death" instincts are also trying to "collect living substance."

Freud (1933*f*) says, "Even punishment-dreams are wish-fulfilments, but they do not fulfil the wishes of the instinctual impulses, but those of the critical, censuring and punishing function of the mind." Yet, with the desire for "fear" and "death" present in the sexual instinct and awaiting sublimation, one presumes that Freud is wrong in his assessment that the wish for punishment does not fulfil the instinctual impulses. It is this fear, enshrined in sex, which is so usefully ready for displacement to fear of punishment in social conditioning.

The distinctive explanation of the psycho-somatic theory for the ambi-

valence of love can be further demonstrated. Thus Freud (1925*b*) says, " The relation of hate to objects is older than that of love " ; but it is deducible from the theory of this paper that if by hate is meant the desire to kill, it has been co-existent with love from time immemorial.

Zuckerman has suggested that the association in monkeys of sexual activities with fear and aggression is a social conditioning. The psycho-somatic theory of this paper is that the " conditioning " of sex with fear and aggression has taken place ever since fear and aggression were in the world.

The meaning of ambivalence thus established there is an important clinical deduction. Freud's outlook justifies catharsis and an attempt at removal of unconscious aggression and fear from sexual love ; this would be excellent were it not that the primitive sexual acts of suckling and coitus as described in this paper make a mockery of catharsis of their emotions and render any such attempt futile. Freud has not appreciated that the erotic instincts are a loving demonstration of the primitively necessary instincts of aggression and fear. Reliving emotion may, on the other hand, have its uses where it is not directed towards purgation of the emotion, but towards acceptance and reorientation to the emotions aroused.

Jones (1938*f*) describes abreaction as " the process of working off a pent-up emotion by living through it again in feeling or action." There is no doubt that good may ensue from what is called abreaction, but it would appear from the psycho-somatic sexual theory that it is the unsatisfactory orientation to the emotion which is " worked off," while the emotion itself is accepted and " worked in " to a better orientation.

It behoves one to give the normal aggression and fear a primitive expression in suckling and coitus and otherwise a sublimated expression.

Ambivalence will be related to primitive people and to the emotions of babies, children and adults.

Primitive people.—The theory gives a biological explanation for the paradox of the killing and eating of the totem parent and for the mortal fear in which the totem is held.

Marro's belief that the presence of force in the courtship of savages is to allow the female to test the man's virility is a similar example of this ambivalence.

Babies.—The reason for the appeal of the story of Red Riding Hood in which the child is in danger of being eaten by its " grandmother " is clearly evident. Riviere's conception of a baby displacing its " horrible phantasies " of a cruel mother on to animals by the use of the " totemic " mechanism is near the mark, but is somewhat confused, for both the " totemic " mechanism and the baby's " phantasies " are derived from the mother, who naturally and very kindly portrays the fierce primitive animal.

Thus the vigilant mother who has prevented her young child from running to its death under a passing bus, smacks it as she shamelessly declares, " I could murder you." Out of her love she wishes to impress the necessary fear of death in her child, and the child is thus comforted that it has learnt so securely something more of the danger of life. Thus, too, does an animal encouragingly cuff its young. And this is the biological explanation afforded

by the psycho-somatic theory for the concept of Isaacs (1933) of the "good-strict" parent.

Freud (1930) says "This instinct (of aggression) . . . is at the bottom of all the relations of affection and love between human beings—possibly with the single exception of that of a mother to her male child." Freud had obviously not appreciated the essential love element of aggression in a mother to her male child or he would not have made an exception where he was presuming love to be unusually strong.

The baby is also exercised in aggression. This not only confirms Freud's beliefs in the internally generated need of the baby to express aggression, but also adds that the aggression is cultivated by suckling.

Thus a mother's reaction to some unusual success achieved by her child is to say "I was tickled to death"; she is content to the primitive foundations of her mind, and there the child's success is felt as "killing." She still feels as she did in suckling when the child learned this livelihood on her and she says "I feel tickled to death." She gives expression to the symbolic feeling of death, although she is happy and in blooming health.

Hence is the ease with which a mother's and the baby's equilibrium shifts to a distressing exhibition of fear or anger. This is normal psychology so long as the emotions are used towards the successful re-establishment of equilibrium, when the exhibition of anger and fear is no longer distressing but pleasant.

The ways in which the sexual instinct and its social expression can be thwarted are fairly numerous, and when an instinct is thwarted its emotions become more apparent. McDougall (1940*b*) says, "We do not become explicitly aware of our emotions, so long as we give ourselves wholly to action"; and he says of conation as a mode of experience, "We experience it in the most distinct manner when we are moved by some uncontrollable craving or desire which we cannot satisfy and which will allow us neither to rest nor to turn our attention to other things."

One does not deny that a thwarted baby is angry or frightened, but the anger and fear do not spring from the thwarting or separation which merely removes the object (the mother) of the anger and fear. Violent emotions are normally fulfilled in love of the baby, and the purpose of the violent emotions is achieved in the welfare of the baby, when the mother returns to it or when education guides these primitive emotions, where necessary, into socially acceptable sublimated expression. When, however, this mechanism breaks down the instinct is again thwarted, but psycho-pathology does not ensue if the emotions are put into some other acceptable channel.

One does not deny that jealousy of sexual love in others does not show normally as anger and fear in a baby, but, when present, it is more likely to be an irritation aroused by the mother continuing to demonstrate to the father in coitus her willingness for duty on behalf of the baby, when the latter is itself keen to practise the same primitive act of killing on the mother in suckling, in the absence of the father away hunting! There is also the pressing desire of the baby to learn from the mother what the fearful danger is that the father is risking while hunting. It is then not the thwarted desire to kill the

real father, but the thwarted desire to "kill" the "pretence" mother in suckling that is felt in the anger of the baby's jealousy. There is not the fear of the father, but the fear of the external dangers which he so willingly encounters, and which the primitive young can only learn by receiving their direct loving application in suckling from the mother or in play with either parent. The baby's normal jealousy of the coitus of its parents is therefore often just a demand for the satisfaction of the same emotions in suckling or play.

Children.—One does not think an angry or a frightened baby is immoral or unseemly, for a baby is a primitive thing, but it is the object of the latency period to wean the child from the breast, and also from the primitive expression of these instincts to adequate sublimations and so to a recognition of the principles of peaceful civilization. With the repression of sex in the latency period is inculcated in the child a conscious belief in the immorality and wrongfulness of the presence of anger and fear in the world. The child is then taught to eschew violence, is shielded from fear, and is discouraged officially from conscious knowledge of such hidden instincts. The hope is thus established that the child will be fitted for a peaceful civilization, by the sublimation of anger and fear.

Adults.—After the lull and relative innocence of the latency period of childhood, coitus, or the biological preparedness for coitus, reawakens the primitive instincts of killing and death.

The psychoanalytic theories which explain anxiety of adult sex by regression to archaic multiplication by fission and to birth trauma are outside the scope of this article. The theories, however, which describe anger and fear in the adult by regression to babyhood and childhood are appropriate for discussion.

Glover (1933) associates aggressiveness in the adult with sexuality, but by regression to infantile aggression of "children up to the age of five," for "the instincts giving rise to war phenomena belong to that period and to no other." The psycho-analytically described mechanisms are used later to explain the killing and death found along with adult love. One admits that these particular psycho-analytically described mechanisms exist, but they are rationalizations, for according to the psycho-somatic theory of coitus the immediate explanation for the association of killing and death with love in the adult is to be found in coital preparedness, and there is no need to explain anger and fear in the adult by regression to childhood, except in so far as childhood experience modifies the character of the personality. Coitus, and the biological readiness for it, combine "killing," "death" and love, even as does suckling.

One does not doubt that sooner or later the baby's emotions in suckling are displaced to coital precursors (Klein says the oedipus complex starts at six months). Anxiety in the adult male is thus frequently linked by the psychoanalysts with a castration complex arising from infantile incestuous wishes. In regard to the infant's phantasy of coitus or the adult's experience of it, the psycho-somatic theory of this paper is in agreement with the view of the psychoanalysts (though not with some of their explanations) that associated with the emission is fear of death; and the theory is in agreement with the emotional changes at and after the orgasm noted by Callenus, Ellis and Maeter-

linck. We have here a primitive instance within the family of a moral action which is also valued in the community. It has been said that greater love hath no man than this that he lay down his life for his friends—this is analogous to the duty of the primitive male to his family which he portrays in his orgasm, for he must be willing to risk death, if it be necessary, whilst seeking food and life for the young. In peace this primitive readiness to sacrifice oneself must find sublimated expression.

It should be noted that the reversal at the orgasm by the male and female of the emotion with which each commenced the act is normal psychology. The balance or equilibrium of each individual's emotion is thus restored. The psycho-somatic theory therefore adds weight to the importance usually attributed to the orgasm, and explains the phenomenon of the ambivalence of anger and fear.

(b) *Psycho-pathology of Ambivalence.*

Psycho-pathology of ambivalence is present when anger and fear are not recognized as normal channels of love. Thus it is psycho-pathology to explain anger in the baby by fear, or fear by anger, for both are emotions of instincts which are receiving their first cultivation at the breast.

Fear and anger in the baby are not therefore primitively a pathological state of affairs, and the aggressiveness of the mother is not normally just a projection in phantasy of a guilt-ridden child, it is part of the training of the young for an insecure environment and it should not be lost sight of that the baby is nurtured normally in loving symbolic killing and death.

When the baby is not led normally to value its own aggressiveness it projects it on to the mother in phantasy. Riviere (1936*c*) speaks of the baby's phantasy of the mother having "a cruel breast" and also of a "good breast," but one cannot agree when she says, "The next aim of psychic phantasy is then to keep these two images separate and distinct; if they are allowed to merge, clearly a good breast which is also cruel and vindictive has ceased to be good." Such a "cruel" breast has not, according to the psycho-somatic theory of this paper, ceased to love, nor is it a phantasy of the baby.

This psycho-somatic theory has further clinical implications. Thus if we consider the statement of Klein (1932*k*): "According to my observations, the reason why the child needs to have its mother always with it is not only to convince it that she is not dead, but that she is not the 'bad,' attacking mother." Both the observations of Klein are a misunderstanding either on her part or the child's, and normal psychology has been misunderstood as psycho-pathology, for the normal baby wishes the mother to be "dead" when she portrays the inferior species, and the baby needs the "bad" attacking mother, who teaches it the danger to be expected from the superior species.

The fierce emotions practised in love by suckling are meant to breed confidence in the survival of the species. This confidence is shared by civilized mothers and their babies, but when, as so often happens, the instincts are thwarted, there are left unfulfilled most uncivilized emotions. The frustrated emotions may then impinge on the rest of the psyche in other than loving ways.

The " floating " emotions are often rationalized, and it is the rationalizations which the psychoanalysts have detected.

And it is psycho-pathology to attribute too much of the fear and anger found in the baby to the third party of the oedipus complex, for, in so far as there are coital emotions in the baby or child, the fear and anger will have the same normal and essential significance as in the adult.

Actual incest is pathological, but an unconscious incest wish is most natural. A mother is her boy's first sweetheart, it is said. The application in unconscious phantasy of the emotions to the parent of the opposite sex is harmlessly childish and forms a safe repository for these emotions until marriage, but when a murderous jealousy is felt for, or imagined in, the parent of the same sex, then the incest wish has developed psycho-pathological associations. Similarly the complex of the boy that his father will castrate him is psycho-pathology. Catharsis of such a concept is appropriate, but psycho-pathology persists unless it is recognized that disguised in the castration complex is the previously described normal and essential meaning of the emission, which must be accepted and sublimated to a normal concept instead of the concept of castration.

The psychoanalysts attribute too much of adult psycho-pathology to maladjustments of the incest wish in childhood. The same maladjustments to sex arise in the adult, so that neurotic and psychotic anxiety and aggressiveness are attributable to present sexual difficulties and not only to regression. It is always advisable to explain symptoms in terms of the present situation as well as in terms of regression to misunderstood infantile incestuous wishes. Freud indeed explains anxiety neurosis in terms of the current sexual life, but owing to ignorance of the meaning of the sexual act he could not pursue this subject far, and he set the course for infantile regression theories to the too great exclusion of the current sexual disposition of the patient.

Three examples of a misunderstanding of the current sexual disposition in coitus, maternity and paternity will be given.

Murder of a spouse is a crude example of the psycho-pathology of the ambivalent emotions of coitus.

In the neuroses and psychoses of lactation a mother's equilibrium shifts to suicidal and infanticidal feelings, which are obvious displacements of the same emotions found normally in a mother as described in the section on normal psychology of ambivalence.

The simplest example shown in fathers of the psycho-pathology of ambivalence is war. Man goes to war ; he is redeeming his primitive sexual pledge to woman that he will go forth to kill. Coitus conditions him still to kill and to delight in mortal danger, but the environment is subdued already and no other species threatens him seriously. Instead of adequate sublimations he slays the members of his own species, thus manufacturing his insecurity from his kith and kin and laying himself open to disaster. A nation, when attacked by an aggressive nation, defends itself by war in order to avoid a worse psycho-pathology, and thus is condemned to psycho-pathology of civilized fatherhood.

The above three examples are of the simplest and crudest aberrations of the emotions fostered by sex. Much of psycho-pathology consists of a more

disguised failure in the understanding, acceptance and sublimation of the emotions of ambivalence. Such, for instance, are the symptoms described by Adler of a pathological " will to power " and the " inferiority complex."

A sense of both power and inferiority is kept alive in both sexes by our primitive suckling and coitus, which portray the relative power and inferiority of one species to another. The origin is not in sex, but in the order of superior and inferior species which everywhere exists. This situation is portrayed between members of the same species, and in this portrayal power or inferiority do not belong more to male or female as is supposed by Adler. " Organ inferiority " and the " helplessness of a baby " exist, but they, too, easily become a rationalization for a misunderstood sexual portrayal of inferiority.

Jones (1938*g*) says that " The real source, as always with inferiority feelings, is internal forbiddenness because of guilt and fear . . . ," but according to the psycho-somatic theory the sexual sense of inferiority is intrinsic in everybody. " Forbiddenness because of guilt and fear " may well be the source of our noticing the inferiority feelings in an unpleasant way, and thus be a disguised misunderstanding of our primitive sexuality.

E. Conclusion.

A psycho-somatic theory has been presented of suckling and coitus. The theory is definite and fundamental, and gives a qualitative factor for the biological and psychological understanding of sex within the family. The normal primitive psychology of the family has been described as love demonstrated by " animal identification " and " ambivalence."

It has been shown briefly that there are important social, religious and clinical phenomena which may be interpreted by the psycho-somatic theory of sex, but the further elucidation of these has been left for other papers.

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A STUDY OF MENTAL DERANGEMENT IN AFRICANS, AND AN ATTEMPT TO EXPLAIN ITS PECULIARITIES, MORE ESPECIALLY IN RELATION TO THE AFRICAN ATTITUDE TO LIFE.

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INTRODUCTION.

THIS article is a study of mental derangement in Kenya Africans, and is based on seven years' special experience as Medical Officer in charge of Mathari Mental Hospital and of H.M. Prison, Nairobi, and on nine years' previous general medical experience as a Government Medical Officer in various parts of the Colony.

This experience has provided an opportunity of studying the African's attitude to life, the relation of this attitude to insanity in the African, and some possible bearings of this on the aetiology of mental reaction types and of insanity in general.

The need for such a survey at this time is enhanced by the fact that the African is going through a period of cultural transition ; his native institutions are decaying, and he is rapidly acquiring an attitude that approximates to that of the European, so that such a study will become increasingly complex with the passage of time.

The investigation that follows is mainly based on Africans certified insane and admitted to Mathari Mental Hospital (the only mental hospital in Kenya) during the 5-year period from 1 January, 1939 to 31 December, 1943 inclusive, and it should be stated that where a patient was readmitted within the period he is only counted once. The total number so admitted was 736, but three of these showed no symptoms or history suggestive of mental derangement, 16 were admitted solely on account of mental deficiency, 62 were admitted from native regiments passing through the Colony from other territories, and 46 were not admitted for the first time during the 5-year period. For purposes of comparison with British and American figures in my possession, our study is therefore limited to 609 Kenya Africans admitted for the first time and mentally deranged.

A further complication has arisen since the outbreak of war, as a certain number (unknown to me) of military insane have been dealt with at military hospitals as well as at Mathari. So that, for purposes of discussion of total and sex incidence and the influence of detribalization, all Mathari military cases from Kenya (numbering 51) have had to be eliminated, and the total native population of the Colony reduced by the average number of persons serving in the military at any one time. The total number of patients under

consideration in Part 3, Sections a, b, and d, is therefore still further reduced to 558.

During the same period, 165 European and Asian patients were admitted, but these will not be further discussed except on a few occasions for comparative purposes.

Arabs have not been counted in either of these categories. As Seligman says, "In Africa the term Arab may be applied to any people professing Islam, however much negro or other foreign blood may run in their veins, so that while the term has a cultural value it is of little ethnic significance and often is frankly misleading." Persons calling themselves Arabs have therefore been entirely ignored for the sake of simplicity.

The article falls into eight parts: first, a short summary of the historical background; second, a short summary of the racial and anthropological background; third, a short summary of the public health background; fourth, a description of the facts in regard to mental derangement occurring in Kenya Africans; fifth, a tabulation of the more striking peculiarities of mental derangement as compared with such derangement in Europeans and in American negroes; sixth, a description of native culture, thinking and attitude to life; seventh, an attempt to explain the peculiarities of mental derangement listed in Part 5; and eighth, a short general conclusion followed by a summary.

1. The Historical Background.

A few words are required on the history of Kenya, mainly to demonstrate the duration of influence of alien cultures on its inhabitants. The word "Kenya" is used throughout for the sake of brevity, though in fact this has only become the name of this part of Africa since 1920.

There must be few parts of the world, or of Africa, with a shorter certain history than Kenya. No written records have been kept by Africans themselves, and such early history as relates to the interior is purely a matter of myths and stories handed down within each tribe, and only reliable for a few generations back. In the words of Professor Coupland, referring to the interior of East Africa prior to 1856,—"a curtain falls, shrouding the vast interior of the continent in impenetrable darkness."

These remarks are not true of the coast however, which does have an ancient history. In brief, from prehistoric times until about 700 A.D. Arabs, mainly from Oman and the Hadramaut, traded all along this coast and from that date onwards established settlements at all its anchorages. Their sole object was trade, the main items of export were slaves and ivory, and their only effect on the interior was to encourage inter-tribal feuds (for the capture of slaves), and thus depopulate the country and indirectly but very effectively maintain its backwardness. For a period from 1502 to 1698 the Portuguese obtained control of the Arab ports, but in effect they merely replaced the Arabs as middlemen in the commerce of the coast and, when ousted in the latter year by the Arabs, had left practically no mark on the life of the country. In 1698 the Arabs regained control of the coast north of Cape Delgado and re-established their ancient commerce. In 1840 Seyyid Said, sultan of Oman, transferred his court from Muscat to Zanzibar and, from that date until its

final suppression in 1876, the slave trade from the coast rapidly increased, and the field of Arab exploitation was extended throughout Tanganyika to the great lakes and beyond. Further north however, the hinterland, except for a few miles round Mombasa, remained almost unknown, and the export of slaves and ivory little greater than before. By the time of the partition of East Africa between England and Germany in 1886, the sole effects in Kenya of Arab settlement had been the hybridization of a narrow belt of people along the coast and their introduction to Islam and to a certain stilted type of oriental courtesy, and on the interior a vague fear and respect for light-skinned strangers with guns.

European exploration and influence began with the establishment of a C.M.S. mission by Krapf at Rabai, near Mombasa, in 1844. The outstanding events of the next 44 years were shortly as follows: In 1851 Krapf explored the Kamba country as far as the border of Kikuyu-land; in 1862 the Methodists established a mission at Ribe, near Rabai; in 1878 the Denhardt brothers explored part of the Tana river; in 1883 Fischer travelled from Pangani to Lake Naivasha via Arusha, Thomson travelled from Mombasa to Lake Victoria via the Kenya highlands, and the C.M.S. established a mission at Teita; in 1884 the Methodists established a mission on the lower Tana river; in 1886 partition of East Africa was effected between England and Germany, the former taking the country now known as Kenya Colony; in 1888 a charter was granted to the Imperial British East Africa Company, who established their headquarters at Mombasa and made treaties with the Nyika, Teita and Kamba tribes, and in the same year Count Teleki discovered Lakes Rudolf and Stefanie. By 1888 therefore the main geographical features of Kenya had been discovered, but missionary and other European influences were still limited to the coastal belt, and very locally at that.

The opening up of the interior began with the establishment by the Imperial British East Africa Company of a trading station at Machakos in Kamba country in 1892. From this date onwards the Company developed trading posts here and there in Kenya, and various mission stations were established in Kamba country. In 1895 Indian traders were invited to Machakos, where they opened shops and introduced the rupee to the interior of Kenya—all previous trade having been by barter. In this year also a protectorate was declared over British East Africa and the Company relinquished its charter. Between 1895 and 1902 the Kenya and Uganda railway was built. Between 1900 and 1920 most of the existing mission stations were established, Europeans bought farms throughout the "settled areas," Indians opened shops throughout the Colony, and Kenya acquired substantially its present character.

Until about 1890 therefore the peoples of the interior were almost completely untouched by any alien influence, and were living presumably as their forefathers had lived for countless generations. There is not even any record in Kenya of the development of native kingdoms such as occurred in West Africa, Uganda and Tanganyika, and this in turn may be related to the minor part played by the slave trade in this country, as it has been suggested that African kingdoms have arisen as a defence in war, especially the slave wars.

Finally, European influence only began to be important about 1900 and,

though it developed rapidly from that time onwards, its development has been very uneven. So that at the present time certain tribes (such as the Kikuyu, Nandi, Bantu Kavirondo and Jaluo) have experienced a relatively long and close contact with this alien culture, whereas others (such as the Turkana and Masai) remain almost untouched.

2. The Racial and Anthropological Background.

The part of Africa now called Kenya Colony stands on what has been for hundreds and probably thousands of years the main highway of Hamitic infiltration into negro Africa on its eastern side. This country has therefore for long been one of the chief racial melting-pots in Africa, and every type from pure Negro to pure Hamite can to-day be seen.

The true Negro, according to Haddon, has a black skin, woolly hair, a flat broad nose, thick, often everted lips, often considerable prognathism, a tall stature averaging 68 inches, and moderate dolichocephaly with an average cephalic index of 74 to 75. The true Hamite on the other hand has a light skin, wavy hair, a projecting narrow nose, lips often thick but never everted and no prognathism ; the height and head shape vary considerably in different tribes, though the Somalis (the chief Hamites in Kenya) show an average height of 68 inches and a cephalic index of 75.

These pure types are in fact comparatively rare in Kenya, are only seen in scattered individuals, and no tribe within the Colony could be described as either true Negro or true Hamite. The great bulk of the native population falls somewhere between these two extremes, and though there are at least 60 different tribes, the Kenya African can be broadly classified into five large groups.

These groups are shortly described below but, as none of them has been comprehensively studied on anthropological lines, the descriptions make no claim to scientific exactitude. Nevertheless the differences are real enough to the experienced observer, and no one who has lived long in Kenya would be likely, for example, to mistake a Jaluo for a Somali.

(a) *Bantu Negro.*—The separation of this group from the others was based primarily on linguistic considerations, as all Africans living south of the well-known Bantu line, which runs in an irregular manner from the mouth of the Rio del Rey in West Africa to the mouth of the Juba River in East Africa, speak closely related " Bantu " languages.

But although the Bantu were primarily delimited on linguistic criteria, it has been found that the title implies much more than a common language and that, at least as far as Kenya is concerned, their physique and culture are also closely related.

The Bantu peoples of Kenya are slightly Hamiticized Negroes and their physical characters are mainly negroid (as above described), but with a variable though usually slight admixture of Hamitic characters. Thus, though the hair is almost invariably woolly and the lips thick and everted, the nose is often quite narrow.

They are mainly agricultural, peace-loving, attached to home, and by

religion pagan, though an ever-increasing number of the younger generation are becoming Christianized.

They number about 2,225,000 persons, and the largest tribes are the Kikuyu (634,000), the Kamba (453,000), and the Meru (205,000).

(b) *Nilotic Negro.*—The Nilotes speak a Sudanic language, quite distinct from the Bantu languages, their centre (according to Seligman) being "the Anglo-Egyptian Sudan, where they constitute by far the strongest of the ethnic units into which the blacks of the Nile Valley can be divided."

The most typical representatives of the Nilotes—the Shilluk and Dinka of the Sudan—converge more closely than the Bantu to the hamitic type, but the Jaluo (the sole nilotic tribe in Kenya) are hardly separable on other than linguistic grounds from the Bantu.

Physically, they are slightly Hamiticized Negroes, and if anything more negroid than the Bantu peoples of Kenya, with darker skins, thicker lips, more prognathism and heavier build.

They live by agriculture and fishing, are pagan, and like the Bantu, their young people have a great admiration for European institutions, and are attending school and becoming Christianized in ever-increasing numbers.

They number about 577,000 persons, and are confined to the country round Lake Victoria.

(c) *Half-Hamites.*—Again quoting Seligman, the Half-Hamites as their name implies "carry a considerable amount of Hamitic blood, i.e. definitely more than almost all the Bantu and Nilotes. This relative preponderance of the hamitic side of their ancestry is reflected alike in speech, appearance and culture. They all speak languages of Hamitic type, and although their skins are dark, their faces are generally negroid rather than negro, the difference being especially obvious in the nose. Culturally they are predominantly pastoralists—indeed many of their tribes depend entirely on their herds, leading the semi-nomadic life that this entails."

In fact Seligman hardly does justice to the good looks of Half-Hamites, in whom light skins are sometimes seen, prognathism is rare, and of whom some are by European standards extraordinarily handsome.

They are aggressive, racially proud, and at least in certain tribes profoundly indifferent to European institutions. Neither European scholarship nor Christianity has much appeal for the Half-Hamites, who are almost entirely pagan.

They number about 375,000 persons, the largest tribes being the Kipsigis (92,000), the Turkana (62,000), the Masai (50,000) and the Nandi (50,000), and they extend in a belt down the central highlands of Kenya from Lake Rudolf in the North to Tanganyika in the South.

(d) *Hamites.*—The Hamites are of Caucasian stock, and in characteristic tribes, such as the Ababda of the eastern desert of Egypt, conform to the Hamitic type as above described.

The Hamites of Kenya however show a slight admixture of Negro elements, so that although their features are fine, their skin is often black and their hair woolly.

They speak a Hamitic language, are predominantly pastoral and nomadic,

are proud, independent and rather vindictive, and by religion are mainly Mohammedan—often fanatically so.

They number about 70,000 persons, the largest tribes being the Somali (40,000) and the Borana (26,000), and they inhabit the Northern Frontier District of Kenya. Somali cattle-men trek vast distances to sell their cattle, and often settle as traders in other parts of the Colony.

(e) *Immigrants.*—This is not a natural group, but is a heterogeneous assortment of Africans who have immigrated into Kenya in recent years from other parts of the continent. They live mainly in the towns, are detribalized, and number about 33,000 persons.

3. The Public Health Background.

Psychiatry cannot of course be entirely isolated from general medicine, so we have inserted a brief summary of the main public health problems in Kenya in so far as they differ from those found in Great Britain.

Far from being the healthy savage living in an earthly paradise envisaged by early writers, the African living in his reserve is seldom quite fit or free from parasites, and the infant mortality, though unknown, is certainly very high. In areas untouched by our civilization latrines are unknown, flies abound, drinking water is unclean, food is inadequately cooked, and great epidemics of enteric and dysentery are only averted by the scattered nature of the population. The huts, which are overcrowded, have a fire but no chimney, and the atmosphere is such that a European feels faint and sick after a few minutes. The diet is usually ill-balanced, and apt to be lacking in various essential items.

The main public health problems can be described under two heads—(*a*) Food Deficiency and (*b*) Infectious Disease.

(a) *Food deficiency.*—The items that are apt to be deficient in the diet, especially among the agricultural tribes, who form the great bulk of the population, are protein of good quality, calcium, and sometimes iron, vitamin A, P.P. factor and vitamin C. Vitamins B_1 and D are rarely deficient.

C. R. Philip in a recent survey of 2,182 school children drawn from various tribes found general undernourishment (as assessed by weight and height measurements) in about 84 per cent., signs of vitamin A deficiency in the "great majority," signs believed to be due to some deficiency in P.P. factor in practically all growing children, bleeding gums which might be attributed to some deficiency of vitamin C in 26 per cent.; an insufficient calcium intake was common if not the rule, and a deficiency of iron, as evidenced by a haemoglobin index under 80 per cent., occurred in 90 per cent.

Pyorrhoea, which is almost universal in adult natives, and ulcers of the leg, of which over 50,000 were treated in Kenya in 1943, are also probably related to food deficiency.

(b) *Infectious disease.*—The following are the chief infectious diseases. The figures are taken from the Annual Disease Returns of the Medical Department.

Malaria is endemic in most areas below about 6,000 feet. In these areas the children that survive infancy acquire a limited immunity. In areas above this level severe and fatal epidemics are apt to occur in wet years. This

infection is accountable for much recurrent ill-health and many cases of anaemia. 55,231 cases were treated in Kenya in 1943, and 293 deaths were recorded.

Dysentery of various types is as common as might be expected in view of the unhygienic habits of the people as described above. 7,493 cases were treated in 1943, and 170 deaths were recorded.

Conjunctivitis, of which 20,717 cases were treated in 1943, is probably related to the prevalence of flies, which often swarm unchecked around the eyes of native children.

Schistosomiasis, a potent cause of anaemia, is especially common in the coastal belt. 1,613 cases were treated in 1943, but this is no measure of its frequency, as the passing of blood-stained urine is hardly regarded as abnormal by natives at the coast.

Ankylostomiasis again is especially common at the coast, and is the cause of most of the severer anaemias seen. 2,596 cases were treated in 1943, but this figure again is no measure of its frequency. It is no uncommon experience at the coast to meet natives with a haemoglobin rate of 40 per cent. or less caused by hookworms, in the course of a routine survey of the population, who are not complaining of ill health.

Taenia and Ascaris are almost universal, but cause surprisingly little obvious ill-health. Of the former 27,072 cases and of the latter 15,023 cases were treated in 1943. The sole species of taenia seen is *T. saginata*, as pigs are quite a recent introduction to Kenya.

Yaws, of which 9,707 cases were treated in 1943, used to be endemic throughout the colony, but is probably being slowly stamped out, and it is becoming increasingly difficult to find examples of the more florid (and infectious) manifestations of this disease. In 1933 the equivalent figure was 14,595.

Syphilis, of which 13,515 cases were treated in 1943, is on the other hand becoming increasingly common. It is probable that this disease was almost unknown in the interior of Kenya before the beginning of the century, and was only introduced in earnest during the last war. Even to-day it is hardly known among certain tribes. In 1933 only 6,205 cases were treated, and the difference between the figures for 1933 and 1943 would be still more dramatic if cases treated at military hospitals (in 1943) could have been included. The subject of the introduction of syphilis to Kenya will be further discussed in Part 7.

4. The Facts in Regard to Mental Derangement.

This part is divided into five sections dealing with (a) Total incidence, (b) Sex incidence, (c) Racial incidence, (d) Incidence in relation to detribalization, and (e) The various types of mental derangement.

Age cannot be scientifically discussed as ages are rarely exactly known. They have however been estimated in all cases and are referred to under the various types of derangement, but can only be taken as approximate.

(a) *Total incidence.*—For the purposes of this section all military admissions have been eliminated, and the total population of the Colony reduced by the average number serving in the military at any one time.

558 mentally deranged Kenya Africans were admitted to Mathari for the

first time during the 5-year period. All Africans certified as insane in Kenya come to Mathari so that, with the exceptions referred to in the introduction, this figure of 558 represents the total number of Africans certified as insane throughout the Colony. So 111·6 new cases of insanity are known to have occurred per annum—a rate of 3·4 per 100,000 of the population per annum.

In 1938 in England and Wales 23,153 patients were admitted to mental hospitals for the first time—a rate of roughly 57 per 100,000 per annum. In the years 1917 to 1933 the rates for first admissions for mental disorders to mental hospitals in the State of Massachusetts varied between 72 and 86 per 100,000. This figure includes persons of all races, that for negroes alone being about 161 per 100,000.

The discrepancy between our rate of 3·4 and these British and American rates of 57 to 161 is so vast that we must now consider the possible fallacies in our figure, and the possibility that other cases occur which are never seen at Mathari.

The only possibilities that occur to one can be listed as follows: (i) Are the insane deliberately killed? (ii) Are they housed in other institutions? (iii) Do they simply pass unnoticed? (iv) Are they deliberately thrown out of their homes, or allowed to wander away and die? (v) Are they looked after at home? We will attempt to answer these questions in turn.

(i) It is not impossible that a certain number of congenital idiots may be put away at or shortly after birth, but with the question of mental defect we are not at present concerned. In regard to mental derangement, which hardly occurs before puberty, the answer to our first question is a clear negative. As Medical Officer in charge of H.M. Prison, Nairobi, one examines the evidence in all cases of murder that come to trial throughout the Colony and interviews the prisoners themselves. Among all the cases so seen (about 200) in the 5-year period, no case of murder of a mentally deranged person on account of his being so deranged has occurred. If such a practice existed some cases would surely have come to trial.

(ii) The only other possible institutions are the prisons and general hospitals scattered throughout the Colony. If a person's sanity is in doubt he is taken before a magistrate, who orders his detention in the nearest prison for a period not exceeding 14 days, so that the local Medical Officer may have an opportunity to observe the patient. At the end of this period the Medical Officer either certifies the patient as insane (in which case he is sent to Mathari and included in our figures), or finds him not insane (in which case he is discharged). In fact many (if not most) of the persons discharged *were* temporarily insane, but recovered within the 14-day period. They thus fall into the class of case classified by Neil Dayton in *New Facts on Mental Disorders* as being "admissions without mental disorders," and defined as "persons who exhibited mental symptoms in the community but the attack was of such short duration that, after observation in a hospital, the staff diagnosed them as non-psychotic." As we are only concerned in this article with persons "with mental disorder," and as our comparisons are made throughout with the figures of American Negroes "with mental disorder," these observation cases can therefore be ignored.

Two other types of case that occur in prisons and hospitals remain to be mentioned, namely criminal lunatics, and patients in hospitals suffering from deliria associated with their physical illness. But the former are sent to Mathari anyway (as there is no criminal lunatic asylum), and the latter are no more likely to be detained in the general hospitals than is the case in other parts of the world.

(iii) There is no reason to believe that mentally deranged persons are more likely to pass unnoticed in Kenya than elsewhere. If we were discussing the incidence of mental deficiency the story would be quite different, as the level of intelligence required to pass muster in primitive communities such as those in Kenya is definitely lower than Europe and America, but apart from a few mild dementias and paranoias this can hardly apply to insanity. This question will be referred to again however under the fifth heading of this section.

(iv) This question falls into two parts which are not clearly separable, and the whole question is more difficult to answer and can only be approached in indirect ways.

In regard to the question as to whether insane persons are deliberately thrown out of their homes the following comments should be made: Every individual in an African community plays an important part in that community, has ceremonial and other duties to perform, and is regarded as a valuable asset by his clan. This subject is dealt with in detail in Part 6, and is only mentioned at this stage to make it clear that, unlike in civilized communities, the unwanted individual hardly occurs, and the death of anyone past childhood is the occasion of an orgy of emotional display by all the relations to a far remove.

It is therefore probably rare for anyone to be deliberately thrown out of his home, and no case of its having occurred has come to my knowledge.

In regard to the question whether insane persons are allowed to wander away, it should be said that any sick person becomes the responsibility of his family, and if his sickness takes a mental form and he tends to wander away, his relations would be promptly informed, as everyone in a native reserve is well known to everyone else for miles around. Only if he wandered into a township, or a European settled area, or the country of another tribe would his identity be likely to be lost, and in the former two cases at least he would certainly be apprehended and not allowed to die.

Hence, although it is probably not very uncommon for insane persons to wander away from home and get lost, it is probably rare for such persons to die and thus fail to appear in our records. (In fact, among 100 recent consecutive non-criminal and non-military admissions to Mathari, 12 cases were admitted on account of being found wandering and homeless—6 in an adjacent township or estate, 2 in a train or bus, 1 in an adjacent tribal reserve, and 3 in their own tribal reserve.)

(v) The question whether considerable numbers of insane are looked after at home now arises. It cannot be answered directly, as no comprehensive surveys of the population as a whole have ever been undertaken in regard to this point.

In general it can be said that in *all* cases of unaccountable illness, physical

or mental, it is customary for the African to assume that the patient has been bewitched, the medicine-man is consulted, and by various charms and devices he attempts to remove the bewitchment. As a rule it is only after he has failed that the assistance of alien medicine is invoked, so that one would expect to find that the insane are looked after for a short time at least at home.

A more definite answer can, however, be obtained by a consideration of the circumstances and history of those cases that *are* certified, and accordingly arrive at the mental hospital.

Of our 558 admissions, only 292 certainly (and another 41 probably) came straight from their homes in the reserves. The remainder were certified away from home in circumstances that will be more fully described in Section (d). Accordingly, although about nine-tenths of the population live at home in the reserves, only a little more than half of our admissions come from these reserves.

It is of course possible that the African living at home is much less likely to become insane than if he leaves his home and the protection of his tribal institutions (and this, as is shown later, appears to be true), but the *figures* suggest that a large number of insane are looked after at home.

Of 50 consecutive recent cases that came straight from their homes, 32 were described as exhibiting aggressive and violent or destructive behaviour, 2 abusive or threatening behaviour, and only 16 were merely restless, noisy or unmanageable. In 27 of these cases the period of time for which they were looked after at home before certification was specifically stated. It varied between 1 day and 2 years, and showed an average of 6½ months.

We deduce therefore that it is probably the rule for Africans to attempt to look after their insane relations, that they are only brought in from the reserves if they become unmanageable, and that a considerable number of the more amenable insane are looked after at home.

* * *

This deduction having been made, a more direct approach to the problem was attempted by enlisting the help of the District Commissioners of the native reserves of Embu, North Kavirondo, and Elgeyo.

These reserves contain a total population of 616,000 persons. All the local chiefs were required to make a census of the insane and mentally deficient persons in their respective locations, and there is no reason to doubt that all the persons known to be insane and mentally deficient in these reserves at the time of the census were counted.

The figure for the insane was 205. If we add to this the number of insane in Mathari at the time and admitted from these reserves the total becomes 228, or about 0·37 per thousand of the population. There might also be a few military insane from these reserves. The equivalent English figure (of patients notified as under care in the mental hospitals of England and Wales in 1938) is 3·9 per thousand. If the same proportion occurred here as in England and Wales there would be over 2,400 insane from these reserves.

Now the figure as produced by the Chiefs is open to the obvious objection that it is based on the non-medical diagnosis of a medical condition. In the

case of insanity, however, with its repercussions on society, this objection is less valid than in the case of most physical diseases, and we have found in practice that the native estimate of a patient's mental condition is seldom entirely false. Nevertheless it is likely that a certain number of simple types of schizophrenia and mild paranoias and dementias have been missed.

The expectation of life of the African, moreover, is likely to be lower than that of the European in view of the high incidence of infectious diseases described in Part 3, so that some of the cases seen in Europeans in later life should be subtracted from the figure of 2,400.

Furthermore, the expectation of life of the insane living in an African reserve is doubtless lower than that of European insane housed in mental hospitals—a consideration that would still further reduce our figure of 2,400. It is within our knowledge, however, that the mentally abnormal are often very well looked after at home ; one idiot for instance who could neither sit up, crawl, speak nor feed himself was looked after at home by the Masai, a very primitive and savage tribe, for 17 years before admission !

In spite, however, of these various qualifications, it would appear that the enormous gulf between our figure of 228 and the figure of 2,400 (as estimated from British incidence) remains substantially unbridged ; and it is finally deduced that, although no precise figure can be calculated, the incidence of insanity in Kenya Africans (at least in those living at home in their reserves) is probably very much lower than that in Europe or America.

(b) *Sex incidence.*—Of the 558 persons admitted, 367 were men and 191 were women, a ratio of nearly 2 men to 1 woman. If military insane were included the disproportion would be still greater. In the State of Massachusetts, " on the whole six psychotic males are admitted to mental hospitals for every five females." Henderson and Gillespie, presumably referring to figures in England and Wales, say, " The total incidence of mental disorder differs but slightly in the two sexes."

There is thus in Kenya a relatively very large excess of males, and at first sight it might appear that this represented the true relative incidence of insanity in the two sexes. But let us study our material more closely.

Of the 367 men, only 168 were admitted from their homes in the reserves ; whereas of the 191 women, 124 came from their homes. Hence a large proportion of the excess of men were living away from home at the time of their certification, and the ratio of men to women coming from home was approximately 4 to 3.

Men on the whole also are less likely to be manageable at home and more apt to be certified. Of the 50 consecutive admissions described in Section (a) 28 were men and 22 were women, but of the former only 6 were not specifically described as violent, destructive or threatening, whereas of the latter 10 were not so described.

For what it is worth, moreover, in the 26 cases in which the period of time looked after at home was stated, the average period for men was 6 months, and for women was 7 months, but the number concerned is too small to be of much significance.

Finally, of the 45 insane persons being looked after at home in the Embu

and Elgeyo reserves, 26 were men and 19 were women. (Sex figures were not shown in the North Kavirondo census.)

It seems most likely, therefore, that the sex incidence of insanity in the reserves is not markedly different from that obtaining in other parts of the world, and that the large excess of male admissions to the mental hospital is directly related to a high certification rate among detribalized Africans.

The sex ratios are described under each of the various types of mental derangement, but will only be commented upon if, after dividing the male admissions by 2, there is still a significant difference between our sex ratio and the American sex ratio for all races—American Negro figures for sex not being available to me.

(c) *Racial incidence.*—The total number of admissions during the 5-year period was 609. Of these, 444 were Bantu Negro—a rate of 4·0 per 100,000 per annum, 67 were Nilotic Negro—a rate of 2·3, 46 were Half-Hamites—a rate of 2·5, 22 were Hamites—a rate of 6·3, and 30 were immigrants—a rate of 18·2.

At first sight it might appear that these figures represented the relative degrees of liability to insanity of the various races concerned. But when one examines the incidence in greater detail—by tribes instead of races—one finds that it varies markedly in different tribes within the major races. For instance, the Kikuyu (a Bantu Negro tribe numbering 634,000) showed a rate of 9·3 per 100,000, whereas the Kamba (another Bantu Negro tribe numbering 453,000) showed a rate of 2·1; the Nandi (a Half-Hamite tribe numbering 50,000) showed a rate of 5·2, whereas the Turkana (a Half-Hamite tribe numbering 62,000) showed a rate of *nil*; the Somali (a Hamite tribe numbering 40,000) showed a rate of 9·0, while the Borana (a Hamite tribe numbering 26,000) showed a rate of 1·5. (The Nilotic Negro race contains only one tribe in Kenya —the Jaluo; and the immigrant people have now largely lost their tribal titles.)

Clearly, therefore, the different rates observed in the indigenous races have no meaning as an index of liability to insanity in these races. There is indeed no evidence of varying liability in these races, and the varying tribal incidence can be better explained in other ways, a matter that will be discussed in Section (d) of this part.

Equally clearly, however, the rate among immigrants is very high—much higher than in any Kenya tribe. Even if the excessive admissions are largely accounted for by the fact that these people live mostly in the larger townships (and so have to be certified if insane), yet it remains likely that the incidence of insanity is relatively high among these people.

This is in agreement with the admission rates of mental patients in the State of Massachusetts, where foreign-born persons show the highest rate, native-born of foreign or mixed parentage a lower rate, and native-born of native parentage the lowest rate.

The racial figures are mentioned under each type of mental derangement, but will only be commented upon when they differ significantly from the total racial proportions.

(d) *Incidence in relation to detribalization.*—From the foregoing it has now emerged that the total incidence of insanity is probably very low, that a dispro-

portionately large number of our admissions were certified away from home, that the large excess of males is directly related to a high certification rate among persons that have left their reserves, and that the certification rate among immigrants is relatively high. All these facts point in the same direction, namely that so long as an African remains at home he is very unlikely to be certified insane, but as soon as he leaves his home his chances of being so certified are much increased.

Now the primitive African has a very definite culture and attitude to life, as will be seen in Part 6—the old idea of the happy-go-lucky uncultured savage has been recognized as false long since. Unlike the Bushman and certain other primitive races, the East African native has however an immense admiration for European institutions and manner of life, so that contact with this alien culture is rapidly destroying his own. The conflicts and difficulties engendered by this tendency might well be expected to be a potent source of mental breakdown, and it is with this aspect of the problem that this section of our article is concerned.

The question of detribalization is, however, a complicated one and might be studied from several angles, i.e. Christianization, secular education, working relationships with non-African employers, relationships with Government officials and with shop-keepers (the latter mostly Indian), life in townships, and the introduction of syphilis and alcoholic spirits and other drugs.

The part played by syphilis, spirits and drugs is discussed under the different types of insanity and, as will be seen, this part is so far small and relatively unimportant, though it is unlikely to remain so for long.

The parts played by Christianity and education are inextricably mingled, and impossible to assess in a scientific manner. The great bulk of the schools of this Colony are Mission schools, where religious teaching plays a large part —indeed if one asks a native whether he is a Christian he will probably reply, "Oh yes, I have been to school." A great number of the rising generation of Kenya Africans have been to school at some time, but mostly only for a year or so, and though they may describe themselves as Christian and educated, they remain in fact essentially unaffected by these influences; a few are highly educated, and by European standards good Christians; and between these extremes are a large number of persons in whom it is impossible to assess the influence of these factors on statistical lines. The problem is still further complicated by the multiplicity of religious denominations, and it is unlikely for instance that the parts played by Roman Catholicism and Seventh Day Adventism would be very similar. It is therefore proposed to ignore the influence of religion and education in this thesis, and in this we are further justified by the fact that the African (like the European child) has a good intuitive perception of the springs of action of other people and is much more likely to be influenced by example than by precept.

There thus remain the factors of working and business relationships with non-Africans—factors which usually involve separation from home and often living in townships, and factors which can be very roughly assessed on the basis of our figures.

Of our 558 admissions, 292 came straight from their homes in the reserves;

173 were working away from home on estates, in townships, or in prison, or were living in a township at the time of certification ; 18 were living as squatters on estates ; and in 75 cases it was not clear where the patients came from at all. As the last 75 cases must fall into the other 3 groups and cannot be ignored, we can only proceed to allot them to the other groups proportionately to the size of the latter. We thus arrive at an approximate figure of 337 admitted from their homes, 200 certified while at work away from their homes or living in townships, and 21 living as squatters.

From a study of the Special Labour Census, 1943, of other Census figures, and of the Annual Report of the Prison Department, and after subtracting the average number employed in the Army, it appears that approximately 300,000 Africans are employed away from home or are living in townships at any one time, approximately 165,000 live as squatters, and approximately 2,940,000 live at home in the reserves.

So that among Africans living at home the certification rate is about *2·3* per 100,000.

Let us next deal with the squatters. These are labourers resident with their families on European estates in their own huts and usually possessed of cattle and goats, who, in return for the right of residence and a monthly wage rather lower than the normal, work for the estate owners for about six months in the year. They usually carry with them the habits and outlook of the tribal area from which they came, family life is not disrupted, the traditional manner of living is not seriously interfered with, and in general the influence of the alien culture on these people is minimal. In regard to the certification rate among squatters we find a figure of *2·5* per 100,000. This figure is of considerable interest. If a squatter becomes insane he is more likely to be certified insane than a native living in the reserve, as he is not likely to be tolerated for long by the European residents on the estate. In other words we have here a section of the population living under fairly primitive conditions, but subject to a degree of contact with Europeans that would be likely to ensure certification if insane. Yet the figure is hardly greater than that for the native reserves. This affords strong corroboration of our previous deduction that the incidence of insanity among Africans in their primitive state is exceedingly low. It even suggests that the incidence is not out of all proportion to the certification rate as described above.

In regard to Africans employed or living away from home, the certification rate is now seen to be *13·3* per 100,000. It is thus considerably higher than that of those living at home. But the yet more striking fact is that the figure still remains quite small compared to British and American figures and, as it is unlikely that employed natives would not be certified if insane, this figure is probably a fairly true measure of the incidence of insanity in these people.

Furthermore, these 300,000 persons living away from home are not a representative cross-section of the population as a whole. They are mostly men, and the great majority lie within the age-group of 15 to 45 years. The rate for this group in America is approximately 95 per 100,000, as opposed to approximately 80 per 100,000 for the population as a whole. So the discrepancy is seen to be even greater.

It was previously demonstrated in Section (c) of this part that there is a marked tribal variability that rides roughshod over the racial incidence, and we are now in a position to explain this phenomenon. The tribes, irrespective of race, that are most detribalized are those with the highest certification rate. Detribalization is difficult of assessment, and other factors besides employment away from home enter into it, but as we are confining our approach to that angle, let us see if the Special Labour Census of 1943 can help us any further. It is there recorded that of the Bantu Kavirondo, Jaluo, Kipsigis, Nandi, Kikuyu, Embu and Meru tribes, about 183,000 were employed in 1943. The total population of these peoples is about 2,165,000, so that approximately 1 in 12 of the population were employed. Of all the other Kenya tribes, about 58,000 persons were employed in that year out of a total population of about 1,082,000, so that about 1 in 19 of these peoples were employed. Of non-Kenya natives, nearly 9,000 were employed out of a total population of about 33,000, or about 1 in 4 of the population. The rate of certification among these three groups was 4·0, 1·7, and 16·2 per 100,000 respectively, and it can thus be seen that the question of tribal incidence is closely bound up with the amount of employment, and can be more simply explained in this way than by invoking hereditary and constitutional factors.

The figures of persons living at home and away from home at the time of their certification are shown under each type of insanity (the figures for squatters being included in those for persons living at home as they are now seen to fall for our purposes into that group), but will only be commented upon when they differ significantly from the total ratio.

(e) *The types of mental derangement.*—The admissions have been classified into ten main groups, namely (i) organic psychoses, (ii) epilepsy, (iii) mental defect, (iv) psychopathy, (v) schizophrenia, (vi) paranoia, (vii) manic depressive, (viii) involutional melancholia, (ix) psychoneuroses, and (x) unclassified psychoses.

This classification permits of comparisons, which are made throughout, with the figures for American Negroes in the State of Massachusetts, and comments are made on the lines laid down in the earlier sections of this part.

Finally, figures of those doing work that could, by European standards, be described as highly responsible are shown separately for reasons that will appear later.

(i) *Organic Psychoses.*

There were 191 cases, or 31·4 per cent. of the total admissions, corresponding to an American Negro figure of 47·0 per cent. 101 were males and 90 were females. The racial figures were Bantus 144, Nilotes 12, Half-Hamites 15, Hamites 5, and Immigrants 15. 95 were known to be living at home at the time, and 65 away from home. Only 3 were known to be doing work that could be described as highly responsible.

The causes were infective-exhaustive (80), senility (45), syphilis (28), encephalitis (10), drugs (7), pellagra (4), brain trauma (3), and unclassified organic (14). They are described in turn, and thereafter organic types that have not been seen are referred to.

(1) *Infective-exhaustive psychoses.*—There were 80 cases, or 13·1 per cent. of the total admissions. The equivalent figure for American Negroes is 4·5 per cent. There were 30 men and 50 women, and their ages varied from 10 to 50 years, with an average of 27 years.

The causes were puerperal (22), malaria (21), acute pulmonary infections (15), phthisis (6), bacillary dysentery (1), typhoid (1), uraemia (1), profound anaemia, probably malarial (3), and various septic conditions (10).

Seventy-three of the cases showed a typically organic type of mental reaction with clouded consciousness, disorientation, inattention, distractibility, incoherence, and sometimes hallucinations; the majority of these were wildly excited and often violent at first, a minority were vague, dazed and muttering. In 7 cases schizophrenic or manic elements were also seen.

Of these cases 10 died, 4 remained at the end of the period, 7 were discharged uncured and 59 recovered—the recovery was usually quite rapid and the average time spent in hospital was 3 months. (This average period refers to the time spent within the 5-year period, so that no account is taken of the time spent in hospital in 1944 by the 4 cases that remained at the end of 1943. This applies to all subsequent average periods mentioned.)

Our high percentage of these psychoses (as compared with American Negroes) is partly due to the high position occupied by malaria as a cause of insanity in Kenya, but appears to be mainly explicable on the following grounds:

In the infective-exhaustive psychoses we see the *one* group of insanities in which (apart from malaria) there is no reason to expect that the incidence should differ very markedly from that obtaining in other parts of the world. So our high proportion is probably due to the relative rarity of various other types of insanity. Indeed if the general incidence of insanity in our Africans is low (as appeared in Section (a) of this part), one could only expect *this* group to show a relatively high incidence.

The large proportion of women is in line with the relative sex incidence for all races in Massachusetts (where the proportion of women is 61 per cent.), and is largely due to the high place occupied by puerperal psychoses.

(2) *Senile psychoses.*—There were 45 cases, or 7·4 per cent. of the total admissions. The equivalent figure for American Negroes is 4·1 per cent. 19 were men and 26 were women, and their ages varied from 55 to 80 years, with an average of 64 years.

Only 7 of these cases were admitted on account of simple senile deterioration, the remaining 38 cases having exhibited delirious episodes in which the predominant symptoms were confusion, restlessness, insomnia, incoherence, irritability, and unconstrained behaviour. They were usually wildly excited, often violent, and persecutory hallucinations and delusions were common.

Of these cases 12 died, 6 remained at the end of the period, and 27 were discharged. Of the 31 non-fatal delirious cases, 15 made an apparently complete and usually rapid recovery, but 16 on recovery revealed a residual dementia. The average period spent in hospital was 6 months.

The delirium was precipitated in at least 20 cases by clear exogenous factors —9 by various real causes of anxiety (fear of bewitchment in 5), 9 by physical illness, and 2 by alcohol.

The large proportion of women is in line with the relative sex incidence for all races in Massachusetts (where the proportion of women is 64 per cent.) and is probably related to a greater longevity in women.

(3) *Syphilitic psychoses.*—The syphilitic psychoses were classifiable into the two categories of cerebral syphilis and general paralysis, and will be described under these headings. The distinction between the conditions was, in this series of cases, a fairly clear one.

(*a*) Cerebral syphilis: There were 11 cases, or 1·8 per cent. of the total admissions; corresponding to an American Negro figure of 2·6 per cent. 8 cases were men and 3 were women, and their ages varied from 19 to 60 years, with an average of 36 years.

These cases showed mental symptoms of organic confusional type in no way different from those described under the infective-exhaustive psychoses. Physical abnormalities included facial and hypoglossal paresis, optic atrophy, tremors of face and hands, dysarthria, dysphagia, convulsions and hemiplegia. The blood Kahn was in all cases positive, and the cerebrospinal fluid in 7 cases examined showed an excess of globulin in 3, an excess of cells in 5, a positive Kahn in 4, and the gold curve was luetic in 4 and paretic in 3.

Of these cases 3 died, 2 remained at the end of the period, and the rest recovered. The average period spent in hospital was 4 months.

(*b*) General paralysis: There were 17 cases, or 2·8 per cent. of the total admissions, corresponding to an American Negro figure of 12·0 per cent. 16 cases were men and 1 was a woman. Their ages varied from 25 to 70 years, with an average of 48 years.

No less than 8 of the 17 cases occurred in immigrant people, in whom it is the commonest type of insanity, forming 27 per cent. of the admissions of these people. So that among admissions of the indigenous population general paralysis only accounts for 1·6 per cent.

These cases were all in an advanced stage of the disease at the time of admission, and were garrulous, inattentive, and usually disorientated in time and place. Their conversation was vague, rambling, often incoherent, and in later stages limited to one word endlessly repeated, or even quite unintelligible. The facial expression was empty and fatuous, and the behaviour apt to be shameless. The mood was euphoric (or even elated) in 13 cases, usually with ridiculously grandiose delusions (e.g. A. M— says he built the whole of Mombasa and owns the whole town; K. K—, on being asked if he has been bewitched says, "He has not, because if any man tried to bewitch him, the man would surely die at once"); anxious, persecuted and somewhat depressed in 3 cases, and apathetic in 1. Constant physical abnormalities were coarse tremors of face, hands and tongue, ataxic gait, slurred and tremulous speech of monotonous tone, and exaggerated tendon reflexes. Argyll Robertson pupils were recorded in 5, but probably occurred in others, as this phenomenon is exceedingly difficult to test in unco-operative African patients with almost black irises. The blood Kahn in all these cases was positive. The cerebrospinal fluid in the cases examined showed an excess of globulin and cells, and a positive Kahn; and the gold curve was paretic in 10 cases and luetic in 2 cases.

Of these cases 15 died, and 2 remained at the end of the period. The

average period spent in hospital, excluding 2 cases that remained for 23 and 58 months respectively, was 4 months.

The very low incidence of general paralysis in the indigenous population is a matter of considerable interest, and will be discussed in Part 7 of this article.

The high proportion showing euphoria and grandiosity is interesting, since in England this "expansive classical form is nowadays rare" according to Curran and Guttmann. Perhaps the most probable explanation is that these "expansive" cases are the most unmanageable, and therefore the most likely to be certified in communities such as ours where many insane are looked after at home.

The relative preponderance of males is noteworthy, but not peculiar to Kenya. In Massachusetts in all races the ratio is 4 men to 1 woman, and Russell Brain (presumably referring to the disease in England) also gives a ratio of 4 to 1.

(4) *Post-encephalitic psychoses.*—There were 10 cases, or 1·6 per cent. of the total admissions. The percentage of admissions of American Negroes for "other brain or nervous diseases," which presumably includes post-encephalitic cases, is 2·2 per cent. There were 9 males and 1 female, whose ages varied from 8 to 40 years, with an average of 25 years.

Physically these cases showed Parkinsonian symptoms with slow, rather rigid movements, mask-like staring expression and monotonous speech; oculogyric crises were observed in 3 cases, slight horizontal nystagmus in 1, and pupillary abnormalities (sluggish and ill-retained reaction to light) in 2, but these reactions are difficult to elicit in unco-operative Africans. Reversed sleep rhythm occurred in 1.

Mentally, the 8 adults were slow, retarded and apathetic, though 2 of these had previously exhibited an acutely excited confusional state; while the 2 children, aged 8 and 13 years respectively, were excessively restless and mischievous.

It is assumed that the cause of these cases was a virus encephalitis, but whether of the lethargica type or some other at present unclassified type is not at all clear. In only two of our series was a clear history of feverish illness at the onset described, and in one other case the syndrome appears to have followed mumps!

Of these cases, 2 died, 2 remained at the end of the period, and 6 were discharged, the average period spent in hospital being 8 months.

(5) *Drug psychoses.*—Two drugs were concerned in the production of insanity in our series of admissions, namely alcohol and Catha.

(I) Alcohol: There were only 4 cases, all men, in whom alcohol had played the sole or preponderant part in the aetiology of the mental derangement. It was thus the cause of only 0·7 per cent. of our admissions, corresponding to an American Negro figure of 10·9 per cent. Their ages ranged from 30 to 60 years, with an average of 36 years.

The cases were all acute confusional reactions from excessive drinking, and all recovered within a few days and were discharged.

It is noteworthy that no cases of delirium tremens were seen in Africans. Among 165 non-African admissions during the 5-year period, 7 cases (or 4·2 per

cent.) were delirium tremens. In fact there is much drinking of native beer with a high alcohol content in the reserves, but the drinking of alcohol in the form of spirits is rare and confined to the townships.

(II) Catha: *Catha edulis*, known in East Africa as miraa, is a shrub the stem of which is chewed and the juice swallowed. The chewing of this shrub in moderate quantities is a common custom among certain tribes, notably Somalis, but as a cause of insanity is not referred to in any of the text-books on psychiatry available to me. Three alkaloids have been isolated, of which one (cathine) is identical with one of the most active constituents of the drug ephedrine. In moderate doses it is harmless enough, and appears to act as a true cortical stimulant like caffeine or amphetamine. Some persons, however, acquire a craving for miraa, chew it to excess and to the exclusion of other food, and become sleepless and temporarily insane.

There were 3 cases, or 0·5 per cent. of the total admissions. It is probable that a few other cases (at present recorded as Unclassified) were missed, as we have only lately become aware of *Catha edulis* as a cause of insanity. The equivalent American Negro figure for "other drugs than alcohol" is 0·4 per cent., though the other drugs do not presumably include *Catha edulis*. All our cases were men, and their ages varied from 20 to 30 years with an average of 24 years.

Physically no abnormalities were observed except some corneal injection, slurring of speech, and a slight inco-ordination of the limbs. Mentally, the picture was like that seen in mania, with the addition of schizophrenic elements.

All these cases recovered within, at most, a few weeks and were discharged, but all returned several times within a short period and in the same state—features which suggested addiction to a drug before the precise cause was discovered.

CASE No. 1018.—An immigrant (Tanganyika) man, aged about 30 years, Mohammedan, able to read and write, and working as a hotel boy in Nairobi.

Between 1943 and 1946 he was admitted to hospital eight times for observation. On each admission he was excited, noisy and over-active, and prattled away in a dramatic, elated, disconnected fashion. He laughed easily and at times his gaiety was infectious, but at other times he was merely silly and giggled in an abstracted manner. Physically his speech was slurred, his eyes injected, and his movements slightly ataxic. Recovery was always rapid and apparently complete, and occurred in periods varying from 2 to 4 weeks. This patient persistently denied the taking of drugs at first, but finally admitted to and gave full details of his addiction.

On the occasion of his last admission to hospital he was detained for 9 months, with a view to seeing if the psychosis might recur in the absence of miraa. After his recovery in the first month or two, however, he remained quite sane and sensible until his discharge, and it seems clear that his recurrent attacks of insanity are always precipitated by miraa.

(6) *Pellagra*.—There were 4 cases, or 0·7 per cent. of the total admissions, corresponding to an American Negro figure of 0·2 per cent. There were 3 men and 1 woman, and their ages varied from 17 to 40 years with an average of 24 years.

Three cases exhibited a confusional reaction type with disorientation, restlessness, inattention and excitement; and one case a schizophrenic reaction type with bizarre gesticulations and grimaces. They all showed the character-

istic sharply defined rash on forearms, legs and back of neck, two had chronic diarrhoea, and two had conjunctival ecchymoses (spontaneous in origin) and suggesting a polyavitaminosis. Improvement was very slow and subject to relapses in the non-fatal cases, but in spite of apparent dementia in the intermediate stages, was surprisingly complete in the end.

Of these cases, 2 died and 2 recovered, the average period spent in hospital being 10 months.

(7) *Traumatic psychoses.*—There were 3 cases, or 0·5 per cent. of the total admissions, corresponding to an American Negro figure of 0·5 per cent. They were all men, and their ages varied from 25 to 35 years, with an average of 28 years.

Two cases exhibited the post-traumatic syndrome with irritability and emotional instability, and one case exhibited transitory " epileptoid " episodes characterized by extreme violence and followed by long periods in which he was apparently perfectly normal except for a complete amnesia in regard to the violent episodes.

All these cases apparently made good recoveries, the average period spent in hospital being 5 months.

(8) *Unclassified organic psychoses.*—There were 14 cases, or 2·3 per cent. of the total admissions. There were 6 men and 8 women, and their ages ranged from 20 to 50 years with an average of 35 years.

These cases were all of the organic confusional type as described under infective-exhaustive psychoses and were probably all infective-exhaustive in origin, but the precise cause remained in doubt.

Of these cases 6 died, 1 was discharged uncured, and the rest recovered, the average period spent in hospital being 2 months.

(9) *Organic psychoses not seen.*—No cases of cerebral arteriosclerosis, cerebral tumour, Huntington's chorea, disseminated sclerosis, pernicious anaemia, tabes or Graves' disease were seen in this series.

The first accounts for 9·2 per cent. of American Negro first admissions suffering from mental disorder, the second for 0·2 per cent. of such admissions, the third for 0·2 per cent., and the other four may or may not be included under the figures for " other brain, nervous or somatic diseases."

To the best of my knowledge no case of disseminated sclerosis or pernicious anaemia has ever been described in a Kenya African, tabes and Huntington's chorea have been described but are exceedingly rare, cerebral tumours are rare though we have seen two cases (both tuberculomas) elsewhere, and Graves' disease is uncommon, though perhaps hardly more so than in Europeans. The questions raised by the absence of these diseases, though of much interest, are, however, rather outside the scope of this thesis. There remains arteriosclerosis, which may show mental factors in its aetiology, and in which there is a dramatic discrepancy between our figure of *nil* and the American Negro figure of 9·2 per cent.

Arteriosclerosis is rare in Kenya Africans. Among 662,846 patients treated throughout the Colony in 1943, only 2 cases were diagnosed as arteriosclerosis. Among 1,000 consecutive post-mortem examinations performed by F. W. Vint on native bodies in Nairobi, no case of generalized arteriosclerosis was described.

Donnison, working in South Kavirondo (Kenya), examined over 15,000 natives and, although searching for cases of cardio-vascular disease, on which subject he was writing a thesis, stated that " on no occasion was a diagnosis of arteriosclerosis made." Yet the incidence of cerebral arteriosclerosis among Negro first admissions with mental disorder in America is 9·2 per cent., and among whites in the same series is 11·5 per cent. The rarity of arteriosclerosis in Kenya Africans will be discussed in Part 7.

The small proportion of organic psychoses as a whole (31·4 per cent.) as compared to the American Negro proportion (47·0 per cent.) is accounted for by the absence of cerebral arteriosclerosis, and the rarity of general paralysis and alcoholic psychoses.

(ii) *Epilepsy.*

There were 21 cases or 3·4 per cent. of the total admissions, corresponding to an American Negro figure of 3·1 per cent. There were 20 men and 1 woman, and their ages varied from 5 to 30 years, with an average of 23 years. The racial figures were Bantus 19, Nilotes 1, and Half-Hamites 1. 17 were known to be living at home and 3 away from home, and none was doing responsible work.

These cases were all " idiopathic " epilepsy, and the diagnosis was only made after excluding other causes of convulsions. Moreover I am informed by F. W. Vint, the Senior Pathologist, that in over 4,000 autopsies he has not seen a case of cerebral cysticercosis, which is not surprising in view of the apparent absence of *Taenia solium.*

Twenty of the patients had typical major epileptic fits varying in number from 1 to 40 a month, and 1 had psychomotor equivalents in which the face was screwed up and the patient ran a short distance with a staggering gait, and was apt to fall over obstacles and hurt himself severely. *Petit mal* was also seen. 15 were admitted on account of excited and violent behaviour, and of these, 9 showed a rapidly increasing dementia, 4 were sullen, resistive, truculent, egotistical and suspicious in the interparoxysmal periods, and 2 were apparently normal between the fits. 5 were admitted on account of extreme dementia, and 1 was congenitally imbecilic. The symptoms and course were in fact quite similar to those seen in other parts of the world.

Of these cases 11 died, 3 remained at the end of the period, and 7 were discharged, the average period spent in hospital being 12 months.

Epilepsy is common among Kenya Africans, and cases are not sent to Mathari unless violent or very demented. This explains the rapid deterioration and high mortality seen in our cases.

The low relative incidence in women is partly accounted for in the same way, and partly in that epilepsy in general appears to be relatively uncommon in Kenya women. Among 120 African epileptics seen throughout the Colony as out-patients in 1943, 98 were men and 22 were women.

(iii) *Mental Defect.*

There were 65 cases, or 10·7 per cent. of the total admissions, corresponding to an American Negro figure of 3·8 per cent. 44 were men and 21 were women,

and their ages varied from 16 to 55 years, with an average of 30 years. The racial figures were Bantus 51, Nilotes 8, Half-Hamites 4, Hamites 1, and immigrants 1. 41 were known to be living at home, and 16 away from home, and none was doing responsible work.

Only feeble-minded persons suffering from other mental disorder are included in our series, for comparative purposes. In fact 34 cases were admitted on account of a super-imposed psychosis (usually schizophrenic but often atypical), and 31 cases on account of episodes of violent and emotionally uncontrolled behaviour quite similar to those seen in the psychopathic class to be described below. Recovery from the mental disorder was usually rapid, but recurrences were the rule in the psychopathic group, and the schizophrenic patients were very apt to relapse if discharged. The distinction between these two groups was often difficult and rather arbitrary. The diagnosis of mental deficiency was made partly on the history, partly on personal impressions and partly on intelligence tests.

Of these cases, 6 died, 28 remained at the end of the period, and 31 were discharged, the average period spent in hospital being 13 months.

The relatively large percentage of mental defectives with mental disorder in Kenya is probably accounted for by the fact that no institution (other than Mathari) exists in Kenya for mental defectives, so it is assumed that a great number of such persons remain at large and are easily precipitated into insanity by the various hazards of life outside an institution.

No deductions in regard to the incidence of mental defect in the general population can be made from our figures, and in any case African figures based on European definitions of mental deficiency would not be strictly comparable with European figures for this condition. An African who for instance " required care, supervision and control for his own protection " in the simple and rather routine life of a native reserve would be a very *low grade* feeble-minded person indeed.

Though rather outside the terms of reference of this thesis it is of interest to record that imbeciles and idiots have been seen, that cases of congenital syphilis with imbecility, microcephaly with characteristic sugar loaf skull, cretinism, and congenital diplegia have been seen, though rarely, but that no cases of mongolism, epiloia or cerebro-macular degeneration have to the best of my knowledge ever been described in a Kenya African.

(iv) *Psychopathic Personality.*

There were 17 cases, or 2·8 per cent. of the total admissions, corresponding to an American Negro figure of 0·9 per cent. 12 were men and 5 were women, and their ages ranged from 16 to 50 years, with an average of 31 years. The racial figures were Bantus 8, Nilotes 2, Half-Hamites 4, Hamites 2, and immigrants 1. Six were known to be living at home and 10 away from home, and 1 was doing responsible work.

Sixteen of these cases fell clearly into the class that has been entitled " predominantly aggressive psychopaths," and exhibited episodes when they were aggressive, truculent, violent, excited, emotional, unmanageable and

often shameless. In the intervening periods they were apparently normal except for their lack of regret and foresight, and a tendency to go for what they wanted at all costs and without regard to consequences. The violent episodes were often precipitated by alcohol, physical illness or some slight environmental frustration, and were usually transitory.

One case, a male, aged 18 years, was a " predominantly inadequate psychopath " who had been arrested for representing himself as a policeman. No very clear reason appeared for his doing so, and his action was probably an attempt to compensate for feelings of inadequacy. He was a happy-go-lucky person and very lacking in foresight, and even indulged in petty theft while in Mathari in circumstances in which he was bound to be discovered.

None of these cases was feeble-minded by intelligence tests and of them all 1 died, 4 remained at the end of the period, and 12 were discharged, the average period spent in hospital being 6 months.

No points of peculiar interest appear to arise in regard to this psychopathic group, and the relatively high percentage of aggressive psychopaths compared to the American figures is presumably due to the fact that in a community such as ours, where many amenable insane are looked after at home, these are just the sort of unmanageable cases that are most likely to be certified.

The large proportion living away from home has no bearing on the aetiology of the condition. It is accounted for by the fact that 7 of the men were certified while serving a prison sentence, and 2 of the women were prostitutes in townships. So that the fact that they were not committed from their homes was a symptom of the condition rather than a cause.

(v) *Schizophrenia.*

There were 174 cases, or 28·6 per cent. of the total admissions, corresponding to an American Negro figure of 27·3 per cent. 129 were men and 45 were women, and their ages ranged from 14 to 50 years with an average of 28 years. The racial figures were Bantus 122, Nilotes 27, Half-Hamites 17, Hamites 5, and immigrants 3. 91 were known to be living at home and 63 away from home, and 8 were doing responsible work.

These patients were mostly classifiable into the four types commonly described, though a few could only be described as mixed types of schizophrenia. The symptoms as seen in the different types were as described below.

(1) *Simple type.*—There were 23 cases, 17 men and 6 women. The chief symptom in these was a marked apathy, with inattention, lack of interest in the environment and self-absorption. They were usually slow, vague, silly, evasive, suspicious and muttering, and sometimes showed evidence of emotional dissociation and apparently causeless giggling or weeping. Their manner was often odd and affected, and slight echolalia was not uncommon. Some cases showed symptoms described under the hebephrenic type, but in a mild form; indeed the distinction between these two types was often rather arbitrary.

Of 17 known cases, 9 (or 53 per cent.) were certified away from home, and 8 at home.

(2) *Hebephrenic type.*—There were 87 cases, 67 men and 20 women. These patients were usually admitted on account of noisy, aggressive, abusive, destructive and violent behaviour. When first seen at hospital they remained in this state, or exhibited bizarre grimaces, attitudes, gesticulations and general behaviour, bizarre thought content (e.g. A. K— was told by God he would see more light if he drank his own urine) and emotional dissociation and uncontrol. They were resistive, inconsequent, nonsensical, shameless and dirty, and often exhibited verbigeration and ill-systematized delusions, usually of a religious and exalted type (e.g. N. C— said that God would burn the District Commissioner's office, and she would command the soldiers by wireless to burn his books), and showed evidence of hallucinations, especially auditory. When the florid symptoms passed there was often some residual mental deterioration. Of 77 known cases, 27 (or 35 per cent.) were certified away from home, and 50 at home.

(3) *Katatonic type.*—There were 32 cases, 21 men and 11 women. These patients showed periods of muteness, apathy, curious statuesque attitudes, catatonia, stereotypy, negativism or sometimes flexibilitas cerea. At other times (often before admission) they were noisy, incoherent, turbulent, dirty, unconstrained, abusive, violent and probably hallucinated. Delusions when observed were usually persecutory (e.g. O. K— made a murderous attack on a complete stranger and said, "You have bewitched my head and made me mad"), but sometimes grandiose (e.g. M. A— believed he had a right to anything he wanted, and threatened to assault a man who would not give up the shoes he was wearing).

Of 30 known cases, 16 (or 53 per cent.) were certified away from home and 14 at home.

(4) *Paranoid type.*—There were 11 cases, 8 men and 3 women. The symptoms on the whole were of the hebephrenic type but with a tendency to chronic grievances and delusions, the delusions being ill-systematized and often bizarre, usually persecutory but sometimes grandiose (e.g. G. K— hears his wife, who is actually 100 miles away, continually abusing him by wireless; M. K— is really a European, and the reason for his black skin is that his European parents lost him as a baby so he was turned into a Jaluo; J. D— had been called to preach to everyone to fight for freedom, and believed that the possession of an Altar Cross which he stole from a Mission Church was necessary for his purpose; M. C— has enormous wealth and is Jesus Christ and awaits his army who are following behind). These patients were apt to be suspicious, irritable, and at times aggressive and quarrelsome (e.g. one patient who believed he was God made a savage attack on another who also said he was God, as there is only one God).

The whole syndrome was intermediate between schizophrenia and paranoia and the average age of these patients was 5 years greater than that of the other 3 types, but it should be mentioned that the title "paraphrenia" has not been used in this article so that some of the cases included in this section might be called paraphrenics by another observer.

Of 9 known cases, 4 (or 44 per cent.) were certified away from home, and 5 at home.

(5) *Mixed types.*—There were 21 cases; 16 men and 5 women. These were all typical schizophrenics, but not definitely classifiable into one of the above types.

* * *

Of all these cases 31 died, 54 remained at the end of the period, 89 were discharged, and of those discharged 59 had apparently made a good recovery or remission. As, however, is the case elsewhere, schizophrenia is *the* chronic form of insanity and the average period spent in hospital was 13 months.

A feeble-minded element was probable in the aetiology of at least 13 cases, and an organic in 10. Most of the others, however, were definitely *not* feeble-minded and some were clever.

In regard to the detribalization figures (i.e. 63 out of 154 cases of known origin, or 41 per cent.), it will be noted that they are almost exactly the same as those for insanity as a whole, which is 42 per cent. But we have drawn attention (in section (a) of this part) to the fact that insane persons are looked after by their relations for an average period of 6½ months, and as schizophrenia is *the* chronic type of insanity, so the figure of schizophrenics admitted from the native reserves is likely to be much nearer the true figure for this disease than is the figure for infective-exhaustive and other short term types of insanity. The proportional incidence of schizophrenic psychoses in persons living away from home is accordingly likely to be much higher than in other insanities as a whole.

There is of course nothing very remarkable about this. It merely serves to support the theory that certain types of personality in a certain age-group tend to respond to environmental difficulties with a schizophrenic syndrome, and to indicate that the African mind is not immune from this type of pathological response. That the problems are real enough will appear from Part 6, and it is merely surprising that schizophrenia is not even commoner.

In regard to the several types of schizophrenia, the large proportion of simple types certified away from home (53 per cent.) merely suggests that such cases, if living in the reserve, are apt to be looked after at home or possibly not even recognized as insane. The small figure for hebephrenics certified away from home (35 per cent.) and the large for katatonics (53 per cent.) and paranoids (44 per cent.) suggests that constitutional factors may play a larger part in the former and environmental factors in the latter (especially katatonics), though other explanations are possible. But the total numbers concerned are too small and the differences too slight to warrant any profound analysis of their separate causes. Moreover in our experience the distinctions between the various types are often rather arbitrary, and Curran and Guttmann's observation that these types are not separate entities, and that " when a case is observed for a sufficient length of time combinations and permutations can usually be observed," is as true for Africans as for Europeans.

(vi) *Paranoia.*

There were 11 cases, or 1·8 per cent. of the total admissions, corresponding to an American Negro figure of 3·2 per cent. 10 cases were men and 1 was a woman, and their ages varied from 35 to 60 years, with an average of 48 years.

The racial figures were Bantus 3, Nilotes 2, Hamites 4, and immigrants 2. At the time of their certification 4 were known to be living at home and 6 away from home, and 5 were doing responsible work.

These patients exhibited well-systematized delusions of a persecutory type, and were otherwise normal except for a general tendency to petty grievances, suspicions and litigiousness, and occasional aggressive outbursts due to the persecutory ideas. An element of superiority in manner and attitude occurred in all, but definite grandiose delusions were only seen in 3. None of these patients were hallucinated, and all were of comparatively high intelligence. As examples of the delusions, H. H— is in very close touch with God and Jesus Christ, and has a mission to perform by telling all the people to go to church and school; B. B— was convicted of manslaughter, and subsequently developed a fixed delusion that the trial judge had actually allotted him £2,200 and two forests, and continually pestered the authorities about this.

Of these cases 5 remained at the end of the period and 6 were discharged, the average period spent in hospital being 15 months. Complete recovery was never seen.

Three points arise for comment:

Of the 11 cases, no less than 9 had for long been living in an alien or inimical environment—4 as travelling traders, 2 as prisoners, 1 as an itinerant preacher, 1 as a farm overseer, and 1 as an internee.

The large proportion of Hamites (36 per cent.) is also noteworthy. Hamites form only 3·6 per cent. of all our admissions, and 18 per cent. of all our Hamitic admissions are paranoiacs. It was at first thought that there must be a racial tendency to paranoia. Indeed this possibility cannot be excluded, but on closer scrutiny of all the case histories it seems that the manner of life of our Somali paranoiacs (cattle driving and trading over vast distances through alien tribes) is sufficient to account for the high incidence of this disease in them, without invoking racial factors.

The large proportion of men finally calls for comment. In America there are more than twice as many women as men. But the manner of life again accounts for this; it is rare for women to live in the types of environment above described.

(vii) *Manic-Depressive Psychoses.*

There were 23 cases, or 3·8 per cent. of the total admissions, corresponding to an American Negro figure of 8·3 per cent. The racial figures were Bantus 22 and Nilotes 1. 9 were known to be living at home and 11 away from home, and 8 were known to be doing responsible work. The cases fell into two classes, acute mania (19) and chronic mania (4) and no cases of depression were seen.

(1) *Acute mania.*—Of the 19 cases, 18 were men and 1 was a woman. Their ages ranged from 18 to 45 years, with an average of 30 years.

These patients were excited, elated and garrulous, and showed a press of psychomotor activity and a flight of ideas which were usually grandiose. Grandiose delusions when seen were more in the nature of gross exaggerations of fact than definite delusions (e.g. M. M— says he is "immensely strong and

broke 6 pairs of handcuffs in 6 days "—he did in fact break one pair before admission to Mathari). They were apt at times to be irritable, quarrelsome, aggressive and occasionally dangerously violent.

Of these cases, 2 remained at the end of the period, and 17 were discharged, of whom 15 had apparently made a good recovery, the average period spent in hospital being 4 months.

These 19 cases were all first admissions to Mathari, as only first admissions are described in this thesis, but it is noteworthy that 3 of them returned within the 5-year period with a similar attack, that 5 others gave a history of a previous attack not in Mathari, and that 10 other admissions with acute mania (not included in our figures) were not first admissions. So that the condition is very apt to be a recurrent one.

In no case was a previous history of depression obtained, however, and none showed depressive symptoms on recovery from the mania.

Among the 19 cases, organic precipitating factors were observed in 10. None of them, however, was feeble-minded, and most were highly intelligent. At least 8 of these cases were doing responsible work at the time of their certification—3 running their own business (as butchers or timber merchants), 2 working as clerks, 1 as a school-teacher, 1 as a hospital assistant, and 1 as a European's cook.

(2) *Chronic mania.*—There were 4 cases, 3 men and 1 woman, and their ages ranged from 50 to 65 years with an average of 60 years.

The symptoms were precisely as described under acute mania, but the course was very chronic, and with the passage of time a certain stereotypy of thought and behaviour was seen.

Of these cases 1 died, 2 remained at the end of the period, and 1 was discharged, the average period spent in hospital being 14 months.

Only one of these cases had had a previous attack of acute mania to my knowledge, and none any previous depression.

(3) *Depression.*—No case of depression, other than the involutional melancholics described in the next section, has been diagnosed at Mathari. Nor have any of the manias given a previous history of depression, but it must be admitted that this statement is of little value as African histories are very unreliable. Moreover H. L. Gordon, working at the same hospital and describing 120 consecutive male admissions in 1935, saw no cases of depression.

Yet among 165 non-African admissions during the 5-year period 9 were suffering from acute depression (with depression, difficulty in thinking, psychomotor retardation, and usually ideas of guilt). Moreover among the 14 acute manias seen in the same series, at least 6 had had previous depression; and at least 5 of the 9 acute depressions had had similar previous attacks elsewhere.

From the figures of American Negro insane available to me no clue appears in regard to the relative proportion of manias and depressions, but it seems fairly safe to assume that it is not strikingly different from the proportions obtaining in other parts of the world or the matter would have been commented upon.

* * *

In regard to the manic-depressive psychoses in general, the low percentage of 3·8 per cent. can probably be explained as a result of the absence of depression.

The very small proportion of women is noteworthy; in America for all races there are nearly 3 women to 2 men, but here again we do not know what is the sex ratio for manias alone. The large proportion of men can, at least in part, however, be accounted for by the fact that so large a proportion of our cases were certified away from home (when the ratio of males is always high).

The large proportion of persons certified away from home (55 per cent.) is noteworthy, but the really striking fact (with which it is linked) is that at least 42 per cent. of the acute manias were doing responsible work. In regard to all other types of insanity the equivalent figure is 3·6 per cent.

Finally, the absence of depression is remarkable, and one is forced to wonder if cases do occur but fail to reach the mental hospital. It is theoretically possible that they might not be recognized as insane, or that they might commit suicide or recover before certification.

In regard to the first possibility however, one can see no good reason for such cases being more likely to remain at home than, say, simple schizophrenias or involutional melancholias, of whom not a few have been admitted.

In regard to the last two possibilities also, suicide fails to prevent the admission of involutional melancholias, and is perhaps less likely than in that condition to account for an absence of cases. It must be recorded, however, that the suicide of Africans is not unknown, and not confined to the involutional period of life. Moreover attempted suicide was occasionally seen in prisoners during the 5-year period, but in none of the cases so seen did the depression last long enough nor was it severe enough for the subject to be certified as insane. As will be seen in Part 6, the African in general is highly "cyclothymic" in the sense that he exhibits well-marked though transitory mood swings which are usually clearly related to environmental factors. It seems not unlikely, therefore, that our lack of cases in this category is related to an absence of *sustained* depression of psychotic type—a point which is referred to again in the conclusion.

(viii) *Involutional Melancholia.*

There were 8 somewhat atypical cases, or 1·3 per cent. of the total admissions, corresponding to an American Negro figure for "involutional psychosis" of 0·4 per cent. 4 were men and 4 were women, and their ages ranged from 40 to 65 with an average of 51 years. The racial figures were Bantus 6, Nilotes 1, and Half-Hamites 1. 5 were known to be living at home and 2 away from home, and none was doing responsible work.

These cases occurred at the climacteric period of life, and the patients were depressed and anxious, vaguely persecutory and hypochondriacal, and sometimes agitated or suicidal. The mood change appeared to be primary and the persecutory ideas secondary. In no cases were psychomotor retardation or ideas of sin or unworthiness seen. In none of these was a previous history of mental disorder found, and the cases clearly fell into a separate group from the

manic-depressive psychosis proper—an observation that supports the views of Henderson and Gillespie on this subject.

Of these cases 2 died, 1 remained at the end of the period, and 5 were discharged, the average period spent in hospital being 5 months.

The only feature that appears to call for further comment and will be discussed in Part 7 is the consistent absence of ideas of guilt from the picture.

(ix) *Psychoneuroses.*

There were 24 cases, or 3·9 per cent. of the total admissions, corresponding to an American Negro figure of 1·8 per cent. 22 were men and 2 were women, and their ages ranged from 20 to 55 years with an average of 32 years. The racial figures were Bantus 15, Nilotes 4, Hamites 1, and immigrants 4. Four were known to be living at home and 15 away from home, and none was doing responsible work.

All the cases except one recovered within 3 months, mostly within a week, and the average period spent in hospital was 2 months.

These cases fell into two main types, namely hysteria, and one which we can only designate as "frenzied anxiety." These two types are described below and thereafter the psychoneurotic absentees are briefly referred to.

(i) *Hysteria.*—There were 3 cases, all men, 1 fugue, 1 deafness, and 1 aphonia. It is doubtful whether these cases should be included in this article, so they will not be further discussed. The hysterical syndromes that occur in Africans are similar to those seen in Europeans, but naturally only certain types such as those above mentioned are likely to find their way into a mental hospital.

(ii) *Frenzied anxiety.*—There were 21 cases, 19 men and 2 women. In this condition the onset is associated with some real source of anxiety (perhaps only real to an African), but the anxiety is not sustained, and is soon replaced by a state of frenzy in which the patient is excited, noisy, incoherent, and perhaps filthy, aggressive, and dangerously violent. The violence often results in homicide but is apt to be ill-directed and generalized, and the supposed author of the patient's anxiety may or may not be among the victims. Recovery usually occurs within a few hours or days and is as complete as it is rapid, but 4 of these cases on recovering from the frenzy developed hysterical symptoms —2 deaf-mutism, 1 deafness and 1 aphonia. The subject subsequently always denies all memory for the period of the frenzy. The precipitating cause is usually clear, and most of the patients on recovery are themselves cognizant of at least some of the factors that produced their mental breakdown. How far the condition is deliberately self-induced in some cases is a moot point, but once induced it becomes a very real type of insanity—the patient is temporarily quite without insight or self-control, and may commit irreparable damage to his own interests and violence quite unrelated to the precipitating cause. Thus one patient had been physically ill, believed himself bewitched by a neighbour, and developed a hysterical frenzy in which he killed his wife and child.

The chief precipitating causes were as follows: in 8 cases an urgent wish to

leave work and return to the reserve was thwarted, in 3 cases the onset of unaccountable illness induced a fear of bewitchment, and in 4 cases the patient's wealth or ill-treatment of his wife also resulted in fear of bewitchment (for reasons which will become clearer in Part 6). The causes tend, however, to overlap, temporary physical illness often plays a part, and the patient usually believes he has been bewitched by a particular person (often the object of his own guilty feelings, though hardly recognized as such), and will die.

A closely similar, if not identical, condition is described by Fletcher under the title of "amok" occurring in Malays, but perhaps it is common to various primitive peoples, and it is doubtless much commoner in Kenya than our figures would indicate, as the great majority recover too quickly to be certified insane.

As the condition appears not to have been described before in East Africa and may not be identical with "amok," it behoves us to discuss its differential diagnosis from other conditions.

There is a certain resemblance to the temporary paranoid states that sometimes complicate physical illness, in that physical illness does often precede the onset of the mental disturbance. But the relation of the physical illness to the mental is quite different in the two cases, for whereas in these paranoid states the mental faculties are directly affected by the illness so that the patient's critical faculties and judgment are impaired, in the case of "frenzied anxiety" the patient's judgment in the early stages is only too clear according to his lights and he sees his illness as definite threat to his life.

The distinction from the violent episodes that occur in aggressive psychopaths is perhaps rather unreal, in that the episodes themselves may be identical. In practice, however, it is found that such an episode is apt to occur as an isolated event in the life of an African, is precipitated by some very real source of anxiety, and does not (as it does in Europeans) imply the possession of a certain markedly egotistical type of personality. One might of course argue that *all* primitive Africans are psychopathic, in that their personalities are by European standards immature. Part 6 of this article shows that this is substantially true, and we believe that in certain circumstances this reaction may be exhibited by *any* such African.

CASE No. 1005.—A Mkamba (Bantu) man, aged about 30 years, living at home in the reserve, pagan, married, with one wife and three children—all sons, and the youngest aged about 7 years.

On 10.i.44 he was tried for the murder of his wife and youngest son on 28.12.43. At the trial it transpired that he was apparently normal until 4 p.m. on 27 December, when he "started behaving in a very odd manner, plucking grass and putting it in the fire, picking up stones and putting them on the cooking pot and throwing water about." The next morning he got up, collected his bow and arrows and a hammer, and chased his wife and other relations out of the house and down a hill towards a river. The relations managed to cross the river and escape, but the wife —running behind them and carrying her son—was too late, and the accused caught up with her and battered both her and his little son most brutally to death with the hammer. All the witnesses were agreed that he had never been insane before, was on good terms with his wife, and never took alcohol. His father, who saw him just after his arrest a few hours later, said he "looked mad" at that time.

In answer to questions by the accused at his trial, his sister-in-law said, "Yes,

you told me that you thought you were going to die and instructed me to call the elders, so that if you did die your wife would be well cared for—you told me to tell your father and brothers to look after the children—you then told me to go away but to come back later to see if you had died." It is not made clear in the evidence when he made these remarks, but it is fairly certain they were made on the evening of the 27th, as the sister-in-law was in the house at that time.

At this point the accused was remanded for 10 days for observation of his mental state and, the trial being resumed on 19.i.44, the doctor gave evidence that he had found no signs of mental or physical disease.

The accused elected to make a statement which ran as follows: " I would not have killed my wife and child had I not been ill ; if I had not killed my wife I would have died. All my troubles have come from an old man called ' X ' with whom I had a quarrel. There was another man who wished to marry my sister and he brought beer to my father as a preliminary to the marriage. ' X ' wished to drink this beer but I refused to allow this as my father was away at the time. ' X ' then said, ' You may drink the beer to-day but this will be the last time.' He meant that he would bewitch me and cause my death. I had only one wife and by her death I have now no wife and no one to look after my children." X's threat appears to have been made a week or two before the crime, and two days before the crime some charms were found at the entrance to accused's home and were assumed to have been placed there by X.

The accused was found guilty but insane at the time of the act, and was admitted to Mathari on 4.ii.44.

On examination he was found to be of good physique, no physical abnormalities were observed and his blood was negative to malaria and to the Kahn test. Mentally he was found of good intelligence and in no way insane, though naturally somewhat depressed at what had happened. He adhered to his story as given in court, but admitted to no recollection of his behaviour on the morning of the 28th, though he had heard about it later.

His condition up to the time of writing (12.ii.47), remains quite unchanged, and in fact quite normal except for the amnesia for the time of the crime.

His manner is at all times mild and amenable, and he shows none of the truculence and resentment so characteristic of aggressive psychopaths, nor has he exhibited any aggressive outbursts, although frustrations must have been frequent during this period.

Like the other cases that fall into this category he arrived at Mathari long after he had recovered his mental equilibrium, but the history is sufficiently complete to support the diagnosis of frenzied anxiety. An interesting point that emerges in this case is his remark, " If I had not killed my wife I would have died." It appears most probable from the evidence that he would have killed anyone he caught up with, and that the fact that he killed his wife was merely due to her being the last to reach the river.

It was suggested in Part 7, Section (h) of this article that a primitive person whose life is in jeopardy believes that *any* death will appease the gods, and we believe that the accused in this case really meant, " If I had not killed *someone* I would have died," but the failure to generalize is characteristic.

(iii) *Psychoneurotic absentees.*—No cases of obsessive-compulsive neurosis or anxiety neurosis in the European sense have been seen at Mathari.

They would of course be unlikely to be sent to a mental hospital, but it is of interest to record that, with the single exception of " cardiac neuroses " which are not uncommon in Africans, these syndromes appear to be rare—an observation that is based on one's general medical experience throughout the Colony. Among non-Africans, on the contrary, anxiety neuroses of all types are among the commonest of medical conditions seen.

It seems likely therefore that the condition we have labelled " frenzied anxiety " tends to replace in Africans many of the types of anxiety neurosis,

and perhaps some of the depressions, that are seen in Europeans. This problem and the absence of obsessional neuroses are discussed in Part 7.

* * *

In regard to the statistics of psychoneuroses as a whole the only points that appear to require further comment are the large proportion of persons certified away from home and the high ratio of men. Frenzied anxiety, however, by the brevity of its course, is *par excellence* the type of insanity that is unlikely to find its way from the reserves to the mental hospital unless crime results. This explains both these points, and the condition is doubtless really quite common in the reserves.

(x) *Unclassified Psychoses.*

There were 75 cases, or 12·3 per cent. of the total admissions, corresponding to an American Negro figure of 4·7 per cent. 55 were men and 20 were women, and their ages varied from 15 to 60 years with an average of 34 years. The racial figures were Bantus 54, Nilotes 9, Half-Hamites 4, Hamites 4, and immigrants 4. 38 were known to be living at home and 33 away from home, and 5 were doing responsible work.

Twenty of these cases had recovered their sanity before they were examined, 11 cases died shortly after admission and before a certain diagnosis could be made, 11 cases could only be described as terminal dementias (probably initially feeble-minded), and the remaining 33 cases were undiagnosable mainly because of the absence of histories or difficulties in interpretation of the numerous tribal languages—factors which account for the high proportion of unclassified cases in general.

Of these cases, 19 died, 10 remained at the end of the period, and 46 were discharged, the average period spent in hospital being 6 months.

* * *

In view of the absence of true psychotic depression from our series, it is important to record that in 10 cases in the unclassified group the prevailing mood was depressive. But two of these were almost certainly katatonic stupors (sitting in a mummy position and remaining mute or monosyllabic until their deaths 10 and 24 months after admission), and the other 8 showed symptoms or signs suggestive of organic disease and were probably secondary to physical illness of various types. None of these cases, in short, fell clearly into the above-mentioned category.

* * *

The method of comparing proportional rates, used throughout this part, is convenient when considering figures of a grossly different order of magnitude, but is sometimes fallacious.

The following table is therefore appended and shows the absolute annual figures, the proportionate rates and the absolute rates, and the final column shows the ratio obtained by dividing the Kenya rates into the American rates. The figures for Kenya Africans shown in this table refer to non-military cases, for reasons explained in the introduction.

	Kenya Africans.			American Negroes.			
	Admissions per annum.	Admission proportion.	Rate per 100,000 per annum.	Admissions per annum.	Admission proportion.	Rate per 100,000 per annum.	Ratios.
Organic psychoses	36·2	32·4%	1·12	36·6	47·0%	75·5	67
Epilepsy	4·0	3·6%	0·12	2·4	3·1%	4·9	41
Mental defect	13·0	11·6%	0·40	2·9	3·8%	6·0	15
Psychopathy	3·4	3·0%	0·10	0·7	0·9%	1·4	14
Schizophrenia	32·0	28·7%	0·99	21·4	27·3%	44·1	45
Paranoia	2·2	2·0%	0·07	2·5	3·2%	5·2	74
Manic-depressive	4·2	3·8%	0·13	6·5	8·3%	13·4	103
Involutional melancholia	1·6	1·4%	0·05	0·3	0·4%	0·6	12
Psychoneuroses	2·4	2·1%	0·07	1·4	1·8%	2·9	41
Unclassified psychoses	12·6	11·3%	0·39	3·6	4·7%	7·4	19
	111·6	99·9%	3·44	78·3	100·5%	161·4	47

5. A Tabulation of the More Striking Peculiarities of Mental Derangement as Compared with such Derangement in Europeans and American Negroes.

The facts have now been described, and from these facts the following appear to emerge as the most significant peculiarities:

(*a*) The incidence of insanity among Africans living in their natural environment is probably very low.

(*b*) The incidence of insanity among Africans working away from home is probably considerably higher than that of those living at home, but is still low.

(*c*) General paralysis is rare in the indigenous population.

(*d*) Arteriosclerosis is rare.

(*e*) The relation of paranoia to certain modes of living.

(*f*) The relation of mania to responsibility and the absence of depression (manic-depressive type).

(*g*) The absence of ideas of guilt in involutional melancholia.

(*h*) The common occurrence of "frenzied anxiety" and the apparent absence of most of the types of anxiety state seen in Europeans.

(*i*) The absence of obsessional neuroses.

* * *

Most of these peculiarities can be discussed in relation to the African's attitude to life, arising out of his peculiar culture and thinking, so that Part 6 will consist of a description of these. The description refers particularly to the agricultural peoples (who form the great bulk of the population), but is also true with slight modifications of the pagan pastoral peoples. It does *not* refer to hunters and food gatherers, of whom we have no experience in Kenya, and whose attitude may well be a very different one.

6. Native Culture, Thinking and Attitude to Life.

The peculiarities of the primitive African's attitude to life would appear to be conditioned by three factors: (a) his inherent mode of thought, (b) his relation to his natural environment, and (c) his relation to his social environment. These three factors are almost inextricably mingled in his attitude but, for the sake of clarity, we have tried to describe it in relation to these factors.

As far as practicable, and with a view to minimizing personal bias, this part takes the form of direct quotation from several other writers.

(a) *His inherent mode of "thought."*—The peculiarities of primitive African thinking can for the most part be well explained on the assumption that "phantastic" thinking plays a larger part in it than "directed" thinking. "Phantastic" thinking, as defined by Jung, is characteristic of day-dreams, dreams and myths, is especially marked in children and primitive peoples and is essentially an immature mode of thought. In contradistinction to "directed" thinking it is undirected, or more correctly is directed by the passing emotions and not by conscious effort. It is accordingly automatic and spontaneous, effortless and untiring, wish-fulfilling and dependent on unconscious and semi-conscious impulses, unproductive and uncritical, and leads from reality to phantasy and thinking in images and feelings rather than in words.

Largely in accordance with this and to quote Westermann, "With the Negro emotional, momentary, and explosive thinking predominates . . . dependence on excitement, on external influences and stimuli, is a characteristic sign of primitive mentality. Primitive man's energy is unstable and spasmodic. He is easily fired with enthusiasm for an undertaking and begins his work with great zest; but his interest dies down quickly and the work is abandoned. . . . Where the stimulus of emotion is lacking, the Negro shows little spontaneity and is passive. He waits for what is coming to him and evades what is inconvenient, or adapts himself to it, instead of bravely confronting the obstacles of life and mastering them. . . . The Negro has but few gifts for work which aims at a distant goal and requires tenacity, independence, and foresight." He lives in fact more vividly in the passing moment than does the European, and it is for example common for an African in receipt of good monthly wages to be penniless and starving for a few days before his next pay-day.

In regard to the outer world, and in Westermann's words—"The interest which the African takes in things is not an academic one. They concern him in so far as they are useful to him or can do him harm . . . observation is often superficial; conclusions have been drawn from it in a most uncritical way; and instead of further thought on the matter, word-spinning has seemed sufficient. The African has never progressed so far as the knowledge of true causal connections or natural laws. He possesses a certain amount of knowledge of nature, . . . but for the greater part it is pseudo-science-knowledge mixed with a child-like play of imagination. . . . His meditation . . . easily assumed the character of an interesting and amusing entertainment." The ability of the African to lie convincingly is notorious, and one is constrained to believe at times that the story-teller has also temporarily convinced himself.

As a result perhaps of his immature and egocentric imagination speculation about nature is essentially anthropomorphic, and in Westermann's words, "The idea of an event happening from an inner natural necessity is difficult for him to grasp. . . . Behind an occurrence there is for him not so much a cause as one who causes. If a tree or a human being dies, then someone, be it a spirit or a person or a 'power,' has made him die. For inner necessity or natural causes a 'personal' will is substituted." In accordance with this

and with his ill-developed powers of self-criticism the African usually attributes his misfortunes to the anger of some external agency and rarely blames himself.

In general, as Westermann says, "The world of the primitive African is characterized by its unity and coherence. No sharply defined aspect exists by itself; wish and reality, the possible and the impossible, knowledge and belief, thought and imagination, the realms of secular and religious life are interwoven and fundamentally one." Dreams and conscious experiences might well be included—a homesick labourer is apt to dream that his father is ill and calling for him, and to attach as much significance to this "message" as if it came by post.

(b) *His relation to his natural environment.*—The primitive African is very close to nature and the realities of life and death. Disease and misfortune are familiar experiences, they come apparently causelessly like bolts from the blue, and the workings of fate are so inscrutable that he is apt to feel like a feather blown by the wind. He feels an especial fear and suspicion of anything striking and unusual, and a great consciousness of ignorance and awe of the unknown.

As will be seen in Section (c) of this part, each man is heir to the whole knowledge of his group, with the obvious corollary that he is well aware of the limitations of that knowledge. The individual European by contrast is usually profoundly ignorant of the limits of human knowledge and so has largely lost this feeling of awe of the unknown.

This feeling, which may well be described as "religious," plays a large part in primitive life, and in Driberg's words—"Every activity has its religious background and sanction, and it would be quite impossible to divorce their religious beliefs from their everyday practices without completely destroying the basis of their society." Thus, to quote Kenyatta, "At the birth, initiation, marriage and death of every Kikuyu, communication is established on his behalf with God. . . . When people meet to discuss public affairs or decide a case, or at public dances, they offer prayers for protection and guidance."

Moreover he hates admitting to any sort of success (e.g. number of children alive); he is so used to misfortune that success itself is strange, and likely to be snatched away by the jealous gods.

(c) *His relation to his social environment.*—Most primitive people including East Africans have developed a large, complicated and rigid social organization (based on a wide extension of the family system), by which a high degree of security for the individual is achieved in face of the manifold hazards of nature; there is a place for everyone within this system, and widows and orphans for example are never outcast or destitute.

This organization implies and demands the observance of meticulous rules and restraints in regard to manners and behaviour in all departments and at each stage of life, and in Kenyatta's words, "In all tribal education the emphasis lies on a particular act of behaviour in a concrete situation." Thus the manner of address and behaviour of a Kikuyu would be different in the presence of his father's sister from that in the presence of his mother's sister, and would be subject to still further rules according to whether he were circumcised or not. These rules, though unwritten, are so well known that any infringe-

ment implies an unsocial motive. In Driberg's words, primitive peoples " draw much more precise conclusions from acts or words of discourtesy. Not only is resentment felt, but it is also assumed—and generally rightly—that there was a deliberate intention to offend. . . . When all are disciplined to a certain uniformity of behaviour, any aberration is apt to be looked upon as a manifestation of witchcraft." Moreover the rules only apply within the group and tribe ; outside these limits there are no rules for there is no general abstract code.

Everyone sooner or later knows the whole culture of the group; there is little specialization and a great equality of knowledge. Status depends on age rather than on intellect, knowledge or achievement (indeed outstanding achievement is apt to be deeply suspect), and, as actual ages are unknown, on certain landmarks, especially puberty and marriage. Occupations and rules of conduct are strictly arranged according to these landmarks, and the African constantly acquires more rights and duties in an ever-widening field, as the social organism of which he is an essential part increases in size with each rise in status. Thus O. F. Raum, referring to the Chaga—a Bantu tribe of Tanganyika—says, " The majority of children have conduct patterned for them by their sex and their membership in a clan and age-group . . . in those social situations which matter conduct is prescribed and enforced, as well as facilitated, . . . age, sex and clanship assert their influence throughout life . . . primitive life simply places individuals in definite relationship to one another, prescribing how each is to behave, and reserving for each his share of rights and duties."

The primitive African's sex-life is similarly governed by meticulous and explicit rules and taboos, which correspond to his age status and permit of sexual outlets related to his developing physical needs. Thus, according to Kenyatta and referring to the Kikuyu, " before initiation it is considered right and proper for boys to practise masturbation," but " it is considered an indecency to be seen doing it, except by boys of the same age-grade." After initiation " the boys and girls are told that . . . they must acquire the technique of practising a certain restricted form of intercourse," and " anyone seen masturbating after initiation would be looked upon as clinging to a babyish habit and be laughed at, because owing to the free sex-play which is permitted among young people, there is now no need to indulge in it." In regard to marriage, " a man may have as many wives as he can support—the custom also provides that all women must be under the protection of men—and that all women must be married in their 'teens," so that spinsters and prostitutes are unknown, and indeed no words having these meanings exist in the language. Instruction in general is clear and shameless and, though specific restraints are imposed, there is no shameful mystery about sex or need for repression.

All primitive peoples (including East Africans) are closely attached to particular areas of land; all customs, culture, religion and myths refer to particular localities which are the visible symbols of clan kinship and nurse the ancestral spirits. Thus, for the Kikuyu, the ancestral spirits reside at the tops of certain fig trees, and God resides on Mt. Kenya. The primitive cannot visualize annihilation, and the African believes his spirit survives and acquires

(by a natural age-group progression) still greater status and power after death, and is finally reincarnated in the family. Indeed, as Driberg has pointed out, the most potent factor in the authority of primitive law is the moral support it draws from the will of the dead ancestors. So the land is held in trust by the individual for the family (past, present and future), and landless people do not occur.

In regard to religion the primitive, as was mentioned in Section (b) of this Part, feels a great awe in face of the unknown and recognizes higher powers —higher than the ancestral spirits—who must at times be supplicated. There is however, little link between ethics, and religion and in Westermann's words, " The gods and ancestors take but a slight interest in the ethical behaviour of their worshippers and are almost indifferent as to the inner attitude in which they are approached. What they demand is offerings and invocations. . . . Ethics, in the sense of civic virtues, are rooted in the traditional rules regulating the behaviour in social groups." Both ethics and religion apply moreover only within the group, and the gods can only be supplicated by the group, not by a lone individual. There is thus no conception of universal truth or justice, or of right or wrong in any general sense, and in Raum's words, " The child becomes conditioned to a morality whose demands become less stringent the remoter they are from the ' initial situation ' of the family."

* * *

We have now described, as shortly as possible, the factors that appear to condition the primitive African's attitude to life, and it remains to describe the attitude that results.

Again we cannot do better than quote Westermann, who says: " The consciousness of being an organic and well-protected member of a group gives the individual a definite self-consciousness and dignity . . . he is not easily embarrassed. Within his own circle he is never in a position where he does not know how to behave or what to do . . . work is not specialized in the same way as with us and therefore the non-expert ' layman ' . . . does not exist. The African is able to enlarge with ease on any subject; . . . he does not suffer from social disabilities, for there is hardly any economic dependence, nor is there a distinction between servant and master, rich and poor. Hence nobody suffers from an inferiority complex. . . . It is natural for him to express his real personality, for everybody knows everybody else, and no one can therefore permanently conceal his nature." In spite of age statuses the prevailing feeling is one of equality—each man after all will be of high status one day if he lives long enough. His attitude to sex is equally self-assured and healthy.

This is the bright side of the picture, and the contrast with the European, who is apt to be trammelled by social castes and economic disabilities and to suffer from a sense of social or sexual inferiority, and who often tries to act a part, needs no stressing.

The African feels, however, that what strength and stability he has comes from the fact that he is part of a larger organism, and that he can only preserve this modicum of power by playing most meticulously his special part in this

organism. In fact he enjoys observing the rules, as they give him a feeling of correctness and security, and he does not like thinking for himself.

This attitude governs his whole life, and results in extreme conformity to tradition, conservatism in thought and fear of innovation—there is no room for free thought or for misfits, and even secretive, solitary or outstandingly successful people are suspect. In Westermann's words, a " man does not plan his life, set himself an aim and exercise his strength in attaining it. The individual as such has no aim in life if his task is to become exactly like the rest. . . . The motives for his actions are predominantly social, not individual, and are deeply influenced by public opinion. . . . Personal responsibility is avoided wherever possible." In the absence of any general conception of the inherent nature of cause and effect, he regards the workings of fate as arbitrary and haphazard and, provided he has obeyed the traditional rules, he rarely blames himself for his failures and misfortunes, but is apt to believe himself bewitched. Since his codes of behaviour only apply within his group and in relation to his clan land, and since he has no general abstract code, alien codes are apt to leave him cold or utterly perplexed and he feels quite lost and rudderless in a foreign land.

The European by contrast is free to travel or live alone, he has general rules only, and he feels that his strength and stability derive from himself alone; but he is apt to feel more isolated and conscience-stricken, often does not know what to do in a given situation and has to think it out for himself.

Finally, in contrast to his social and sexual self-confidence, the primitive is profoundly conscious of the limits of his knowledge of nature and of his power to control his natural environment. An attitude of humbleness and awe results from this, and an implicit faith in higher powers who manifestly set little store by him as an individual, but are interested in and can be approached by his social group. If this is religion, then religion is far more real to the primitive than to the modern European.

7. An Attempt to Explain the Peculiarities of Mental Derangement Listed in Part 5.

We are now in a position to study the peculiarities of mental derangement in our Africans and attempt to explain them. Each peculiarity, as tabulated in Part 5, will be discussed in turn. It must be reiterated that the word " primitive," wherever used in this part, refers to the pagan agricultural and pastoral peoples of Kenya, and that hunters and food gatherers have not been seen.

(a) *The incidence of insanity among Africans living in their natural environment is probably very low.*

This can be partly explained by the rarity or absence of certain specific types of insanity (namely cerebral arteriosclerosis, general paralysis and alcoholic psychoses, which in the aggregate account for 32 per cent. of Negro first admissions in America). Other likely factors are a high general mortality, resulting in wide differences in age composition of the population, and a high

mortality among the insane. These explanations alone seem inadequate, however, to account for our findings, as was deduced in Part 4.

* * *

In the aetiology of mental derangement, hereditary and environmental factors play varying parts according to the type of insanity, so that at one end of the scale we see a psychosis due to brain injury in which the environmental factor may approximate to 100 per cent., and at the other end a psychosis associated with Huntington's chorea in which this factor may be almost non-existent.

Recent research has tended to emphasize the part played by hereditary and constitutional factors in the various types of mental disease but, except in certain rarer types not seen in our series, they have not been credited with exclusive causation. In the great bulk of insanities a place remains for environmental factors—sometimes large as in the infective-exhaustive psychoses, sometimes apparently small as in the schizophrenias and manic-depressive psychoses. Indeed Slater says that the environment and the genotypic milieu probably play an important but non-specific part in *all* the hereditary mental disorders. So long, however, as a place is left for environmental factors, be it ever so small, this place is important, and in certain circumstances might become transcendently so.

To be more precise, Rosanoff found 68 per cent. concordance for schizophrenia in uniovular twins. These twins were presumably on the whole living in roughly similar types of environment. Had one of each twin been translated at birth and for life to some hypothetically easy environment, it is safe to assume that the concordance would have been very much less. If both twins had been so translated it is safe to assume that the concordance would have been roughly the same, but the general incidence much less.

Now the primitive African *may* be less heavily loaded with deleterious genes than the European. The presumption would be so, since natural selection might be expected to eliminate the genes concerned more rapidly in a primitive community. Against this, however, we have the evidence of the American Negro figures. These figures are even greater than those for American whites, and show the same types of insanity in roughly similar proportions. Admittedly American Negroes derive from West Africa but, according to Oliver, mainly from Bantu stock, and there is no reason to believe that the genetic constitution of West African natives is grossly different from East African.

However this may be, it does not seem necessary to invoke genetic factors, as our problem can surely be answered without reference to these. Environmental factors alone could supply the answer.

It is clear from the assemblage of facts in Parts 3 and 6 that the primitive African lives in a difficult natural environment, but that his social environment is made very easy for him, for rules of procedure govern his every act and he seldom has to think for himself, and that his sex life is similarly governed by rules related to his developing needs. Moreover economic problems (such as may arise from droughts, epidemic disease, etc.) are shared with the community and rarely borne in isolation.

In so far as mental derangement is due to problems arising in the social, sexual and economic spheres, it is quite difficult to see how such derangement can occur among primitive people. Indeed a relatively large proportion of our psychoses occurred on a basis of mental deficiency.

We deduce, therefore, that the rarity of insanity in primitive life is due to the absence of problems in the social, sexual and economic spheres, and that its frequency in Europe and America is due to the multiplicity of such problems. This deduction in regard to economic problems is well supported by Dayton's observation that " from 1923 to 1929 the increasing admission rates for mental disorders show a remarkable year to year agreement with the decreasing numbers employed."

(b) *The incidence of insanity among Africans working away from home is probably considerably higher than that of those living at home, but is still low.*

We have explained in Part 6 how an African's life is governed by rules of procedure, and that these rules apply only within his social group and in relation to his own country. Prior to the advent of the European this system was all-sufficient and adequate to his needs. No African at that time would have dreamt of travelling by himself outside his tribal boundary—such behaviour would indeed have been quite efficiently suicidal. European settlement has altered this, and large numbers of Africans are constrained (by the poll tax system) to go forth each year and work on estates and in townships, etc., where their own rules of behaviour no longer apply.

If insanity is ever precipitated by an inability to adapt oneself to environmental problems and frustrations, it is small wonder that its incidence in these people is relatively high.

The fact that the incidence is still low in terms of European figures is again not surprising. The great bulk of employed Africans are not away from home very long—a fact which affects our problem in two ways. Firstly, many of these people are essentially untouched by the alien culture and by no means detribalized; they regard the period as a tragic or comic interlude with no other relevance to their lives than the need to earn the poll tax, and they return to their homes and their tribal customs without any permanent scars or conflicts. Secondly, an unknown but doubtless considerable number break down *after* their return home and appear in our figures as certified in the reserves, although in many cases their insanity was probably precipitated by partial detribalization.

(c) *General paralysis is rare in the indigenous population.*

This raises two points of interest.

Craig and Beaton in the 4th edition of their *Psychological Medicine* (1926) say, " Within the last few years investigators have injected patients with the benign tertian parasite of malaria, basing their action on the apparent immunity to general paralysis of natives in the tropics who have had malaria." Russell Brain in the 2nd edition of his *Diseases of the Nervous System* (1940) says, " In many tropical and subtropical countries where syphilis is rife general

paralysis is almost unknown among the natives." Yet in Uganda (where malaria is endemic and syphilis is rife) Trowell found that 33 per cent. of the persons he certified as insane were suffering from neurosyphilis, and one infers from his description that the great majority of these were general paralytics. The very low rate among the indigenous population of Kenya affords, it is thought, strong support for the statement made in Part 3 that syphilis is a recent introduction to this colony. Far from there being any immunity to general paralysis among " natives in the tropics who have had malaria," they appear to be unduly susceptible to it, as evidenced by the Uganda figures and by our figure (of 27 per cent.) among immigrants. Moreover, there is certainly no racial immunity to this disease in Negroes, as shown by the American figures. No doubt Kenya will reap the whirlwind in 10 or 20 years' time.

The second point is the relation of yaws and syphilis to general paralysis. Manson-Bahr in *Manson's Tropical Diseases*, 11th edition (1941), says, " Harper in Fiji believes that late manifestations of yaws occur as in syphilis, and that they produce neurological conditions resembling those of locomotor ataxia and general paralysis." Shelley and Watson, in *An Investigation concerning Mental Disorder in the Nyasaland Native*, say, " We are . . . tempted to assume that yaws does affect the central nervous system." Yet yaws is endemic in Kenya and until a few years ago was ubiquitous. If yaws were liable to result in general paralysis one would expect to see more cases of the latter. An investigation of the nature of this thesis cannot prove that general paralysis never results from yaws, but it is felt that our figures strongly support this contention, and that general paralysis results solely from syphilis.

(d) *Arteriosclerosis is rare.*

The relation of arteriosclerosis to hyperpiesis and of both to more remote causes remains obscure. It is clear that, while the two conditions are often associated, yet each may run its course independently. It is likely that certain types of arteriosclerosis often result from hyperpiesis, but unlikely that hyperpiesis results from arteriosclerosis.

The facts in regard to the Kenya African are that generalized arteriosclerosis is rare as shown in Part 4, and that hyperpiesis is very uncommon. Donnison, who examined over 15,000 persons in South Kavirondo especially in regard to cardio-vascular disease, found " it was very uncommon . . . to meet with a systolic blood pressure that persisted for long above 144 mm." Furthermore, in an examination of 1,000 healthy male natives aged from 15 to about 75 years, he found the average systolic pressure reached a maximum of 126 mm. in the age group 25 to 35 years, and then steadily fell to below 106 mm. in the age group 60 years and over. Moreover Muwazi and Trowell, in a study of neurological disease among Uganda natives based on 14 years' experience of clinical work in East Africa, say, " We doubt if we have ever seen a case of essential hypertension, unaccompanied by renal disease, in an African, apart from a slight rise in a few elderly people."

The rarity of arteriosclerosis and of hyperpiesis in our Africans suggests that, in so far as these conditions are not causally related to each other (presumably by arteriosclerosis resulting from hyperpiesis), they are both related to

some common cause. Moreover, this cause, which might be hereditary or environmental (or more likely a mixture of both), is lacking in Kenya Africans.

The importance of hereditary factors has been stressed by various writers, but that they do not play an exclusive role is strongly suggested by a comparison of the African and American Negro figures for cerebral arteriosclerosis. For whereas in the former this condition was not seen, in the latter it is actually commoner than in American whites.

It is not within the scope of this article to discuss all the environmental factors that have at various times been postulated as causative of these conditions. The importance of "psychical" factors has, however, been stressed by many writers, and cannot be ignored.

Thus Halls Dally says, "In many persons psychical factors play a leading part in inducing transient or even sustained rises in blood-pressure, but whether these are primary or whether they merely activate an inherent constitutional disposition is still uncertain." Lakin says, "Modern urban life with its constant rush and incessant strain, with its leisure too often spent without relaxation, is highly favourable to the development of arteriosclerosis." Halls Dally quotes Moschcowitz as saying that most hyperpietics conform to a certain type, which he thus describes: "Psychically they are the opposite of the child. They do not play. They have no illusions. They are tense and irritable with 'single-track' minds. While their mental horizon is narrow, within this range they are terribly concentrated, and pursue their aims with grim desperation. . . . Most have lived what may be called a 'hard' life. The struggle for existence has begun early, and their life represents little else than a desperate battle. They have no time for play. Here again the child that is in all of us goes early, and once gone rarely heeds the summons to return." Other recent writers have demonstrated a correlation between hyperpiesis and "chronic hostility."

If psychical influences and attitudes such as those described really play any significant part in the causation of these conditions (and are not merely symptoms of the physical disease), then the latters' absence in our Africans is well explained. A reference to Part 6 of this article shows that the qualities and the attitude described by Moschcowitz for instance are precisely the opposite of those of the African, who seldom "pursues an aim with grim desperation" for more than a few moments. The "long-continued anxiety states" elsewhere described as causative by Halls Dally are hardly seen, and "chronic hostility" is quite foreign to the African attitude. Donnison, writing in 1929 and referring to the theory that hyperpiesis results from a "high pressure existence" or mental stress, said, "I think almost everybody who has been closely associated with the African native will agree that he very rarely can be described as living a high pressure existence."

Approaching the subject as we do from a purely negative angle, we cannot suggest which particular element in the mental attitude of Western civilization is responsible for the high incidence of hyperpiesis and arteriosclerosis; but it is submitted that the rarity of these conditions in our Africans is entirely consistent with the primary importance of a mental attitude in their causation, at least in many cases.

This inevitably leads us to a further point. It is customary to assume that the psychosis occurring in association with cerebral arteriosclerosis are due to the latter. Perhaps it may be truer to say that these psychoses are often simply a senile deterioration in persons with a certain "arteriosclerotic" type of mental attitude, and that both the psychoses and the arterial change develop out of this.

(e) *The relation of paranoia to certain modes of living.*

Out of a total of 11 cases of true paranoia, no less than 9 appeared to be clearly related in their aetiology to environmental factors in the social sphere, namely prolonged sojourn in an alien or inimical environment.

Constitutional factors are sometimes held to play the preponderant role in the aetiology of paranoia, so that the importance of exogenous factors in African cases seems to be worth commenting upon.

The African's codes of behaviour are quite inelastic and have no application in an alien environment, as we have shown in Part 6. Moreover a stranger has little chance of being accepted as one of themselves by the group into which he migrates, and he is indeed often justified in acquiring persecutory ideas. It is not surprising therefore that such people are apt to develop paranoia.

No doubt constitutional factors play their part—not all cattle-drivers or long-term prisoners develop paranoia—but it would seem that such factors are rarely sufficient by themselves to precipitate this illness. Long-standing exogenous factors are also required in the case of the African.

We have remarked in Part 4 that environmental factors appear to play a larger part in the production of paranoid than in that of hebephrenic schizophrenia. If schizophrenia exhibits itself as a *series* of syndromes—hebephrenia, paranoid schizophrenia, and paranoia—with increasing preservation of the personality, then this finding in regard to paranoia is not surprising.

(f) *The relation of mania to responsibility and the absence of depression (manic-depressive type).*

The syndromes classified together under the title "Manic-Depressive Psychoses" may in particular individuals (in Europeans) manifest themselves as recurrent or isolated attacks of depression or mania, or manic-depressive cycles.

Henderson and Gillespie discuss the aetiology of the manic-depressive psychosis as though all these varieties were manifestations of one disease. Curran and Guttmann, more warily, say, "Manic and depressive psychoses are grouped together because (1) they may alternate in the same case; (2) some of the striking symptoms may be regarded as exact opposites." The twin research figures available to me show a 70 per cent. concordance for manic-depressive insanity in monozygotes and a 16 per cent. concordance in dizygotes, but do not discriminate in regard to different varieties of this psychosis.

Our experience in Africans, in whom mania was seen but not depression, suggests one of two possibilities: (1) that the genetic inheritance of different

types may be independent, or (2) that the genetic inheritance may be the same in all, but the African's environment may in some way prevent its manifestation as depression. These two possibilities will be discussed in turn.

(1) Our first possibility implies that types of the manic-depressive psychosis in which depression is manifested have a distinct genetic inheritance from types in which depression plays no part, and that the former is genetically absent in our Africans. In this case, no further comment on our relatively small figure (3·8 per cent) for the psychosis as a whole would be required.

It is easy to imagine that, if the inheritance of the two types were distinct, the depressive types would never establish themselves in a primitive community, as affected stocks would quickly die out. A depressive patient would be likely to die or commit suicide in his first attack, and seldom live to propagate in his first remission.

It seems unlikely, however, that this explanation is correct, as the distinct nature of the inheritance would presumably have been noted elsewhere. Moreover, depression presumably occurs in American negroes (or its absence would have been remarked upon), and we can only assume that their genetic inheritance is not grossly different from that of our Africans.

(2) Our second possibility implies that mania and depression are manifestations of one disease, but that environmental factors play a larger part in the symptomatology of this disease than has been recognized. In this case, our small figure for the psychosis as a whole requires further comment.

In regard to the psychopathology of mania, Henderson and Gillespie say that " from some very strong wish that has been repressed into unconsciousness, the repression is at least partly removed, and the patient feels and behaves as if the wish had been fulfilled " ; in regard to that of depression they say, " the precipitant is the reanimation . . . of an unconscious wish which if allowed to reach consciousness, would ultimately destroy the personality. Hence a gigantic effort is made at repression, and the inhibition becomes generalized, so that all thinking is interfered with." The fact that this psychosis in our Africans always takes the form of mania might therefore be due to the fact that the repressing and inhibiting elements of his mind have so far been less exercised and are weaker than these elements in the European, and that in any conflict between the repressed and the repressing elements the former are accordingly more likely to triumph at the present stage of his development.

If for this or some other cultural reason, the manic-depressive psychosis always takes the form of mania in our Africans, it remains to discuss the relative rarity of the psychosis as a whole.

Now the striking point about our cases (of acute mania) is that a large proportion (at least 42 per cent.) were holding responsible positions, and apparently possessed an attitude of personal responsibility quite foreign to the normal African attitude. For all other types of insanity combined, the equivalent figure is 3·6 per cent. One is led to wonder, therefore, whether the occurrence of this psychosis is not bound up in some way with the possession of a certain attitude to life.

In any race it would seem that the attitude of the manic is, " I am a wonder-

fully successful and important person and my success is entirely due to myself," while that of the depressive is, " I am a miserable failure, and this is entirely my own fault." The two conditions have this in common—a strong sense of personal responsibility. It is customary to assume that the attitudes expressed by manic-depressives are secondary to and rationalizations of the mood change. Our observation does seem, however, to raise the possibility that the attitude may play a larger part in the aetiology of this disease than is usually recognized. The hereditary factor in the manic-depressive psychosis is now known to be large, but we submit that it is unlikely to manifest itself except in the presence of an attitude of individual self-sufficiency.

Perhaps the most striking difference between the European and African cultures is that the former demands self-reliance, personal responsibility, and initiative, whereas there is no place in the latter for such an attitude, as we have seen in Part 6. There seems, moreover, no need to assume that the difference in attitude is intrinsically racial—the individualistic attitude can seldom develop in primitive society, but must thrive in communities such as those of Western Europe, whose watchword (in recent generations and apart from Sundays) has been, " Each man for himself and the devil take the hindmost." On this theory, the fact that the incidence of the manic-depressive psychosis in American negroes is no lower than that in American whites is well explained.

If this theory is correct one would expect to find among Europeans a higher incidence of this psychosis in the higher social strata ; in fact Landis and Page found it accounted for 16·7 per cent. of first admissions to private hospitals and for only 12·9 per cent. of first admissions to state hospitals, and Dayton found it ranked fourth among the types of insanity in persons of comfortable economic status as compared to seventeenth in persons dependent on aid from public funds. One would expect a higher incidence in teetotallers than in drunkards : Dayton found it ranked fifth among the types of insanity in the former as compared to nineteenth in the latter. One would expect to find a low incidence in a period of war (when the State tends to shoulder the individuals' responsibilities) and a high incidence in periods of decreasing employment or economic depression : Dayton's figures of the incidence of this psychosis for the years 1917 to 1933 fulfil this expectation. Perhaps above all one would expect to find a higher rate among Protestants than among Catholics (since in theory at least responsibility is personal in the former and largely shared with the Church in the latter) : Dayton, among persons over the age of 12 years, found a rate of 533 per 100,000 Protestants and of 277 per 100,000 Catholics.

* * *

If the occurrence of the manic-depressive psychosis is partly dependent on an attitude to life as here suggested, then a resemblance to the schizophrenic psychoses appears, for it has long been held by one school of thought (following Meyer) that schizophrenia is dependent on certain attitudes to life, albeit very different ones from that which may operate in the manic-depressive psychosis.

We are therefore led to wonder if the defunct theory of polymorphism might not be resuscitated in a limited form as applicable to these two psychoses. Henderson and Gillespie say, " There is an impression that the children of

manic-depressives show an abnormal liability to schizophrenia," and if this impression proves correct, it might perhaps be most simply explained on a polymorphist theory. The rather common occurrence of either psychosis showing features characteristic of the other, and even of frankly undiagnosable mixtures of both, might also be best explained in this way.

(g) *The absence of ideas of guilt in involutional melancholia.*

Our involutional melancholics fitted quite well into the picture of this condition as seen in Europeans, except that ideas of unworthiness or guilt were replaced by persecutory ideas.

There seems little doubt that the mood change in this condition is primary (being related to endocrine disturbance), and that the delusions are in the nature of secondary rationalizations. As we have seen in Part 6, ideas of guilt are quite foreign to the primitive African, and persecutory ideas are predictable as his rationalization of such a mood change as depression.

That cultural influences may determine the type of rationalization has been demonstrated by Seligman, who noted that delusions of a religious nature with a sense of guilt were practically absent in Japan, where religion is cheerful and assumed primitive virtue rather than original sin.

Our observation supports this finding, and seems to require no further comment.

(h) *The common occurrence of "frenzied anxiety" and the apparent absence of most of the types of anxiety state seen in Europeans.*

In regard to the aetiology of anxiety states, Henderson and Gillespie say that " their origin may be found in all the types of conflict of individual needs with reality. . . . Clinical observation shows clearly that when anxiety arises from any conflict it diffuses itself generally throughout the mind, that if this conflict is not squarely faced, in the course of its diffusion the anxiety becomes concentrated again in a manner determined by the individual's mental history to some special topic in itself apparently of indifferent emotional value, and that a state of morbid anxiety results."

It would seem that at the point where the anxiety " diffuses itself generally throughout the mind " the primitive can sustain his anxiety no longer. His emotions in general are ill sustained, as we saw in Part 6, he feels that something must be done, his aggressive impulses are allowed full play, and he runs amok with indiscriminate violence. His ill-developed powers of self-criticism with a constant tendency to look outside himself for the causes of misfortune are the main factors in the onset of this reaction type.

A further factor is believed to play a part, and helps to explain why the impulse to action so often takes the form of homicide.

In many cases, such as those in which the patient is physically ill or believes himself bewitched, the anxiety is really a fear of death. Now according to Porteus it is one of the characteristic patterns of Bantu belief that all life is related in a mysterious way, and that there is only a certain amount of life force ready for disposal. This belief affects Bantu custom in many ways,

e.g. a mother must not become pregnant again till the last child is weaned, new life must not come into contact with new life elsewhere, twins are unfortunate, a pregnant woman must not visit a sick person, and so on.

We question whether this belief is confined to the Bantu. Opportunities for unlimited increase of human life must everywhere (especially in primitive life) be few and far between, and usually achieved at the expense of human life elsewhere; and this experience would be readily translated by primitive people into a belief in a limited amount of life force.

It is therefore suggested that, when a Bantu (and probably any other race that exhibits this syndrome) kills in a state of frenzied anxiety, he believes in his heart of hearts that *any* death will appease the gods, and that his own life can only be saved in this way. In Case 1005 this point is well illustrated.

Biologically, the physical concomitants of fear (or anxiety) prepare the body for fight or flight, but in our civilization the impulse to action is suppressed, with results which, though advantageous for society, are often disastrous for the individual.

(i) *The absence of obsessional neuroses.*

Primitive culture is essentially obsessive—compulsive. Behaviour is normally governed by a host of precise rules and, if misfortune occurs, further complicated procedures must be followed.

In Western society the individual must often develop his own standards of conduct. But such standards are never so satisfactory as those sanctified by tradition, for the individual cannot forget that he has as much right to modify them as he had to develop them in the first instance. Indeed many people attempt to fill the void by subjecting themselves to various bizarre or even whimsical disciplines.

The aetiology of the obsessional neurosis is not, according to Henderson and Gillespie, the same in all cases, but it would seem that it is only when the individual stands alone and must develop his own ethical code that this neurosis can develop.

8. Conclusion.

Judging from the American negro figures and from our own observations, we find (rather surprisingly) that the African's inherited tendencies to mental disease are probably not very different from the Europeans.

The African, in common with other primitive agricultural and pastoral peoples, has however evolved a social system that has probably remained substantially unaltered for many thousands of years. This system, though completely obstructive to any type of change or progress, must be well suited to man's mental needs, and rarely permits of situations that might cause mental breakdown (except of the transitory type that we have designated frenzied anxiety).

The essential feature of this system is that the individual, in his social

behaviour patterns, *is never introduced to abstract concepts*, but obeys meticulous rules in a host of concrete situations. Internal consistency is not developed or required, and phantastic thinking prevails.

Civilization of the modern European type, with its insistence on individual self-sufficiency, derives from the ancient Hellenic culture. In its modern expression, however, it dates from the Protestant and the later Industrial Revolution, and is only a few hundred years old.

Its essential feature is the constant necessity for personal choice and personal decision—the *constant application of general codes to particular situations*. Its implications are manifold. It implies an attitude of responsibility for the past, and of concern for the future. It implies the emergence of a dominant "self-regarding sentiment," to which the expression of conflicting urges must be reconciled. It implies the *generalization* of inhibition, for whereas the African attitude is "one *may* do anything not specifically prohibited by society," the European attitude is "one *may not* do anything unless specifically permitted by oneself." It implies the development of endogenously conditioned and *sustained* moods, as opposed to environmentally determined and transitory emotions. Finally, directed thinking is required and a higher minimum level of intelligence.

These developments, implicit in a change from social to personal control, must seriously disturb an equilibrium that had until recently been stabilized for so long. They appear to account for the occurrence of certain types of mental disturbance in particular, and its high incidence in general in Western Europe and America to-day.

The habit of directed thinking and all that this implies in the way of intellectual self-confidence and fearlessness has doubtless come to stay. If evolutionary progress, as Huxley says, has always followed the lines of increased control over and independence of the environment, then directed thinking fulfils these requirements and is a valuable human asset.

But this advance need not imply *complete* self-sufficiency, and a personal responsiblity that embraces *all* aspects of life. The need for co-operation is not thereby diminished but, with the growth of recorded knowledge, is increased. Nor is such an attitude adequate to man's sense of values.

Society is not absolved by this advance from *its* responsibilities to the individual, and we are led to surmise that the next steps in human progress must include a release of directed thinking into more totally satisfying and ultimately useful channels by a partial return to primitive ways in the shape of some form of social protection and control.

Summary.

The scope of the present article is to describe the nature and extent of mental derangement as it occurs in African natives of Kenya; to compare the picture with the very different one which occurs in North American negroes and in Europeans; to explain the differences observed by reference to environmental factors; and to discuss the significance of our findings in regard to the aetiology of mental derangement in general.

The clinical material consists of 609 patients admitted to Mathari Mental Hospital during the 5-year period 1 January, 1939, to 31 December, 1943.

The article falls into eight parts:

First: A short summary of the historical background, to demonstrate that, until quite recently, the natives of the interior were untouched by alien influences.

Second: A short summary of the racial and anthropological background. Kenya lies on a highway of Hamitic infiltration into Negro Africa, and every type from pure Negro to pure Hamite can to-day be seen. The five main racial and cultural groups are described.

Third: A short summary of the public health background. This is a description of the main public health problems in Kenya in so far as they differ from those found in Great Britain.

Fourth: A study of the facts of mental derangement as seen in admissions of new cases to the Mathari Mental Hospital. The facts are studied under five headings: (a) total incidence, (b) sex incidence, (c) racial incidence, (d) incidence in relation to detribalization, and (e) the types of mental derangement.

Fifth: Based on the studies undertaken in Part 4, the more striking peculiarities of mental derangement as compared with Europeans and American negroes are here tabulated.

Sixth: A description of African culture, thinking and attitude to life.

Seventh: An attempt to explain the peculiarities of mental derangement in the African listed in Part 5, largely with reference to the attitudes described in Part 6.

Eighth: This part attempts to review the picture as a whole, and to relate its essentials to a background of social and mental evolution in a frame of time—past, present and future.

* * *

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A CLINICAL AND PSYCHOLOGICAL STUDY OF ECHO-REACTIONS.

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THE automatic repetition of words heard (echolalia) and actions seen (echopraxia) has long been known to occur in certain psychotic states in cases of aphasia and in low-grade mental deficiency. Echographia was established as a sub-type of echopraxia (Pick, 1924). The similarity of the pathological echo-reactions with phenomena occurring normally in childhood during the early period of speech development was pointed out by Wyllie (1894) and Pick (1902), who studied them in aphasia. The most recent study dealing with echo-reactions is that of D. E. Schneider (1938), who described the syndrome echolalia, echopraxia, grasping and sucking. Most previous writers investigated echo-reactions either from the neurological or psychiatric point of view and not enough attention has been paid to the comparative aspect and to the question of a common underlying mechanism. In this study an attempt has been made to investigate that problem.

Echo-reactions have been observed chiefly in the following conditions: (1) Aphasia of the "transcortical" type and advanced dementia resulting in a similar speech disorder. (2) Low-grade mental deficiency with incomplete development of speech. (3) Chronic epilepsy. (4) States of clouded consciousness of various origins. (5) Catatonic states. (6) Early period of speech development in childhood. (7) States of fatigue and lack of attention in the normal.

Echo-reactions in Aphasia.

In certain cases of aphasia (transcortical aphasia of the classical scheme) echolalia is a marked feature. Although the anatomical and physiological concepts underlying that term are now obsolete, the existence of the aphasic syndrome described by that name has been established beyond doubt. It was studied most thoroughly by Kurt Goldstein (1917). Spontaneous speech as well as understanding of spoken language are, as a rule, considerably reduced in cases with marked echolalia. Arnaud (1887) was the first to distinguish two types of echolalia which may be observed in the same patient; the one consisting of automatic repetition of words which were not understood; the other in which apparently automatic repetition helped the patient towards understanding the words spoken to him. Pick (1902) followed up Arnaud's observations in studying the changes which automatic echolalia underwent in the course of restoration of speech. Compulsive parrot-like repetition changes into "mitigated echolalia," i.e. questioning repetition of the words heard.

That type of echoing may become modified by introduction of the first person singular into the sentence repeated by the patient, and may be followed by an intelligent response to the question or order. With complete restoration of the understanding of spoken language, the tendency to repetition disappears. Clinical observation of suitable cases confirms Pick's description of the various phases of echolalia. In cases in which the restoration of understanding is incomplete, the echo-reaction becomes stabilized in one or the other phase. The transition from automatic echolalia into almost deliberate repetition argues against the assumption that the automatic echo-reactions are fundamentally different from the others.

In 1935 the present writer* reported on a hitherto unknown phenomenon in cases of "transcortical aphasia" which seemed to throw new light on the nature of the echo-reactions. It was first observed in a 60-year-old woman with a right-sided hemiplegia whose spontaneous speech was reduced to the recurrent utterance "te-te." Understanding of spoken language was almost completely lost. Automatic speech, such as counting and singing, could be elicited by appropriate stimulation. The patient could not repeat spoken language intelligently on order, but she showed marked echolalia. The latter occurred only in the conversational situation, i.e. when the patient was addressed. If the examiner turned his back to her and spoke to himself or to somebody else, however loudly and slowly, she did not echo. She did so, however, when her eyes were covered so that she could not see whether or not she was addressed. The same behaviour was observed in other aphasic patients with echolalia. It proves that echolalia is not indiscriminate automatic repetition of words heard, but depends on a specific setting, i.e. the conversational situation.

Completion phenomenon.—If the examiner spoke to the patient sentences of simple contents slowly without completing them, the patient responded, as a rule, not with echolalia, but with completion of the sentence. Sometimes she would echo the last word spoken by the examiner and then spontaneously complete a sentence.

Specimen responses: ("How did you sleep last . . . ?") "Night" or "Last night." ("You are a good . . .") "Woman." ("Shake . . ." "Hands."

When there was a variety of possibilities open to her for completion her responses varied according to her mood and to the situation, e.g. ("Life is . . .") "Hard" or "Good" or "Difficult." ("The weather is . . .") "Fine to-day" or "Bad to-day." ("What did you have for . . .") "Supper" or "Lunch" or "Breakfast," according to the time of day. Grammatical mistakes made on purpose by the examiner in the sentence to be completed, tended to inhibit the completion response. The patient also reacted to changes in the meaning of sentences, e.g. the sentence "Life is . . ." was invariably completed by her according to her mood, but she was perplexed and did not react at first when the sentence was worded "Mr. Life is . . ." However, after a moment's hesitation, she continued "A man."

The completion response was always a spontaneous reaction and appeared

* "On Transcortical Aphasia," paper read at the International Neurological Congress in London, 1935, *Zeitsch. ges. Neur. Psychiat.*, 1936, **156**, 778.

to be as automatic and compulsive as echolalia. The patient showed marked signs of satisfaction when she had succeeded in completing a sentence which she had never been requested to complete. Even if she had, her lack of understanding of spoken language would have prevented her from appreciating such an instruction.

If the examiner completed a sentence himself the patient started accompanying him from the moment she would have been able to take over.

The completion phenomenon has never been found missing by the author in cases of aphasia with echolalia since it was first observed. With the restoration of understanding the completion phenomenon undergoes changes similar to those of echolalia. Automatic completion is superseded by a probing, sometimes questioning, continuation of the sentence, not unlike the reaction which one would expect of a healthy subject who, owing to lack of attention, does not fully appreciate what he is expected to say. With progressive improvement of speech the spontaneous completion response becomes more difficult to elicit and gradually disappears.

The completion phenomenon in cases of lost or greatly impaired receptive speech is of interest for a theory of understanding of spoken language. It suggests that the patient, although unable to understand, has some knowledge of what the other person is saying and intending to say. That knowledge is not identical with what is called understanding of spoken language; but the capacity of producing, within limits, what the interlocutor is going to say appears to be a precursor of full comprehension.

Compulsive repetition could in those cases be replaced by compulsive completion of schemata of thoughts and sentences, given suitable experimental conditions. The interchangeability of, and the overlapping between, echolalia and completion phenomenon suggested that the psychological mechanism underlying both reactions was the same. Even without consideration of the completion phenomenon, the old conception of echolalia as reflex repetition of words heard appeared unsatisfactory, as the repetition was, as a rule, confined to the conversational situation, which implies a specific relation to the person uttering the word. (Exceptions to that rule will be discussed later.) The compulsive completion of sentences and thoughts into which echolalia could be changed did not fit into the theory that the latter was simply an expression of a primitive tendency to automatic imitation. In completing sentences of another person with whom the patient has established rapport in the conversational situation, he is making that person's intentions his own and is thus able to follow them to their conclusion, provided the thoughts expressed and their formulation are within the range of his knowledge and speaking abilities. The mechanism underlying the tendency to adopt another person's intentions and to act like him was called "identification" (Freud, 1922). The present writer (1935) proposed that the completion phenomenon and echolalia were instances of identification on a primitive level. That concept, unlike the previous ones, took into account the condition under which echolalia occurred, as well as the completion phenomena. Schneider has later (1938) adopted the same interpretation of the echo-reactions.

The completion phenomenon described here requires also to be considered

in the light of the Gestalt psychology, to be understood more fully. By completing sentences spontaneously the patient showed the tendency to change a "bad Gestalt," i.e. an incomplete structure, into a "good" one, i.e. a complete structure. Completion phenomena, especially in visual and auditory perception, played an important part in the foundation and development of Gestalt psychology. Reference to that aspect will be made later in this article.

Echo-reactions in Low-grade Mental Deficiency with Incomplete Speech Development.

The study of the speech of the idiot seems of little value for the understanding of aphasic phenomena if one understands aphasia to be the complete or partial loss of the normal faculty of speech. If, however, we regard aphasia as the lack of symbolic formulation and expression (Head, 1918) and take into account the regressive character of aphasic reactions, as recognized first by Hughlings Jackson, the rudimentary language of the low-grade mental defective becomes a matter of great interest in the study of acquired speech disorders. There can be no doubt about the relationship between the language of the idiot and certain early phases in the speech of the child. The former can be regarded as speech arrested at a certain phase of its development.

The supposition that there is an intimate relationship between aphasia and the rudimentary speech of the mental defective is borne out by the study of echo-reactions. The various stages of echoing as seen in aphasics can be demonstrated in low-grade mental deficiency. The completion phenomenon corresponding to the type of echolalia present could also be elicited in those cases, and both were used by the patient as a means of learning to speak, in a similar way as they are used in the early stages of childish speech.

The following cases are examples from a considerable number of low-grade mental defectives with echo-reactions whom the writer has observed in the course of his studies.

CASE 1.—*Seventeen-year-old male low-grade mental defective with major epileptic fits.*

The patient showed echolalia, echopraxia, and echographia. He had athetoid movements in the upper extremities and spontaneous movements of the neck, reminiscent of torsion spasm. There were no pyramidal signs. The patient showed the sucking reflex, but no grasping. Echolalia occurred only in the conversational situation, and echopraxia and echographia only when personal rapport had been established. Understanding of spoken language was very limited. Simple orders were carried out and questions which the patient could understand were answered, as a rule, without echoing. Correct responses to more difficult questions or orders which he could still understand were often preceded by echolalia. Otherwise echolalia was the only reaction to spoken language. Usually the word most stressed in the sentence was repeated. Foreign words were echoed with great accuracy. The completion phenomenon could easily be elicited. The patient spontaneously completed the sentences correctly, provided they were within the range of his speech, which was very limited. Completion was, as a rule, preceded by echoing of the part of the sentence spoken to him. He showed the same tendency when serial numbers, letters of the alphabet and parts of nursery rhymes were spoken to him. It was comparatively easy to teach the patient sentences which he learned to complete spontaneously.

Extract from examination records.—("What is your name?") "Name? Peter H."—("How are you?") "Are you. Very well, thank you."—("Any

pain ? ") " No pain."—(" Where do you live ? ") " Live."—(" Crichton Royal ") " Royal."—(" How *old* are you ? ") " Old ? ten."—(" How old *are* you ? ") " *Are* you."—(" What is the time ? ") " What is the time ? Twenty minutes past eight " (incorrect).—(" Are you a good boy ? ") " Good boy, that's a good boy."—(" Write your name ") " Write your name." (Pt. takes the pencil and writes his name in capital letters.)—" Shut your eyes ") Does so without echoing. —(" All right ") Opens them.—(" Where is your ear ? ") " Ear ? " Points to his left ear.—(" Where is your nose ? ") Points to his nose.—(" Where is your left hand ? ") " Hand ? " Raises both hands. He is unable to distinguish between right and left.—Subsequent orders to get up, to sit down, to put out his tongue, etc., are carried out promptly without echoing.—(" 1, 2 ") " 1, 2, 3, 4, 5, 6."—(" a, b ") " a, b, c, d, e, r."—(Bonjour ") " Bonjour."—(" Guten Tag ") " Tag."

Completion phenomenon.—(" How . . . ") " How are you ? Very well, thank you " ; or, on another occasion, " How old are you ? "—(" What is your . . . ? ") " Name ? Peter H."—(" Are you a . . . ? ") " Are a good boy ? "

The patient completed sentences in a foreign language after they had been spoken to him four to five times. He also learned to count in a foreign language. When a story was slowly read out to him he repeated the words emphasized and accompanied the reading by echoing. The patient was shown familiar objects with the question " What is this ? " or " What do you call this ? " When he could name the object correctly (e.g. handkerchief, spectacles, matches, tie, pencil, keys, cat) he did so without echoing ; but he echoed the question when he could not name a pound note shown to him.

When the examiner spoke to himself, for instance looking at his watch and remarking on the time, the patient did not echo although he seemed to listen attentively.

Echopraxia.—Patient reacted with echopraxia to such actions only which he could carry out fully himself in the particular situation. He did not echo manipulations with objects which were not at his disposal. His behaviour proved that, in this case at least, echopraxia was not an indiscriminate automatic repetition of actions seen. The patient was echopractic only if the action he observed fitted into his " total situation."

Specimen responses.—The examiner successively coughed, whistled, got up from the chair, sat down, sneezed, put his tongue out, stamped his foot three times, tapped on the table four times. The patient, without being requested to do so, repeated those actions promptly and correctly. When the examiner took out his watch and wound it, or took his spectacles off, or opened his purse or cigarette case, the patient, though following those actions attentively, did not even attempt to repeat them. However, when a coin was put on the table in front of the patient and thrown into the air, he promptly took the coin and repeated the action. When the examiner pinched patient's right hand he immediately pinched his own right hand. He did exactly the same when the examiner pinched his own right hand and he repeated other actions on his own body which the examiner performed on himself. When imitating the patient never trepassed beyond his own body. He did not reciprocate actions carried out against himself, but imitated or completed them on himself.

When the examiner pulled his tie out the patient, who on that occasion was not wearing a tie, did nothing ; on the following day, when he was wearing a tie, he repeated the action immediately.

Completion phenomenon.—When the examiner only initiated an action familiar to the patient without carrying it out, the patient, on his part, completed it.

Echographia.—The patient could, to order, write his name in capital letters and some letters of the alphabet. He could read only a few letters contained in his Christian name. When a pencil and a piece of paper were lying in front of him and the examiner wrote single letters or made simple drawings, the patient spontaneously copied them.

CASE 2.—*Low-grade female mental defective, aged* 26.

The patient had major epileptic fits in childhood. Her speech had not developed beyond the ability to form short sentences in telegram style and to understand

simple questions or orders. Familiar objects were named correctly. There was marked echolalia and the completion phenomenon could be elicited.

Specimen responses.—(" You are a good girl ") " Good girl."—(" You are a . . . ") " Good girl."—(" Get up ") Patient does it without echoing.—The patient had her hair cut on the previous day. (" Who has cut your . . . ") " Hair ? Hairdresser."—(" What is your name ? ") " Mary."—(" How are you ? ") " Very well."—(" Open your . . . ") " Mouth."—(" You are a silly . . . ") " Girl."—(" What date is to-day ? ") " Is to-day ? "—(" How long have you been in hospital ? ") " Hospital ? "

When the examiner turned his back to the patient and spoke in a similar manner as before, no echo-reactions ensued. When, however, her eyes were covered so that she could not see that she was addressed, she echoed promptly and completed sentences. The patient sang nursery rhymes when the beginning of a rhyme was sung to her.

There was marked echopraxia and a tendency to complete familiar actions initiated by the examiner. She followed the doctor's actions in the ward with great interest and tried to imitate them, even when they had not just been carried out ; for instance, she would take the reflex hammer from a tray and test her patellar and ankle jerks, or take a needle and stroke her sole. On two occasions she took a spatula and a torch, opened her mouth and carried out the movements that she had seen the doctor carry out in the examination of the pharynx. She also imitated activities of the nurses. The selective nature of echopraxia was very marked in this case.

CASE 3.—*Low-grade mental defective, aged 47, with infantile hemiplegia.*

The patient showed mitigated echolalia and the corresponding phase of the completion phenomenon. Often her echo-reactions were similar to those of a normal subject who is inattentive. The patient spoke little spontaneously. Her sentences were of the telegram style. Understanding of spoken language, although limited, was better than in the cases described above. Naming of simple objects was intact. She could read and write short words.

Specimen responses.—(" When were you born ? ") " When I was born ? 1889."—(" What sort of weather are we having to-day ? ") " Weather ? It is raining, isn't it ? "—(" Have you got any children ? ") " Children ? I am not married."—(" Why do you repeat everything I say ? ") " Beg pardon. I did not listen."—(" I have a new suit ") " Oh, you have a new suit, doctor."—(" I have a brown wallet ") " Brown wallet."—(" Have you stolen a lot ? ") " Stolen? I am a good girl."

In this patient whose understanding of spoken language was fairly good, the completion phenomenon could only occasionally be elicited and if it occurred, it was of the probing, questioning type. For instance, (" Open your . . . ") " Mouth ? " and does it.

The similarity between the mitigated echo-reactions of this patient and those of a normal subject in a state of inattention was very obvious. It was noteworthy that the patient herself explained the tendency to repetition as due to lack of attention. She appeared to repeat in order to understand better. If, however, her attention was stimulated by the provoking nature of what was said to her, mitigated echolalia was either followed by an intelligent response or she answered without echoing.

Other cases observed showed reactions similar to those described above. In some of them, especially in those with very rudimentary speech, the sucking reflex was present. A considerable proportion of low-grade mental defectives with echo-reactions were either subject to major epileptic fits or had had such fits in childhood.

Echo-reactions in Chronic Epileptics.

It has been pointed out above that a considerable proportion of mental defectives who showed echo-reactions were epileptics. Echoing is sometimes observed in cases of chronic epilepsy who are not mentally defective. It occurs in the state of clouded consciousness following major fits and also in

epileptic twilight states. Occasionally it can be found as a habitual reaction in advanced epileptic dementia when mental activities in general, and speech in particular, are slowed down. Provided the disturbance of consciousness at the time of the examination was not too severe, the completion phenomenon, too, could be observed in epileptics.

It seems that echolalia in epileptics was seen more frequently by the old psychiatrists than now-a-days, when the frequency of fits is reduced by anti-epileptic treatment. Tuke (1876) spoke of the "echo-sign in the epileptics" and described it as a typical post-convulsive phenomenon in chronic cases.

Echo-reactions in States of Clouded Consciousness.

In states of clouding of consciousness due to brain lesions or intoxication, echolalia often occurs. It has been described in cases of coal gas, barbiturate and alcohol poisoning, and in various forms of delirium and coma. The occurrence of echolalia during the restoration of consciousness after a major epileptic fit has been mentioned above. If return of consciousness is gradual the transition from automatic to mitigated echolalia can sometimes be observed. Echolalia is, of course, possible only if the disturbance of consciousness is not too deep to prevent the perception of outside stimuli. The completion phenomenon could occasionally be elicited in states of clouded consciousness.

Schneider (1938) has noted the occurrence of echolalia in the hypoglycaemic coma induced therapeutically. Mayer-Gross and the present writer (1945) have pointed out that it is apt to emerge in a phase of the awakening from hypoglycaemic coma in which paraphasia and a tendency to clang associations and iterations were also present. Echolalia was more frequent in cases of relatively quick recovery of consciousness from insulin coma. Sometimes the patient tended to echo words or even noises not directed to him. It is clear that in that condition the patient is unable to differentiate between words directed to him and to others. He behaves like the aphasic patients whose eyes are closed. The occurrence of echolalia in insulin coma has no relationship to the clinical type of the psychosis. It is noteworthy that the stage of consciousness in which echolalia sometimes makes its appearance in the awakening from insulin coma is preceded by a phase in which the sucking reflex can often be observed. Those two phases may overlap. The co-existence of sucking and echoing is obviously not incidental, as both are primitive oral reactions to outside stimuli.

Echo-reactions in Catatonics.

The echo-reactions in acute catatonics impress the observer as even more automatic than in other conditions. Mitigated echolalia, in which the patient repeats apparently with a degree of understanding, is uncommon in those patients. Only on two occasions has the writer observed the completion phenomenon in acute catatonic states. The rarity of the latter and of mitigated echolalia in acute catatonics is obviously due to the fact that they imply a degree of mental co-operation which those patients do not as a rule provide.

Echo-reactions can sometimes be observed in advanced cases of chronic catatonia. They may be present over many years, but they cannot be elicited with the same regularity as in aphasics and mental defectives. They are subject to the same variability as cataleptic phenomena and schizophrenic mannerisms. The writer has observed two cases in which echo-reactions became permanent symptoms in deteriorated catatonics many years after the onset of the psychosis. Both patients, prior to their illness, had been intellectually backward, though not grossly defective. This is of interest in view of the occurrence of echo-reactions in low-grade mental defectives. The following is a short report on the case observed recently.

CASE 5.—*Male chronic catatonic, aged* 45.

Has been in hospital since he was 20. He started talking at the age of three and was always regarded as somewhat dull and backward. His progress at school was below average, but he could express himself very well and learned to read and write without much difficulty. He left school at the age of 14 and went to work on a farm. His employer described him as a good worker, though slow in the uptake. No intelligence tests were carried out, but the history was suggestive of high-grade mental deficiency. At the age of 16 he became odd, lost interest in his work and isolated himself. His condition grew gradually worse, his habits became faulty and he had impulsive outbursts. On his admission to hospital in 1922 he presented the picture of a deteriorated catatonic. He did not speak spontaneously. When questioned he replied very slowly and in monosyllables. He had periods of inaccessibility during which he was mute and negativistic. A few years later he became very noisy and was destructive at times. In 1937 echolalia was first noted and has remained very marked since. He also shows echopraxia. Catalepsy with flexibilitas cerea are present.

The echo-reactions in this patient are very similar to those seen in low-grade mental defectives with incomplete development of speech, but they are less constant. He would often, with or without echoing, answer a simple question correctly or comply with a request to which, on other occasions, he would respond only with echolalia. When addressed by the doctor he would often add " Sir " to the words echoed, thus giving his reaction a conversational character. He did not echo when not addressed. The completion response could be elicited as a rule, but sometimes it was missing when he failed to establish rapport with the examiner. When echoing or completing sentences he sometimes made additions referring to the doctor or himself.

Specimen responses.—(" It is cold to-day ") " It is cold to-day, Sir."—(" How long have you been here ? ") " Been here ? "—The following day he replied to the same question " A good long time."—(" Do you like it here ? ") " Like it here ? " —(" Do you hear voices ? ") " Yes."—(" What do they say ? ") " Say ? "—(" What is your . . . ? ") " Name ? " The following day he responded to the same words with " Birthday ? "—(" How do you like being . . . ? ") " In here ? "—(" Write your name ! ") " Write your name."—(" Write your . . ! ") " Write your name, you fool ! "—(" It is rather . . . ! ") " Rather cold to-day, I think."—(" You are a silly . . . ") " Silly fool."—(" 1 ") " 1, 2, 3."—(" a ") " a, b, c, d."—The patient sings the National Anthem and a nursery rhyme without being requested to do so when they are begun by the examiner. When addressed in a foreign language he always echoes, sometimes adding " Sir."

The patient imitates simple actions carried out by the examiner, such as getting up, sitting down, raising an arm, tapping on the table, etc. However, when asked to write his name or words on dictation he only scribbles about. Otherwise his echopraxia is of a similar type to that of the first case of mental deficiency described above.

It is interesting that in this patient, who in all probability was a high-grade mental defective, the schizophrenic deterioration resulted in a regression to a

level of speech observed in low-grade mental defectives. Without the aid of the history the patient could easily be mistaken for such a case.

Echo-reactions during the Early Stages of Speech Development.

Echolalia during the early stages of speech development is well known to the psychologist. A tendency to imitation of gestures, inarticulate sounds and the inflection of a voice can be observed at as early an age as eight months. Articulate echolalia rarely occurs before the age of two. Echolalia is very marked in some children, while it may be completely lacking in others. Froschels (1918) suggested that the emergence of echolalia in childhood depended upon a discrepancy between a strong impulse to speak and a poor ability to understand. Children in whom the impulse to talk is weak in the early stages of speech development, as well as those whose understanding is fairly advanced, are not likely to show marked echolalia.

In echoing words and actions the child identifies itself with persons of its environment, and especially with those to whom it is attached emotionally. Piaget (1932) has pointed out that the element of play is of great importance in the imitiative behaviour of the child. He differentiates between egocentric and socialized functions in the language of the child and does not agree with Janet and Baldwin, who regard the childish imitation as a confusion between the "I" and "Not I." According to Piaget, the game of imitating, although it seems to apply a social attitude, is essentially ego-centric. He believes that the copied movements of words have nothing in them to interest the child and that there is no adaptation to anyone else. "The child does not know that it is imitating, but plays his game as if it were his own creation. That is why children up to six, when they have had something explained to them, and are asked to do it immediately afterwards, invariably imagine that they have discovered by themselves what in reality they are only repeating from a model. In such cases imitation is completely unconscious." Piaget's observations prove the enormous power of the tendency to identification in childhood. According to Freud, identification is for the greater part an unconscious process. As it implies a relationship to another person it is a fundamentally social mechanism. The game of repeating words heard is one of the means in which the child identifies itself with its models.

The echo-reactions of the child are not as compulsive and automatic as in aphasia or mental deficiency. They depend a great deal on the child's mood and on its willingness for imitation. They also show a considerable selectivity. The same applies to the completion phenomenon which can be easily elicited in young children. Like the adult aphasic or mental defective, they show a tendency to carry on with sequences initiated by another person and they avail themselves of it for the purpose of learning speech patterns. The readiness of the child to imitate speech and to complete sentences is one of the most important means of teaching a child to speak. With the progress of spontaneous speech and understanding of spoken language, reactions corresponding to mitigated echolalia and its counterpart of the completion phenomenon make their appearance. Those reactions can also be observed long after speech

is fully developed whenever a difficulty in understanding arises. Such difficulties may be due to lack of comprehension or of attention. It can be seen from those observations that echo-reactions in mental defectives have much in common with those of the normal child.

Echo-reactions of the Normal Adult in States of Fatigue and Lack of Attention.

In conditions of drowsiness and fatigue when attention to external stimuli is low or diverted, and comprehension of spoken language suffers as a result, the normal subject sometimes shows echolalia, usually of the mitigated type. In those states he may even occasionally respond to words not directed to him. Sometimes such reactions can be elicited by speaking to a person who is in a state of awakening from natural sleep. Another instance is the, usually mitigated, echolalia which may occur when a person whose full attention and interest is taken up by his own thoughts or by some other pre-occupation, is addressed unexpectedly. He either would not respond at all or he only half listens, in which case he may respond with mitigated echolalia ; for instance, the question " What is the time ? " may not elicit any response ; or it may be echoed automatically without being answered, or it may provoke mitigated echolalia (" What the time is ? ") followed by an appropriate reply. In persons who are in a state of reduced alertness to outward stimuli, characterized by the layman as " absentmindedness," such reactions are not uncommon and have become a topic of popular jokes.

Conditions in which the normal subject encounters difficulties in understanding what is spoken to him may result in the emergence of echo-reactions, especially when, at the same time, attention is faulty. One of those conditions is the stage of learning a foreign language when understanding is still incomplete. In that stage the student is in a situation not unlike to that of a patient suffering from auditory aphasia, and he will often find himself repeating automatically, although not necessarily aloud, a question or a request directed to him, before responding intelligently. Mitigated echolalia, often almost deliberate, is not uncommon in that situation. In those echo-reactions of a person grappling with a foreign language, the mechanism of identification with the interlocutor for the purpose of better understanding of spoken language is obvious. There is also a tendency to verbalization and completion of sentences offered incomplete, as if to make sure of full comprehension. Those reactions lack the compulsive character of the corresponding reactions in pathological cases. With progressing command of the foreign language they cease to occur, but they are more liable to reappear in states of fatigue and inattention than in the mother tongue. It is of interest in this connection that cases of aphasia in polyglots have been observed which showed echolalia in the last-learned language only (Bateman, 1870 ; Pick, 1916 ; Schneider, 1938).

Discussion.

The conditions under which echo-reactions are observed have the following features in common ; an impulse to speak on the one hand, and incomplete development or impairment of expressive as well as perceptive speech on the

other. That constellation can be demonstrated in the various states listed above. The conditions under which echopraxia can be observed are similar. There is an urge to act and an impairment or incomplete development of spontaneous activity. Probably the emergence of echo-reactions depends on a certain quantitative relationship between urge and impairment.

Some notes on the psychology of echo-reactions.—Echo-reactions in their various forms have above been interpreted as expressions of a primitive tendency towards identification with other persons. They are fundamentally social reactions and, in their automatic form, rudiments of such. The observations in children justify the assumption that when we first learn to use speech as a means of social intercourse we identify ourselves with those who are speaking to us. In that stage of speech development, and under certain abnormal conditions, repetition of spoken words often precedes intelligent response. The patient with the automatic form of echolalia does not get beyond the stage of repetition, i.e. identification with the interlocutor. Automatic echolalia can be described as a rudimentary response to being addressed in the conversational situation. Repetition preceding the response to spoken words can be observed in normal conversation only when the speech mechanisms are not functioning fully. It may also occur in a normal subject when, owing to difficulty of comprehension, an immediate intelligent response is impossible. An example of such a reaction is the semi-automatic or even automatic repetition of questions put to a candidate at an oral examination.

Echopraxia has its normal corollary in the unconscious imitation by a normal subject of another person's movements, especially when he is watching with intense interest and is instinctively putting himself in the other's place.

The question may be asked whether echo-reactions are not sufficiently explained as imitation phenomena, and whether anything is gained by introducing the concept of identification. Echo-reactions are, of course, instances of imitation on a primitive level and may be regarded as expressions of an instinct of imitation postulated by some writers. But by calling them imitation phenomena we do not go beyond the purely descriptive and almost tautological. In characterizing them as instances of identification on a primitive level we are introducing an interpretative term ; we are referring to the underlying mechanism which implies a certain emotional relationship to the model and thus accounts for the selective nature of the echo-reactions as far as the situation and the choice of the model are concerned. The fact that echo-reactions often occur only relative to certain persons has also been illustrated in Schneider's case material. It is well to remember that identification is the mechanism underlying the phenomena of suggestibility.

The term identification refers to the social aspect of the echo-reactions. That interpretation has to be supplemented by an examination of the phenomena from the point of view of Gestalt psychology. The great value of that approach for the formal understanding of the completion phenomenon is evident. Gestalt psychology also throws light on the dynamics of echo-reactions. Lewin's (1927) and Koffka's (1932) studies of behaviour are of particular interest in the analysis of echolalia and the associated completion phenomenon. A person who is addressed becomes, with the interlocutor,

part of a "behavioural field." The words spoken to him call forth tensions demanding discharge. Normally those tensions are released by an appropriate response. If this is impossible, owing to impairment of comprehension or of other faculties, the forces tending to "close the gap" in the total situation may lead to the emergence of at least a rudimentary response. Lewin called those tendencies "quasi needs," in analogy to the biological needs of the organism. Those "quasi needs" are created by events or objects which have the character of an appeal. In this terminology, words directed to a person produce the "quasi need" for an appropriate response. A pattern of a sentence offered incomplete calls for completion. The beginning of a sequence of numerals, of the alphabet, of a song, appeal for continuation. Echolalia can be regarded as an attempt at "closing the gap" in the conversational situation. Viewed from that angle echolalia, too, is a completion phenomenon.

The primitive level of mental activities on which automatisms take place reveals forces at work in the behavioural field which otherwise can be demonstrated only under carefully selected experimental conditions. However, it would not be possible to interpret fully the specific features of the echo-reactions on those lines without introducing the concept of identification which throws light on the nature of those forces.

Echo-reactions in schizophrenia, especially in catatonic states have been observed in association with signs of automatic obedience and other automatisms. They have been interpreted as due to the inhibition of intentions in the presence of a surplus of impulses, and as illustrations of the impotence of genuine activity (Mayer-Gross, 1928). They often co-exist with signs of negativism. The recognition of the fundamentally social mechanism of identification underlying the echo-reactions throws some light on their occurrence in schizophrenic states. They are expressions of an impulse to maintain social contact, however rudimentary, in a condition which is otherwise characterized by withdrawal from social intercourse. The co-existence of features of those contradictory attitudes is typical of the schizophrenic ambivalence which, in the sphere of psycho-motor activities, is most marked in the catatonic states. The form and nature of the echo-reactions are characteristic of a regression to a very early stage of behaviour. What has been said of the echo-reactions in early infancy by Janet and Baldwin, i.e. that they belong to a stage of development in which there still exists a confusion between the "I" and "Not I" applies equally to the schizophrenic regression in which the boundaries of the ego have broken down.

The description of echo-reactions as instances of automatic obedience given in current text-books is correct only in a physiological sense, in that the patient, under certain conditions, obeys a stimulus. Psychologically the response is not one of obedience but a mixture of refusal to respond appropriately and a rudiment of co-operation, whereby the former attitude dominates the situation. The behaviour of a child who has learned to speak but would react to words spoken to him with parrot-like repetition would be regarded as one of obstinacy and spite rather than of obedience.

Physiologically, echo-reactions have been classified by Wyllie (1894) as reflex phenomena. Pick (1902) regarded echolalia as a conditioned reflex

without, however, analysing the conditions under which it arose from the psychological point of view. In his view echolalia is a sign of the re-emergence of an infantile accoustico-motor speech reflex which is an important mechanism in the normal process of learning to speak. He regarded the echolalia of the aphasics as a release phenomenon due to loss of certain inhibiting functions of the left temporal lobe.

Automatic echo-reactions are primitive reponses illustrative of the over-excitability of the organism in conditions of disintegration of nervous functions, described by Goldstein (1942). The patients are " tied to the stimulus."

Echo phenomena are examples of automatisms in which the transition from the automatic to the almost voluntary and purposeful reactions can be observed. They illustrate Hughlings Jackson's contention that there is no antithesis between the automatic and the voluntary, and that there are only degrees from the " most automatic " to the " least automatic " which is the voluntary. The progress of evolution, according to Jackson, is from the former towards the latter, while dissolution progresses in the opposite direction. Either development can be demonstrated in the various phases of echolalia. Jackson's thesis of the fundamental unity between automatic and voluntary forms of behaviour bears out the necessity for the psychological study of both groups of phenomena.

Jackson pointed out the relationship of certain forms of automatisms to emotional states and illustrated this on many cases of aphasia. The fact that echolalia occurs only in the conversational situation when personal rapport has been established is of interest in this connection, as personal rapport implies a degree of emotional relationship to the interlocutor. The observation that many patients echo only when addressed by certain persons points even more strongly to the part which the emotional factor plays in the conditioning of echo-reactions.

Echolalia has sometimes been confused with palilalia. Both phenomena have occasionally been observed in the same case. It is doubtful whether they are closely akin, and whether Brissaud's (1899) description of palilalia as auto-echolalia refers to more than a superficial similarlity based on the tendency to repetition which they have in common. Critchley (1927), comparing the two phenomena, emphasized the absence of aphasia in cases with palilalia. He has pointed out that the latter is a disorder of speaking rather than of speech and is to be regarded as a purely motor mechanism similar to the festination of gait. Psychologically, palilalia lacks the social element inherent in echolalia. However, conditions leading to palilalia have something in common with those in which echolalia occurs, first of all the slowing up of mental activities, and sometimes clouding of consciousness. Both phenomena have been observed to co-exist in cases of post-encephalitic Parkinsonism (Bürger and Mayer-Gross, 1928 ; Critchley, 1927). They have in common an underlying tendency to repetition, but they belong to different levels of mental activities, that of echolalia being much lower than that of palilalia. This is also borne out by the not infrequent co-existence of echo-reactions with such primitive reflexes as sucking and grasping (Schneider's syndrome).

Pathology.—There is no unanimity about the localization of lesions respon-

sible for the emergence of automatic echo-reactions in pathological cases. Goldstein (1917) regarded frontal lobe lesions as important, while Pick (1916) expressed the view that echolalia was the result of a loss of inhibition of speech impulses due to destruction of the left temporal lobe. Kleist (1934) maintained that lesions of the basal ganglia were responsible for echo-reactions. However, in view of their primitive nature a localized lesion alone, even if very extensive, is unlikely to produce them. Bastian's (1890) statement that echolalia can only be found with general impairment of cerebral functions is borne out by clinical as well as pathological observations. The present writer has only in one case of marked echolalia carried out a post mortem examination. It was the aphasic patient described above in whom the completion phenomenon was first observed. A thrombosis of the left middle cerebral artery was found, which had resulted in destruction of the whole speech area. The softening extended into the putamen. Cases such as this suggest that what was left of speech could hardly have originated in the dominating hemisphere. Hughlings Jackson expressed the opinion that automatic speech originated in the right hemisphere. According to him the left hemisphere is the "creative," the right the "automatic." Whether a lesion of the basal ganglia is necessary for echolalia to arise can only be decided by a series of anatomical investigations of suitable cases.

Summary.

The various conditions in which echo-reactions occur have been reviewed. Echo-reactions do not consist of indiscriminate repetition, but depend on personal rapport. The selectivity of echo-reactions, with regard to both the person imitated and the actions repeated, has been demonstrated. The fundamentally social nature of echo-reactions has been pointed out. The tendency of the patients with echo-symptoms to complete automatically sentences and actions initiated by the persons with whom they have established contact has been described. Those completion phenomena are an alternative to, or superimposed on, echo-reactions. The psychological mechanism underlying echo-reactions and the associated completion phenomena is that of identification on a primitive level. The various phases which echolalia and the associated completion phenomenon undergoes in the course of the evolution and re-evolution of speech have been demonstrated. A new interpretation of echo-reactions in schizophrenia has been advanced. They are to be understood, from the psychological point of view, as the result of an impulse to maintain social contact co-existing with the opposing tendency to extreme autism. An unusual case of chronic catatonia has been reported in which echo-reactions existed over many years. This patient, who had been a high-grade mental defective, had in the course of his psychosis regressed to a level of speech corresponding to that of low-grade mental deficiency. Echo-reactions in infancy and those occurring under certain conditions in normal adults have been discussed. The conditions in which echolalia occurs have been found to have in common an urge to speak or act, a tendency to repetition and an incomplete development of impairment of expressive as well as perceptive

speech. The conditions for echopraxia are similar but concern motor activity. The echo-reactions have been analysed from the point of view of Gestalt psychology, which throws light on their formal as well as dynamic significance. The pathology and some aspects of the physiology of echo-reactions has been discussed. The part played by the emotional element in their conditioning has been considered in the light of Hughlings Jackson's studies on automatisms.

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EMOTIONAL INTERPLAY AND DOMINANT PERSONALITIES IN THERAPEUTIC GROUPS: OBSERVATIONS ON COMBINED SCHIZOPHRENIC-NEUROTIC GROUPS.

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THE observation and treatment of neurotic patients in groups has attracted much attention in recent years. Schizophrenics have occasionally been included in such therapy groups, and favourable results with them have been reported by Blackman, Foulkes and Lewis, Schilder, Wender and others.

The purpose of the present paper is to describe two group settings in which either half the patients (Group I) or a majority of them (Group II) were schizophrenics, and to comment on the mode of response, the interpersonal relationships and the emergence of dominant personalities in these groups. Emphasis will be laid on those observations which seem to distinguish group from individual treatment. The short duration of the group courses does not justify any comment on their possible therapeutic effect, or on factors which appeared either favourable or unfavourable in this respect.

The schizophrenics chosen for participation were male patients, and they had to fulfil a number of negative criteria. Patients with hallucinations, systematized delusions, marked paranoid trends, low intelligence, strong thought disorder and pronounced apathy were excluded. All the schizophrenic patients selected had either received insulin treatment (about 40 comas) before the group meetings started, or they were undergoing it during the period of group observation.

The groups met once a week for approximately 1½ hours. They were informed in the beginning that the purpose of the meetings was to stimulate the discussions of personal problems and to improve their social adjustment. The therapist was mainly observant, and only took part in the discussions in order to guide them, to sum up or to clarify special points. Direct answers to questions, lecturing or leadership were avoided.

OBSERVATIONS.

Group I.

The first group was formed in September, 1945, and met altogether six times. The group consisted of four schizophrenic and four neurotic patients. The schizophrenics took part in all meetings; the neurotic participants varied except for one (E—), who attended all sessions.

The ages of the schizophrenics ranged from 17 to 25; the neurotic ages were higher and varied from 35 to 50.

The discussions of the first group meeting were recorded and are here presented in outline.

The conversation was opened by a schizophrenic, who related his personal difficulty in making social contact. He was afraid that people observed him unfavourably and criticized his general manner and appearance. Very soon all the group members admitted, spontaneously or after prompting, that they were either suffering from a similar feeling of social discomfort or that they had experienced it in the past. This topic established the first loose bond of fellowship in the group. It was, however, noticed that a difference of emphasis and conviction existed which divided the neurotic and schizophrenic sections of the group. The neurotics spoke of uneasiness, of being square pegs in round holes, and they realized that the difficulty was imaginary rather than real; the schizophrenics, on the other hand, stressed that their fear occurred in almost any social setting, and they were inclined to attribute it to the reality of an unfriendly environment rather than to imagination. Two of the schizophrenics were vague and indefinite in their contributions; one of them—a border-line case—only spoke when he was questioned, and his dread of social contact was more observable than verbally admitted.

The conversation then changed to a discussion of justified fears: the fear experienced during air raids. One schizophrenic (A—) amazed and shocked the group when he remarked that he did not feel scared at all during raids; on the contrary, he felt elated. He could give no reason for this incongruous emotional reaction when he was questioned about it by others. The border-line schizophrenic eventually confessed a similar response to raids, although he had to admit that he felt afraid as well. His fear could, however, be banished by the simple expedient of putting his head under the bed-clothes.

There was some speculation on the possible reason for feeling elated during air raids. Youth and inexperience were ruled out as explanations by one of the neurotic patients whose 2-year-old daughter had shown considerable fear during bombing. Finally another neurotic patient (E—) suggested that A— obviously did not care very much for the world of reality and would be happy to see it "atomized." To this A— replied with an embarrassed smile: "Perhaps."

A phantasy of world destruction is not infrequently encountered in early schizophrenics. Freud, in his analysis of the Schreber case in 1911, interpreted the phantasy as an expression of the patient's frightened awareness that the libidinal cathexis had been withdrawn from the external world. A—, during individual interviews, admitted that such a world-destruction phantasy had occurred to him. His response to air raids was therefore not as incongruous as it appeared at first; he felt relieved when the nightmare of living in a destroyed world became a reality which other people experienced with him. E—'s interpretation had hit the mark.

The further progress of this group will be demonstrated by the case records of the four schizophrenic patients and of one of the neurotics (E—), who attained a position of prestige and dominance in the group.

E—, aged 50, was a neurotic and psychopathic individual. He was admitted after prolonged alcoholic excesses with an unsteady gait, tremors and neuritic pains. His bearing was confident and self-assured, although he professed that this attitude was a defence against feelings of inferiority. He had described himself at first as a medical psychologist possessing a Ph.D.Leipzig and Sorbonne, but soon admitted that these statements were entirely untrue.

He had had a course of psychotherapy several years prior to his admission, when he was suffering from a reactive depression. He asserted that his alcoholism started then. Also his interest in psychology dated from that time, and he had, in recent years, largely lived by " giving advice and writing articles," making use of whatever psychological knowledge he had acquired.

By the time of the first group meeting he had been in hospital for four months and the symptoms of chronic alcohol intoxication had disappeared. He had impressed other patients as a person of knowledge and experience, but the stories he told were often too tall to be true.

The group was soon dominated by his personality. He helped to foster a group spirit, tried to arrange group activities and to smooth out differences which occurred between the meetings. The following episode is characteristic as an example of the confidence he inspired: A neurotic group member confessed to him that he had had an extramarital love affair, which had been the immediate cause of his symptoms. He had been unable to reveal this either to the group or to the therapist privately, and he asked E— to pass this information on to the therapist.

One of the schizophrenic patients (A—) became very attached to him and seemed to benefit from this relationship.

When the group meetings terminated E— was persuaded to leave the hospital, and nothing has been heard from him since.

A— was a 17-year-old schizophrenic with a history of peculiar and erratic behaviour for the past three years. He had twice made irresolute suicidal attempts by poisoning and had become " boorish, aggressive and rude " at home. His resentment was particularly directed against his mother, who was a fussy and nagging person.

His thoughts were vague and often blocked. He felt that people remarked he had a bad smell, and he complained of a lack of energy and interest. After 40 insulin comas there was some improvement; he had lost his hostile attitude to his parents, but he remained shy and self-conscious.

He had no difficulty in joining in group discussions, although his contributions were sometimes rather involved. When he could not make his point clear, or when he was questioned too closely, he retired from the conversation with an embarrassed smile or an attempted jocular remark. His relationship to other group members, particularly between sessions, remained on a schoolboyish level of good-natured banter and teasing. His attitude to E— was, however, noticeably different. He seemed to admire and trust E—, and was more at ease in his company than with anybody else. He adopted E—'s interest in psychology, and made plans to study medicine with the idea of becoming a psychotherapist eventually. He developed an attitude of airing some half-understood psychological knowledge in the group to demonstrate his desire to help others. Very often such psychological contributions were vague and abstruse, but this attitude seemed to help A—'s feeling of self-importance. He remained very awkward and embarrassed in female company, although he was able to learn dancing.

He left the hospital soon after the last group meeting, but had to return after about two months and then took part in Group II.

B— was a 17-year-old youth in whose case the diagnosis of borderline schizophrenia was clinched by his behaviour in the group. He had a bad family history and had been stammering since the age of six. For the past three years he had been suffering from a twitching of the right side of the face and a blinking tic. He had become increasingly shy and self-conscious. His eyes watered when he met people, even if they were only casual passers-by in the street. He also had a compulsion to touch telegraph poles.

He was a reticent observer in the group for the most part, but responded obediently when his contribution was invited. Only rarely did he intervene actively or

make a spontaneous remark, as, for instance, when he announced that he shared with A— the feeling of joy during air raids. He later admitted paranoid fears that everybody was hostile and critical towards him. His stammer was not sufficiently pronounced to account for his reticence, and his speech became almost free from stammering after a few sessions.

He improved to some extent, and this improvement continued after the group meetings had ceased. There was a temporary relapse occasioned by a brief stay at home and, on his return, he explained that he felt ashamed of his family, who were only poor labourers. He had been so sensitive about this that he had never dared to reveal it to the group. He soon regained his former level of improvement however and even accepted a part in a Christmas pantomime, although he admitted stage fright and a fear he might stammer on the stage. He did, however, quite well at the actual performance.

C— was a 25-year-old medical student, who had been a shy, ambitious and serious-minded person with a good school record up to the age of 17. Then the problem of leaving school, choosing a career and accepting adult responsibilities caused a breakdown which was diagnosed as schizophrenic. He made a fair recovery after several months and then decided to study medicine.

The structure of his psychosis was based on a re-activated oedipal conflict, but the original conflict was changed to an ideological contest. The patient, his younger sister and his mother were Roman Catholics; the father was Protestant and a medical man. When the patient started his medical studies, he began to feel that the tenets of the Roman Catholic Church were in opposition to the teaching he received, and he found it very hard to assimilate medical knowledge. It was only with great difficulty and after a few minor schizophrenic disturbances that he managed to pass his pre-clinical examinations.

He was also distressed by a compulsion to masturbate excessively. He made a pilgrimage to Lourdes, confessed his sins to several priests, but he could not conquer the sexual urge. He became emotionally attached to various girls, and this also aggravated his perturbed condition.

When he had to attend lectures on gynaecology the situation became unbearable for him. On several occasions he openly opposed his clinical teachers and voiced his religious objections. Eventually he had an acute psychotic episode; he felt himself surrounded by enemies, jumped out of a first-floor window and shouted that the time of resurrection had come. He was admitted in this state as a temporary patient. He had 43 comas, and towards the end of his insulin treatment joined the group meetings.

In the group situation the emotional constellation of his overt conflict was fairly well copied. The therapist was not a Catholic, and C— made it clear from the start that he could not accept the therapist's authority on that score; the only true authority for him was the Roman Catholic Church. He told the group of one of the incidents which had disturbed him prior to his breakdown, when he had felt compelled to argue against the interruption of pregnancy in an epileptic woman because it was contrary to Christian ethics. He tried to defend his point of view again, but the group members refused to be drawn into an ethical argument. They wondered why C— should have felt so strongly about the incident. Eventually a neurotic patient, after casting about for the right word, characterised C—'s attitude as "rebellious."

At the fourth group meeting the same emotional conflict led to a violent demonstration of hostility directed against the therapist. C— opened the discussion in an excited mood and referred to a previous debate on the significance of dreams. During that debate C— had asserted, against the opinion of the rest of the group, including the therapist, that dreams were quite nonsensical and without meaning. He had since consulted a priest, who had confirmed that it was unjustified to look for a meaning in dreams. How could the therapist defend a theory which was contradicted by the Church? He argued fiercely, and during the whole group session prevented the consideration of any other topic. At the end he announced that he felt an outsider who impeded the progress of the group and he would not attend further meetings. He was asked by the therapist not to make a hasty decision, and was assured that he was not a disturbing element in the group.

At the next meeting C— apologized for the disturbance he had caused. He had

seen the priest again, and it turned out that he had misunderstood the priest's opinion on the question of dreams.

This emotional outburst had a beneficial effect on C—'s subsequent behaviour in the ward. He began to display his medical knowledge, and was pleased when patients approached him for some medical information. The conflict of Church versus Medicine was not mentioned again.

When he left the hospital he was advised to have further psychological treatment, if possible, by a Roman Catholic therapist. He did not follow this advice, yet a letter received from his father a year after his discharge reported a " good recovery." He had resumed his medical studies and had shown great interest in them.

D—, aged 24, had been mentally disturbed and unable to work for six years. His fear of a hostile environment had recently caused suicidal speculations. He had always felt inferior because of a rheumatic heart lesion, and was surprised and gratified when he learned that his heart was strong enough for him to have a combined insulin and electric shock treatment. He had 38 comas and 6 E.C.T. without any disturbing incident.

He took an active part in group discussions, but regarded the meetings as of little consequence compared with insulin treatment. He was engaged to a girl four years his senior and, although he had broken off the engagement before his admission, he now met her every day. He never joined in any group activity apart from attending the sessions, and therefore remained more or less an outsider.

He left the hospital prematurely as soon as his insulin course came to an end, and has not replied to follow-up letters since.

Group II.

In this group the schizophrenic patients were always in the majority and the number of participants was not limited to eight as in Group I. New patients, schizophrenic or neurotic, were introduced at times and others allowed to drop out.

The group met eight times, and seven of the schizophrenic members attended five or more meetings. The ages of the schizophrenics varied from 17 to 33, the younger ages prevailing; the neurotic ages ranged from 29 to 49, but one of them was only 15.

A record of all meetings was kept and the salient events will be reported. It is not possible to give more than a sketchy outline of the observations made, and only significant happenings can be mentioned.

First meeting, 7.i.1946. Present: 6 schizophrenics and 1 neurotic.

After a long initial silence the schizophrenic patient Z—, although handicapped by stammering, opened the discussion with the question: Why is it that people feel anxious in crowds? He denied that he felt such an anxiety; he only wanted to put a problem for discussion. The response by the group was rather cautious and hesitant; yet several members, including the neurotic patient, admitted that they had experienced anxiety in crowds. It seemed that such an anxiety was linked with a fear of becoming the centre of attention. Z— revealed that he once felt an urge to smash the cups in a café. This remark by Z— was not in keeping with the preceding trend of a halting conversation and another silence followed.

The therapist then put the question whether there was an association between a fear in crowds and the present situation in the group? Were they afraid to speak up because they would become the centre of attention then?

This elicited an enumeration of further fears by various patients. The neurotic patient attempted to fill in gaps in the conversation by mentioning personal experiences, by commenting on those of others, or asking for contributions by silent members. Z— remained out of tune with the rest of the group, and his occasional remarks were not taken up.

Second meeting, 14.i.1946. Present: 6 schizophrenics and 2 neurotics.

The discussion, for the greater part of the session, was lively, as a problem was considered that was not personal and yet concerned them all. They criticized the hospital regulations concerning Occupational Therapy. Several complaints and some constructive proposals were made. The neurotic patient, who was a newcomer and who had taken part in a previous neurotic group, opposed the other members and rated them aggressively for being lazy. The group took this accusation very calmly. Y—, a patient who had recovered from a schizophrenic episode, explained that it was not laziness that had prompted them to criticize the O.T. arrangements; they would all welcome having regular physical exercise instead of O.T. Eventually it was agreed upon that the group should bring definite proposals with regard to O.T. and other communal activities which they would like to arrange among themselves.

Then the new neurotic patient put his problem of feeling guilty and inferior because he was an illegitimate child. The group showed a sympathetic understanding of his feelings.

The rest of the session was taken up by a hesitant debate on the relationship between sexual and guilt feelings. They arrived at the conclusion that the feeling of guilt was due to the way in which they had been sexually enlightened in adolescence. The lead in this discussion was taken by Y—.

Third meeting, 21.i.1946. Present: 6 schizophrenics and 2 neurotics. One of the schizophrenic participants had been discharged and the newcomer was A—, who had been a member of Group I and had just been readmitted to hospital.

It was noticed that Z—, who had started the discussion at the first meeting, selected a chair in the furthest corner of the room. In all subsequent sessions he stuck to that place and refused to join the circle formed by the other patients.

Definite proposals regarding O.T. were put to the therapist by one of the neurotic patients. There was a short discussion, in the course of which the therapist was called away.

When he returned he found an animated conversation in progress, which had been started by A— in an attempt to gain prestige by airing a superficial knowledge of psychopathology. A— had stated that there was a definite connection between the sexual urge and nervous breakdowns. Three members disagreed with this statement and explained why it was not applicable in their own case. A— stuck to his point and tried to expound an over-simplified Freudian theory. He was rudely interrupted by the illegitimate neurotic; economic factors were at least as important as sexual ones in causing nervous diseases. If sex played a role, then it was only because of the way in which society dealt with such problems as abortion and sterilization. The rich could afford it, but not the poor.

Y— attributed his illness to Army discipline and his resentment of Army doctors, who had treated him as a malingerer. People in authority had always caused him to feel frightened. But he had other fears too; the fear of being alone in a room, of people making adverse remarks about him, and of being attacked by someone who approached him from behind.

This remark prompted Z— to make, from his corner seat in the background, a comment which, as so often with him, was only related to the fringe of the conversation; he had never had a fear of being attacked from behind, but at one time he had a peculiar "compulsion." When he lifted a glass or a cup to his lips, he had to jerk it over his shoulder. He mentioned that he had certain fears which occurred always at the same time, namely, at four o'clock in the morning. He could, however, not divulge the nature of these fears; they were too personal.

Fourth meeting, 28.i.1946. Present: 7 schizophrenics and 2 neurotics. Two new schizophrenic patients had joined the group; one of the former members was temporarily absent.

One of the newcomers, X—, was a paranoid schizophrenic who, during a more acute phase of his illness, had felt that people accused him of being a homosexual. As a result he had developed a defensive attitude designed to emphasize an aggressive masculinity. With men he was either snobbishly aloof or insolently arrogant; in female company he acted the part of a Don Juan.

During his short stay in the ward he had already aroused the hostility of most of the other patients, and to have him as a group member was a welcome oppor-

tunity for them to show how they disliked him. Y— and the illegitimate neurotic led the attack. The other neurotic participant tried to be conciliatory and to mediate between X— and his opponents.

X— defended himself with restraint, although some of his replies were biting and personal. He explained that he had been slandered in the Army, where everybody was against him and where he had learned that the struggle in life was an individual one; that everybody had to fight against the rest of the world. He was asked if he had been as aggressive before he joined the Army. X— denied this, and revealed that he had been a conscientious objector, but his claim had not been recognized. He had to endure ill-treatment and hardship in detention barracks until he finally changed his mind and accepted non-combatant duties as a stretcher-bearer.

This story produced an unexpected result. His chief opponents admitted that they admired X—'s stand for his principles and that the work of a stretcher-bearer was not a " cushy " one. The general atmosphere became more peaceful, and X— continued his account of a peculiar persecution in the Army; his past was dug up by his comrades who turned against him when they discovered he had been a conscientious objector; he was spied upon and followed everywhere.

A—'s conduct during this meeting was odd. At first he joined the critics of X— and gave some examples of the latter's unfriendly behaviour. But he seemed ill at ease; the attitude he had adopted during the preceding meeting of being a man of psychological knowledge had completely disappeared. When X— started to relate some of his Army experiences, A— interrupted and annoyed him by an involuntary giggle, for which he had to apologize. When X— finished his account with the nonchalant description of how he had knocked down a stranger who had made insulting remarks behind his back in a pub, A— felt compelled to say that he never got roused by insults and could not be bothered by them. This was obviously untrue, and merely expressed his desire to show that he was superior to X— in this respect. He soon had to alter his statement and then told his story of continuous quarrels at home, how he had become more and more moody, and eventually had wandered off from home and lost his memory.

Fifth meeting, 4.ii.1946. Present: 6 schizophrenics and 3 neurotics.

The meeting started with the request by a schizophrenic member to discuss his problem of choosing a career. He wanted a secure job, which did not involve competition. He had, however, no interests, except reading thrillers and listening to jazz music.

The discussion dragged on slowly. The question of fear of criticism was introduced, but the contributions remained few, short and cautious. The presence of X— and the fear of his adverse remarks evidently inhibited the free flow of conversation.

Eventually a neurotic newcomer asked leave to bring up a question which was unconnected with the preceding discussion. He was a 15-year-old boy who looked effeminate, had broken down through anxious overstudy, and who assumed an aggravating attitude of precocious prudence. The question he put was: Should the male sex be stronger than the female sex?

The first response of the group was one of perplexity. They wanted to know why he was interested in this question. He could not explain this; he had asked other people the same question, but no one had so far been able to give him a satisfactory reply. X— then turned on him rather sharply: " If you could give birth to a child, assuming you were anatomically suited to the job, would that not bring home to you that women can be stronger than men? " The boy was rather embarrassed and had no answer.

Sixth meeting, 11.ii.1946. Present: 8 schizophrenics and 2 neurotics.

The discussion remained on a superficial careful level and finally came to a full stop. The hostility against X— seemed to take the form of passive resistance instead of the previous frank opposition. The therapist remarked on this and the discussion livened up slightly.

A— mentioned that he felt upset when he had to pass a couple who were obviously in love. Pressed to say why he should feel distressed then, he confessed that such a situation roused sexual phantasies in him and he often put himself in

the place of the girl in his phantasies. The neurotic and effeminate boy was prompted to admit similar thoughts. He added that he was frequently regarded as girlish.

Sex became the topic for a while until A— asked whether sexual attraction between men was not just as frequent as between men and women. The question remained unanswered, but a short discussion followed of the limits to which premarital relationship between young people should be allowed to go.

Seventh meeting, 18.ii.1946. Present: 8 schizophrenics and 3 neurotics.

There was a renewed demonstration of open hostility against X—, whose behaviour during a recent dance had antagonized everybody. X— had collected a number of female patients around him and had kept them amused by loud and sarcastic remarks directed against any male patients who came near. When this behaviour was sharply criticized by the group, X— countered that he had got so used to knowing that everybody disliked him that he had become quite indifferent to the opinion of others. It was soon made clear to him, however, that he was all but indifferent. He was told that he deliberately behaved in a way that was bound to cause enmity in others.

The neurotic boy was the only group member who had attempted to be friendly with X—, but even he had to admit that the task was difficult. X— would never speak to him first; he might even pass him by without a glance. On the other hand, X— had a great influence over him; he had sometimes caught himself unwittingly imitating X—'s behaviour.

X— seemed flattered, and asserted he had always been able to influence people. Other members were by no means so pleased, and they made no secret of their feeling that the boy's behaviour had made him almost as disagreeable as X—.

Later during the session there was a discussion of masturbation, which caused X— to declare that masturbation was "unmanly." He subsequently boasted of his potency, and that he once had had intercourse five times in a single night.

At the end of the meeting the question was raised whether a group of eleven members was not too large and unwieldy. The therapist promised to consider dividing the group. This suggestion was welcomed, and Y— asked if they could decide among themselves who should be together in a group.

Eighth meeting, 11.iii.1946. Present: 5 schizophrenics and 3 neurotics.

There had been an interval of three weeks since the last meeting as the therapist had been away from hospital. On his return he found that some changes had occurred during his absence. X—, whose disregard of hospital rules had become too infectious, had been asked to leave the hospital. Most of the other schizophrenic members of the group had also been called to task on account of disobedience and unruly behaviour.

The meeting started with a prolonged silence, which was followed by a tardy enumeration of symptoms. Then there was a short consideration of the question of a possible physical origin of their symptoms.

Eventually the therapist requested the group to tell him the reason for their obvious resistance. The answer was given by Y—, who stated he could not talk in front of people he either disliked or did not know well enough. Why did the therapist not abide by the former decision to divide the group?

Y— was supported by all the other schizophrenics. The outcome was that the schizophrenic members left the room in a body to wait until the remaining group portion had finished their session. The three neurotics who were left seemed relieved and a fairly lively discussion ensued, during which much fellow-feeling, sympathy and a desire to make helpful suggestions was obvious.

Then the five schizophrenics reassembled. Y— took the lead with a confession. He had been stealing goods while he was in the Army. They were goods he had no need for, and which he gave away later. He felt ashamed and guilty about it, and did not know what had tempted him to commit these delinquencies, which were never discovered. He suggested that there might perhaps be an association with his attitude towards people in authority of whom he had always been afraid and whom he hated and rebelled against. He mentioned particularly his hatred of a certain sergeant-major and his fear of being unfairly criticized. He had always felt compelled to work very conscientiously to obviate criticism.

A— also admitted that he had frequently been stealing, but he had never had

any guilt feelings about it. He only feared detection. He went on to connect the fear of being found out with the anxiety he had often felt that his parents might notice he had masturbated.

Z— was the next one to confess that he had been stealing at one time. It happened after the death of his mother when he was sent to live with his grandparents.

These confessions were made haltingly, and repeatedly there were long pauses. Towards the end of the session there was, however, a more lively exchange of ideas and of symptoms which had not been mentioned before.

A short description of the behaviour of seven of the schizophrenic members follows to supplement the picture of the effect of group attendance.

A—, aged 17, had taken part in Group I. During his brief absence from hospital he had read several psychological books. The scanty knowledge he acquired had evidently done him no good; it had stirred him up, yet offered him no assistance in dealing with his chaotic psychosexual condition. In the group he revealed glimpses of his conscious sexual fantasies and these pointed towards passive homosexual tendencies. He fell, however, in love with a schizophrenic girl, and this made him moody and tearful. During the three-weekly interval between group sessions his behaviour became difficult and antagonistic. The therapist, on his return, found a note in A—'s case-sheet that he had behaved like a " thoroughly naughty boy who sides with everybody who grumbles." A— had not attended O.T., had stolen a wallet from another patient, and had proposed to the schizophrenic girl. He had been reprimanded for his offences and this had not improved his condition.

A week after the last group meeting A— had an acute schizophrenic episode, during which he was under the influence of frightening hallucinations. It was necessary to give him one electric shock to remove the acute disturbance. It was then learned from him that the psychotic interlude had been provoked by an erotic experience—during a social gathering in the hospital a female patient had sat on his lap and had kissed him.

A— was able to leave the hospital shortly afterwards. A psychoanalyst had been found for him, and a report from her six months later stated that he had improved to some extent, but that his condition remained variable.

B—, a borderline schizophrenic, aged 17, had never left the hospital after his participation in Group I. He formed a close friendship with W—, a member of Group II, and after the meetings had come to an end these two patients were constantly seen together. B— was the passive partner in this friendship, which had, however, a beneficial effect on him.

The two friends left the hospital together to work jointly on a farm. But this did not last long. After a week they found the work too strenuous and the living conditions too uncongenial. They left the farm and parted company.

Four months later B— wrote to the therapist asking if he could join a therapeutic group at an out-patient clinic. He mentioned that he felt better, although he still had occasional " bad spells " when he felt " quite as bad as ever."

His friend W—, aged 19, was of high intelligence, but without aim and purpose in life. He had first shown mental symptoms at the age of 13, and since that time had been attracted by younger boys, whom he took out to tea and for walks, in spite of the comment which this conduct aroused at school. He tired, however, quickly of all his boy friends.

In the group he was, on the whole, a merely passive observer. His friendship with B— and its brief duration has been mentioned above.

Eight months after his discharge he had found a job as librarian and was said to be doing " quite well."

Z—, aged 20, had shown neurotic symptoms and peculiarities of conduct since the age of three. He had always retreated from difficulties in life into daydreams and minor ailments. A thought disturbance had gradually developed which, as he said, " blurred the meaning of objects " immediately around him. He had unusual hobbies: reading military biographies and collecting old weapons.

He remained isolated in the group, both physically and mentally. He sat away from the others, and his contributions to the discussion were often inconsistent with the preceding topic and unconnected with the general mood of the group. He never revealed the contents of his phantasies, to which he alluded several times; he felt they were too intimate and personal to be publicly exposed.

He went to a private mental hospital later, and a report about him after eight months said that his condition had not changed.

X—, aged 23, had developed a paranoid psychosis in the Army. He felt himself accused of homosexuality and, to prove the opposite, became arrogant and hostile with men. In female company he affected an ostentatious Don Juan attitude.

After he had joined the group all group proceedings were influenced decisively by him. He got along fairly well with the few neurotics members, but the other schizophrenic participants soon revolted against him in a body. They refused to submit to hospital regulations from which X— had exempted himself high-handedly. Eventually X— had to be asked to leave the hospital, and this restored the peace to some extent. The unity of the group could, however, not be re-established.

Eight months later it was learned that he had gone to Belgium after a quarrel with his father. He was about to get married to a Belgian girl.

Y—, aged 28, was discharged from the Army with the diagnosis psychoneurosis. Soon afterwards he developed acute schizophrenic symptoms, which necessitated his admission to hospital.

In the group he was co-operative, but reserved. He could not stand silent stretches, and usually revived a conversation that had died down. Although he talked freely about his personal problems, there was much that he could never reveal.

He led the attack on X—, and became the mouthpiece of the hostile schizophrenic subgroup. This incident had an unfavourable effect on him. He revolted against hospital discipline, to which he had adjusted quite well in the beginning. He had more frequent attacks of anxiety, and was more distrustful of people than before.

He has improved greatly after leaving the hospital, but has retained some minor neurotic symptoms.

U—, aged 22, has suffered from recurrent schizophrenic episodes since the age of 16, and had had thyroid treatment without effect. He improved after a tonsillectomy.

He took part in only a few group meetings and then asked to be excused from further attendance. The problems discussed disturbed him, and he preferred shutting out all unpleasant themes.

Comments.

The events which take place in a group setting are so complex and intricate that neither a full description nor a ready evaluation of their significance and implications can be given. Even in individual psychotherapy the bilateral relationship between doctor and patient is so full of variation and dynamic interplay that it is notoriously difficult to convey an adequate picture. This difficulty is increased in reporting the events occurring in a group with its multilateral and fluctuating relationships. To overcome this it appears advisable to view the events from selected angles, so that the confusion of simultaneous occurrences is reduced to some order which provisionally neglects complexities for the sake of clarity of presentation.

It is therefore proposed to consider the observations which have been made under the following three headings:

(1) Mode of response (intellectual, motor, emotional).

(2) Inter-personal relationships.

(3) Dominant personalities.

1. *Mode of Response.*

Intellectual response.—The primary problem that confronts and unites the group appears in a cognitive or intellectual guise. The patients want to know the answer to certain questions. Do others share symptoms and experiences which they have found distressing? How can emotional handicaps be avoided or patterns of faulty behaviour be improved? Is there a solution to their personal problems? What is the cause of their symptoms? And so on. The number of topics that can be brought up for discussion is great, but some themes which are of general interest and application recur frequently, e.g. the similarity or dissimilarity of their symptoms, attitude towards problems of sex, anxiety or hostile reactions in certain situations, etc.

Only a few examples of the topics discussed in the two reported groups have been mentioned. The first meeting of Group I, for instance, illustrated in outline the conversation aroused by a symptom shared by all members, viz. social anxiety. Discussion of such general themes which concern all participants is helpful in creating a feeling of group solidarity, mutual interest and sympathy.

The patients were encouraged to work out for themselves the problems they raised, and no authoritative opinion or advice was generally offered by the therapist. Some authors (Marsh, Snowden, Maxwell Jones, Wender) have, however, reported good results from a method of group therapy that consisted in, or at least included, lectures on mental hygiene. It appears that the therapeutic aim in purely didactic groups is a limited one. It may be beneficial for patients with somatic anxiety symptoms to listen to a course of lectures illustrating the physiological mechanisms operative in their illness. Maxwell Jones demonstrated the efficacy of this method of treatment in soldiers suffering from the so-called effort syndrome. Some patients may derive benefit from an instruction in psychopathology and certain social problems, or from advice concerning healthy social attitudes, but the value of such a purely didactic approach is doubtful in more severely disturbed patients or in schizophrenics.

The unknown is full of dangers for the schizophrenic; to know more might reduce his fears. The patient A— seemed to regard psychiatric knowledge as the magic clue that might solve all problems. He was an intelligent boy, and read a number of books on psychotherapy. The result was, however, not at all beneficial, although it had the temporary advantage of providing him with an interest that counteracted his apathy. It also increased his self-confidence for a time. But, on the whole, the store of psychological knowledge of which he was so proud was of little help to him, and in the crucial relationship to the other sex it seemed to have been definitely detrimental.

Motor response.—The emphasis in group treatment can be put on activity, or communal activities, as was done by Slavson in his "activity groups" and to some extent also at Northfield (Main, Bridger, Foulkes). To engage in a common task fosters a group spirit which is capable of alleviating social anxieties and handicaps (Bion and Rickman). Other authors have made use

of group performances to induce cathartic abreactions, e.g. the psychodramatic methods of Moreno and this school, and the group projection methods of Maxwell Jones.

It was intended to encourage the two groups under observation to undertake communal activities, but this plan was not successful. In Group I some outings were arranged, but a common constructive task was never achieved. Group II did not attain sufficient coherence at any time to embark on activities in which all members would willingly join.

During the group meetings the conative urge was mainly restricted to verbalization. Patients experienced this as a desire to participate in any discussion which roused their interest. If they could find no opportunity to join in the debate, or if their inner inhibitions prevented them from it, they felt frustrated and dissatisfied. Once or twice schizophrenic patients openly admitted their fear of talking in the presence of others. Frequently they waited until another patient had touched upon a problem akin to their own, and then they followed his lead when they had reassured themselves that no condemnation or criticism had been roused. They felt relieved when they succeeded in thus revealing a guilt-charged conflict or anxiety which they had previously concealed from everybody.

It was obvious that group discussions could stir up emotional conflicts for which the debate offered only an insufficient outlet. One patient, U—, admitted this frankly, and used it as a plea to be excused from further group attendance. In other instances the emotionally unsettled patient resorted to "acting out," i.e. to irrational and disturbing activitives outside the group setting. This possibility of acting out is an unpleasant eventuality in any type of psychotherapy, but in group treatment the risk of its occurrence seems to be increased, because the personal response of a patient can never be assessed with the same degree of accuracy and validity as in individual psychotherapy.

Furthermore, the possibility of acting out is likely to be much greater in schizophrenic than in neurotic patients. This was particularly evident in Group II, in which the schizophrenic members predominated. The resentment and hostility which actuated the schizophrenic part of this group found insufficient relief in free discussion, but led to acting out in open antagonism against all authority and hospital regulations. During an interval of three weeks, when there were no group meetings, these schizophrenics became such a disturbing element in the hospital that administrative measures were taken against them. The chief culprit, X—, was asked to take his discharge, and similar steps were contemplated with regard to the others. The friction that resulted increased the conflict in some of these patients and caused a temporary deterioration of their mental condition.

Emotional response.—Some emotional reactions have been mentioned in the preceding paragraphs, such as the effect of participation or non-participation in group debates, and the stirring up of conflicts through the discussion of emotional topics. Other affective responses will be considered later under the heading of inter-personal relationships.

It remains here to examine the emotional effect of the group setting as

such, and whether there is any significant difference in the emotional atmosphere of the group as compared with individual psychotherapy.

Most methods of group treatment have as their chief aim the correction of faulty emotional patterns of social response. Wender compared the group setting with the family environment encountered by the young child. He expressed the opinion that " in the group there is undoubtedly a transference of tendencies originally directed toward parents and siblings." He spoke of the " catharsis in the family " as being a potent factor in the therapeutic efficacy of group treatment.

This view is evidently correct, but the same transference reactions are also active in individual psychotherapy and do not distinguish group treatment from it. In Group I the patient C— abreacted emotionally the hostility and rebellion which was originally aimed at his father, and which in the group was focused on the therapist. This incident would certainly have occurred in individual treatment as well. C—'s emotional outburst was a transference phenomenon, but not one that was aroused by the group setting as such. On the contrary, the collective opposition of the group might easily have daunted a less perturbed patient, and prevented him from giving free expression to his feelings.

It is doubtful whether any feelings are operative in a group setting which do not occur also in a group of two, i.e. in individual psychotherapy. It appears, however, that certain emotional responses are favoured by the group environment, and occur with greater strength and frequency in group than in individual treatment. This is particularly the case with two reactions of opposite feeling tone—the feeling of security in a tolerant and friendly society on the one hand, and the fear of an antagonistic and hostile environment on the other.

There is little doubt that the group offers a feeling of greater social security to many patients than does individual therapy. The patient has the support of others who are similarly handicapped when he confronts the therapist. In an individual interview his anxiety is likely to be aroused by a feeling of being under continual scrutiny, whereas in the group he has the opportunity of retiring into the role of a silent observer. This is an advantage that is particularly welcomed by schizophrenic patients, yet one is repeatedly surprised at the amount of significant information which even tongue-tied patients are enabled to volunteer in the group, and which would have remained suppressed for a much longer time in individual interviews.

The opposite type of emotional response, the fear of a hostile environment, is not alleviated to the same extent in schizophrenics as in neurotics. Schizophrenic patients never attained the same degree of social ease, and their contributions remained hesitant and guarded.

2. *Inter-personal Relationships.*

The individuality of a patient is not lost in the group; on the contrary, personal features and symptoms are thrown into greater relief. Whatever happens in the group acquires a very personal significance for the individual

patient, rouses feeling and idiosyncrasies, and activates conscious and unconscious conflicts. He is involved in an intricate tissue of emotional threads that unite or separate the various participants. The dynamic contacts operative in the group are multilateral, as contrasted to the bilateral relationship in individual psychotherapy; they allow a much wider field of emotional responsiveness. Bilateral relations are, of course, not absent; the passing feeling that is aroused by one or the other participant may crystallize into a more permanent friendship or animosity. The emotional inter-relationship may also connect three or more patients. Such emotional constellations among a limited number of participants are naturally influenced by the group setting as a whole, but from the point of view of the individual member involved in such an emotional constellation, the rest of the group is a vague actuality without individual personalities. It seems that it is impossible for any one patient at a given time to establish an inter-personal relationship with more than a limited number of others and yet remain conscious of those other personalities; when the number is more than four, or perhaps five, the idea of a group configuration seems to replace the awareness of definite individualities.* If, for instance, a community of feeling is established in the whole group excluding the therapist, the individual member will be conscious only of the personality of the therapist, and of the existence of a community to which he belongs and which confronts the therapist.

The feeling induced by the group as a whole has already been indicated above. There still remains a great variety of theoretically possible inter-personal relations in which the awareness of the personalities taking part is retained. There are for example in a group of nine, 36 different ways in which any two members might combine in emotional relations. The figure for possible groupings of three or four patients are 84 and 126 respectively. In reality this confusing wealth of possible combinations is never realized. Certain permanent relations among the participants soon evolve in a group, and limit the possible occurrence of further emotional sub-groupings; the group has then acquired a definite emotional structure.

Bilateral friendships which establish themselves in a group seem to be more stable than relationships among three or more members. Examples of the former type were the friendships between A— and E—, and between B— and W—. The active partner in such relationships would try to have a place near his friend during the group sessions, and they would continue their association in the intervals between group meetings. These bilateral friendships are thus to some extent opposed to the formation of a wider group community. An example of a grouping together of five patients occurred in Group II, but it only lasted as long as they were united in the common aim of opposing X—.

Apart from the variety of possible groupings, two other factors have to be considered in inter-personal relationships in a group—the type of emotional response and its intensity.

Freud demonstrated that social feelings derive from a number of different drives among which attenuated sexual tendencies, identifications

* This may also be assumed by inference from Spearman's Law of Limited Mental Energy, and the psychological experiments which demonstrate the limit of the perceptual span.

and modified aggressive impulses play the main role. All these tendencies could be observed in the two groups.

Feelings of friendliness and affection were of great importance in the formation of group unity. That these affects have a sexual derivation is not immediately apparent among normal people. Schizophrenic patients, however, show a greater admixture of uninhibited sexuality in their social activities. Homosexual tendencies, repressed or partially conscious, were therefore very noticeable in our groups, and particularly in Group II. On the other hand, a group setting counteracts the urgency of sexual tendencies, and can thus temporarily relieve symptoms which have been developed in defence against unconscious homosexual desires. X— demonstrated this most clearly. His usual overbearing conduct in male company served the purpose of obviating possible sexual temptations. In the group the need for this defensive symptom was less acute, and he was therefore far less aggressive during group meetings than otherwise.

Examples of identification were noticed in the form of imitative behaviour, and of assimilation of a new ego ideal. These identifications were only superficial, but they were able to exert a noticeable influence on the patients' behaviour. A—'s desire to become a psychiatrist and the way in which the neurotic boy in Group II copied the behaviour of X—, whom he admired, are illustrations of the mechanism of identification in the group.

Aggressive tendencies in the attenuated form of rivalry and competitiveness serve to increase the emotional coherence of a group. A more direct expression of aggressiveness was operative in Group II and made the establishment of group unity impossible.

There remains another type of inter-personal relationship to be considered which is pathological in origin, but which seems to be of importance in the dynamic interplay of a therapeutic group setting. This relationship exploits the presence of other persons for the sake of gaining relief of some inner conflict, both conscious and unconscious. Examples of this type were numerous, but variable in the form in which they were expressed.

Some patients who had not the courage to reveal a personal problem would put significant questions to others in the hope of finding that they were not alone in suffering from that particular conflict or symptom. If they succeeded their anxiety was lessened, and the emotional support they thus derived allowed them to confess their own difficulties. Sometimes these questions had a less conscious and deliberate origin, but disclosed a conflict of which the questioner was not yet fully aware.

The act of confession itself, even without previous attempts at finding a fellow sufferer, often implies a similar exploitation of the group setting. The tolerance of the group is invoked to obtain a feeling of absolution. Sometimes a patient may be grossly extravagant in self-criticism and disparagement to be certain that others will refute these unfair self-reproaches.

Patients may condemn and revile others for faults which they have strongly repressed themselves, or for actions which they dare not carry out themselves. X—'s manner of teasing and criticizing the neurotic boy for the latter's effeminacy is an example of the first kind. Y—'s hostility towards X— had its

origin partly in the fact that X— showed his revolt against authority openly, whereas Y— felt guilty about it.

Both affectionate and aggressive feelings are unifying factors in a group only as long as their intensity is not too strong. Intense love or hatred tends to disrupt the group community. There were no examples of strong erotic attachments between members of our groups, but vehement hostile feelings were at times much in the foreground. The hostility of C— in Group I was directed mainly against the therapist. He had an opportunity to abreact it and this improved his adjustment to the group. A great deal of aggression was roused by X— in Group II; feelings ran so high that this group was broken up.

3. *Dominant Personalities.*

A group of patients who meet with a common purpose in mind does not remain formless. Very soon individual characteristics introduce a stratification of dominance, with one member emerging as the most dominant personality. He will exert the greatest influence on the progress of the group, whereas other members will show a varying degree of status down to the most passive and compliant individual. Such a scale of dominance has been noticed both in hospital and out-patient groups. It appears to be a characteristic phenomenon of all group gatherings with a common purpose, and it deserves special consideration because of its general sociological significance.

Bion has made successful use of this phenomenon during the war in his so-called "leaderless groups," which were designed to throw into relief the leader qualities of the various participants. One cannot, however, simply equate the qualities of leadership and dominance. The fact that an individual is dominant in a group does not necessarily make him a leader. This was exemplified in Group II, in which the most dominant personality was also the most disruptive influence.

Several authors have described this scale of dominance in animal groups. Masserman, for instance, found that "cats placed in a competitive feeding situation in small groups . . . arrange themselves in a relatively stable hierarchy of dominance and submission with almost no actual fighting, and thereafter maintain their positions in the hierarchy with remarkably little friction." He refers to similar hierarchies which have been observed "in groups of chicken, doves, rats, cats, macaques, baboons and other animals, and have often been shown to be less dependent on mere fighting ability than on factors of alertness, initiative, manipulative dexterity and even less clearly defined attributes. . . . Observations showed that the dominance hierarchy is definitely goal-referential. Thus, an animal passive with reference to food would shoulder other animals aside in pursuit of a mouse. . . . Animals neurotically inhibited in respect of a particular goal surrendered their dominance in any group in which that goal or its equivalent was the competitive nidus."

These observations in animals illuminate some of the conditions which determine and influence group dominance. It is of interest that the position in the hierarchy depends on certain objective factors, such as the nature of the group task and the actual aptitude of the various group members in relation

to this task. In observing a group of patients one also gains the impression that their status of dominance is more or less independent of subjective desires and aspirations, but depends on objective personality factors of particular aptitude in the special group setting. Ambition to occupy the position of leadership may be present in several individuals, but such ambition remains ineffectual unless it is combined with the qualities required for dominance. The neurotic boy in Group II, for instance, strove hard to improve his status, but the only result was that he was criticized and disliked for it.

There was one interesting difference between the observations made in animal groups and the two reported patients' groups. Dominant animals which had been made "neurotic" lost their position at the top of the hierarchy. One might consequently have expected that the position of dominance in our groups would have been occupied by a relatively well-adjusted personality with few neurotic difficulties. But the actual findings were different: Group I was dominated by a psychopath, Group II by a paranoid schizophrenic, and the schizophrenic subgroup in Group II was led by a severely disturbed patient who had passed through a schizophrenic episode. It must, however, be pointed out that these two schizophrenic patients who occupied dominant positions had fairly well-preserved personalities. They had broken down under the unusual strain of Army life, and their acute psychotic symptoms were soon superseded by a character defence in one case, and by neurotic features in the other.

The nature of the particular attributes required to make a patient the dominant influence in a group which meets for the purpose of social readjustment remains obscure. E—, the psychopath, was perhaps best suited for this task. He had always shown a capacity to influence people, was impressive in his behaviour, and had been successful in posing as a qualified psychotherapist. No similar characteristics were observed in the other two dominant persons, X— and Y—.

It is evident that the reasons for the dominance of an individual in a group are very complex and that there may be no common denominator. From the material at hand one may tentatively indicate a few factors which seem to have played a role in securing the position of dominance. Both E— and X— were persons of more than average intelligence and had definite exhibitionistic character traits. They were also of superior ability in expressing themselves verbally. This verbal fluency was also relatively marked in Y—, as he was the most vocal patient in the schizophrenic sub-group he led. Intensity of feeling and singleness of purpose were further factors of significance. The character and conduct of X— were governed by the single uncompromising aim of obviating homosexual temptations. His whole life was a constant effort to achieve this purpose. Y—, on the other hand, was a person who had always been roused by oppressive authority; the arrogance of X— stimulated him to intense feelings of resentment, which provided him with the forcefulness necessary for temporary leadership.

It seems, therefore, that dominance may at times have a pathological significance. It need not be due to normal aptitudes and abilities which make the dominant person particularly suited to fulfil the group task; dominance

may be the result of emotions and strivings which are abnormally intense through a particular constellation of unconscious drives and defence mechanisms.

SUMMARY.

1. The response of male schizophrenic patients to a therapeutic group setting is reported. Two groups were observed ; in Group I the schizophrenics equalled, in Group II they outnumbered the other participants.

2. Group II was disrupted by strong feelings of hostility which were directed against one of the attending schizophrenics ; the group eventually broke into two unequal parts when all the other schizophrenic patients insisted on being seen as a separate group.

3. Inter-personal relations in a group can be multilateral. The span of awareness for multilateral contacts seems to be limited, however ; if they are too numerous the idea of a group configuration replaces the awareness of distinct personalities.

4. The emotional response aroused through inter-personal relations in a group appears to be of the same character as in individual psychotherapy.

5. There is, however, the difference that a group setting offers a feeling of greater social security and emotional support than individual interviews to tongue-tied patients, and particularly to schizophrenics.

6. The risk that patients, and especially schizophrenics, may "act out" emotional difficulties seems to be greater in group than in individual treatment.

7. The emergence of dominant personalities seems to be a general characteristic of groups with a common purpose. Some of the factors which may lead to dominance have been tentatively considered. Dominance in human groups may have a pathological origin.

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OBSERVATIONS ON SOME CASES OF EXHIBITIONISM.*

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EXHIBITIONISM was stated by East to be the commonest sexual offence for which men are received into prison; this proved to be true in 1946, when 98 men charged with exposing themselves were received into Brixton Prison during the year. Exhibitionism is customarily dealt with under Section 4 of the Vagrancy Act, 1824, and the offender is charged with being a Rogue and Vagabond in that he "did wilfully, openly, lewdly and obscenely expose his person with intent to insult a female." The term "exposure of the person" is presumed to be synonymous with exhibition of the genitals. The 98 cases about to be discussed represented 32·2 per cent. of the sexual offences and 1·95 per cent. of all offences received into the prison during 1946. Exhibitionism presents a difficult problem both to the doctor and to the layman, as it is often apparently nonsensical and meaningless. All cases received into prison are specially interviewed as a routine and frequently the Court requests a report as to the accused's state of mind. In this series this was requested in 88 cases—a much higher proportion than for any other offence.

In 1924 East recorded a series of 150 cases of exhibitionists received into Brixton Prison to which frequent reference will be made in this paper, and he gave in addition figures of sexual offenders received over a period of twelve months. It is interesting, therefore, to compare these figures he gave with those for 1946 in a tabular form.

	East's series.	Present series.
All sexual offences	291	295
All other offences	7,401	4,728
Percentage of sexual offences	3·8	5·9
Exposing person	107	98
Indecent assault on females	69	78
Carnal knowledge or attempts	42	23
Indecent assault on males	37	39
Importuning	19	24
Unnatural offences against males	17	33
Reports requested by Courts on sexual offenders	101	196

The most striking difference is the increased percentage of sexual offences and the great increase in requests from magistrates for reports as to the mental condition of offenders.

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The act of exposure shows great variations from case to case. Havelock Ellis describes the exhibitionist as usually a shy and timid person, who seldom makes demands on the woman and is satisfied with the mere act and the emotion it produces; he seldom speaks or makes an effort to approach her; he may have no erection and seldom masturbates. The response of the woman may be one of fright and flight, one of indignation and abuse, or one of pleasure and amusement; in the latter case the emotion produced is the most pleasurable. Walker and Strauss state that the exhibitionist will return over and over to the same spot and repeat the act, especially if it is received by the female with a response such as giggling. Allen considers the emotion is greater if the female is shocked; he also mentions the favourite spot, usually a lonely site, such as a country lane or a railway carriage. East and Hubert are more definite and rightly stress that the maximum sexual excitement may not necessarily occur at the time of actual exposure. They describe the object as always a stranger, sometimes plural in number, of constant age, often girls in their twenties or teens. In this series all the above examples were encountered. It was quite common for the man to have a fixed object, such as one or more females in the twenties or teens, but in addition many exposures were to children. In the latter cases, males might also be present, but there were always one or more female children in addition. There were, however, several cases of exposure in crowded places or actually to a crowd. One man, for instance, exposed himself to a crowd who were waiting to see a distinguished personage visiting the "Britain Can Make It" Exhibition; another to a bus queue of schoolgirls; and yet another to several A.T.S. girls standing at the windows of their hostel. In most cases the females were strangers; but one man exposed himself to his neighbour's wife, another to his landlady and a third to his own children. Nor was the object always fixed, for several men stood or sat in public parks and exposed themselves to all passing females, irrespective of their age. In the table below, showing the nature of the objects, the adult women were most frequently in their twenties:

One adult woman only	34	cases.
Two adult women	14	,,
More than two adult women	19	,,
One adolescent only	3	,,
Two adolescents	5	,,
More than two adolescents	5	,,
One child only	6	,,
Two children	3	,,
More than two children	9	,,

The emotion experienced was, in general, directly related to the response shown by the women. If the latter expressed indignation, embarrassment or amusement the greatest emotion was experienced. When the exposure was to two women much greater pleasure was felt if one of them was seen to comment on the exposure to the other. In the few cases in which it was alleged that the woman showed interest or pleasure, much less emotion was experienced;

the most unsatisfactory result, from the man's point of view, was a complete lack of interest on the part of the woman.

The site of the exposure varied considerably. There were lonely country lanes, railway carriages and the windows of the offenders' homes. At the other extreme, there were busy thoroughfares, like Piccadilly, stations like Waterloo, crowds, public parks and, in particular, the entrances of public urinals. A very common site was in bombed buildings.

Thirty-one of the offenders admitted masturbation at the time of the exposure, whereas the remaining 67 denied it; 43 admitted that the penis was erect. In considering these figures it should be borne in mind that reports by the Police were usually available and that a check on the prisoners' statements could be made; they frequently changed their first story when they realized this.

Prisoners charged with indecent exposure deny their guilt more frequently than in any other sexual offence. 46 (= 47 per cent.) of this series denied the offence and many offered an excuse of some sort; in East's series 55 per cent. made a denial. The excuses offered were varied; the commonest was that they had been observed while micturating (18 cases); 5 claimed to be drunk and not to remember anything about the offence; a further 19 alleged consumption of alcohol immediately before; 8 claimed that some physical disability had caused the act, combined with micturition or alcohol. The physical disabilities were (*a*) genito-urinary, such as an enlarged prostate, sensitive small bladder (confirmed by catheterization at the prisoner's request), enuresis, nephritis and urethral stricture; and (*b*) diseases causing scratching or involving auto-examination by the man, e.g. scabies, tinea cruris and furuncle of the thigh. Other excuses offered were that they were observed while masturbating (5 cases), that there was mistaken identity (2 cases), or that they had forgotten to fasten the trousers after micturition (3 cases). At this point it is relevant to mention the rather slender evidence which is sometimes offered that a man has exposed himself. In view of the frequent denials made by men against whom the evidence is indisputable, it is sometimes difficult in less obvious cases to form a conclusion as to the real state of affairs; but there can be little doubt that there are cases in which no exposure, or at any rate no exposure "with intent to insult a female," was in fact committed. It is only fair to say, however, that the Courts tend to take a very lenient view of such cases and few are ever committed to prison.

Contrary to the findings of East, who found 60 per cent. of his series to be bachelors, the greater proportion in this series were married men. Of the 98 cases, 53 were married and 7 had mistresses or were engaged and having sexual intercourse with their fiancées; only 38 were single men. Separation, domestic strife or dissatisfaction were common among the married men as follows:

Separated	15 cases.
Unsatisfactory relations	18 ,,
Wife pregnant and no intercourse possible	5 ,,
No disharmony obvious	15 ,,

These figures still confirm, therefore, the important part that deprivation of sexual intercourse plays in the aetiology of exhibitionism.

The incidence of exhibitionism is greater in the younger age-groups and falls off as old age is approached. The curve was found to drop sharply after the group 30–39 years as follows:

23–29 years	. . . .	37 cases.
30–39 ,,	. . . .	36 ,,
40–49 ,,	. . . .	11 ,,
50–59 ,,	. . . .	9 ,,
60 and over	. . . .	5 ,,

These findings correspond fairly closely to those of East, though the drop after the 30–39 year group is more marked. At the present time only males of 23 years and over are received into Brixton Prison, whereas in 1924 males of 16 years and over were received.

No less than 56 of the offenders had no previous convictions of any kind whatsoever; 19 more had previous convictions for offences other than exposure, usually of a petty nature. One man had 21 previous convictions for larceny, drunkenness, etc. It is seen, therefore, that in all 76·7 per cent. had no previous conviction for exhibitionism. Of the 23 cases which had previous convictions for exposure, 10 had one, 3 had two, 4 had three and 6 had more than three convictions. Some of them had other convictions for non-sexual offences. In view of this relatively small percentage of recidivists—and bearing in mind that none of the 10 cases with only one previous conviction had been sent to prison—may one not again repeat East's question and ask if the effect of prison is not a strong deterrent in cases of exhibitionism? The view that general criminality is more common in exhibitionists than in other forms of sexual offence is also supported by these figures.

There have been many classifications of exhibitionism. Havelock Ellis quotes Maeder as dividing cases into:

(1) The infantile exhibitionists, who desire to gaze and be gazed at; (2) the seniles, who are impotent; and (3) those indulging in exhibitionism for the purpose of invitation, and who are of definite virility.

None of the cases in this series fall into Class 1, not more than two into Class 2 and only relatively few of the remainder were exposing themselves by way of invitation. Krafft-Ebbing in his classical work (pp. 478 *et seq.*) divided exhibitionism into four groups:

(1) Acquired states of mental weakness with cerebral or spinal disease clouding consciousness and at the same time causing impotence.

(2) Epileptics in whom the act is an abnormal organic impulse performed in a state of imperfect consciousness.

(3) The somewhat allied group of neurasthenic cases.

(4) Periodical impulsive cases with deep hereditary taint.

Havelock Ellis criticizes this classification as unsatisfactory; this is confirmed in the present series. Only two cases fall into Group 1, none were epileptic and only four cases would fall into Group 3. East in his paper divided

his cases into two groups—the psychopathic and the depraved. Adopting the same classification for this series the results were as follows:

A. Psychopathic.		B. Depraved.	
1. Psychoses	3	1. The exposure as a preliminary to an attempt at carnal knowledge	0
2. Undeveloped psychoses	4		
3. Psycho-neuroses	4	2. The exposure as an attempt to debauch young children to commit a masturbatory act upon the exhibitionist	9
4. Personality defects	14		
5. Mental defectives	2		
6. Subnormals	11		
7. Visionaries	29	3. The exposure as an attempt to attract, excite or invite a female	17
8. Alcoholics	5		
Total	72	Total	26

It is very difficult to fit all the cases satisfactorily into these groups and many could be placed into two or more. Comparison with East's figures, however, show a striking general similarity. It was found necessary to add a sub-group of personality defects owing to their relatively high number. These consisted mainly of psychopaths, but there were three cases of post-concussive syndrome. All the psychoses were schizophrenics. The psychoneuroses consisted of two anxiety states and two compulsive-obsessive neuroses; this compares closely with East's five and the significance of the small number is discussed below. As in East's series there were no epileptics. The greatest discrepancy between these figures and those of 1924 is the mental defectives—2 as against 24. One can only assume that this is due to the improved detection of mental defectives nowadays by Education Authorities and the disposal of them at a much earlier age. The percentage of visionaries in both series is almost identical. In only four cases was there any strong evidence of other perversions; this figure cannot be regarded as really accurate as the length of time available for observation did not permit of such a deep and detailed investigation as is required to discover other than very obvious perversions. Only 12 cases had had any form of psychotherapy, but 9 of these were men with several previous convictions for the same offence. The 3 who had received treatment and who had no previous convictions consisted of an anxiety state, a compulsive-obsessive neurosis and a post-concussive syndrome. All 4 cases of psychoneurosis had received psychotherapy.

In 1939 East and Hubert gave a further grouping, which is found to be much more satisfactory in use and it is relatively easy to place each case in its correct group; a typical case history is given in each case.

Group 1.—These are the true exhibitionists, who practice exposure as a means of sexual relief in preference to any other means. They have usually been doing it for many years and it replaces, to a great extent, normal sexual intercourse. The act is often repeated; the men are anxious and fight hard against the temptation. Treatment is sought, but often seems of little help to them. In the present series there were 15 cases of this nature; 11 had

previous convictions and in 3 cases they had as many as seven in number. A typical case-history was as follows:

CASE 5.—Aged 61. Seven previous convictions for the same offence. He was a charming old gentleman of good education and pleasant manners. Indecent exposures commenced at puberty and had continued intermittently both in this country and in India, where his career had been ruined in consequence. He married in early life and had a family of three; intimate relations with his wife had never been really good. At first he chose adult women, including coloured girls, as his object, but in later years all his exposures had been to children. His frequent convictions had caused continuous moves from one country to another. Treatment had been sought frequently, but had little curative effect; he had also tried to exhaust himself sexually by frequent intercourse, but with no better result. Thinking it might benefit his condition he remarried a girl of 26 years in 1935; at interview this wife stated that he was completely impotent and had only achieved intercourse satisfactorily on two occasions. At the time of the present offence he was attending a clinic and had recently been a voluntary patient in a private mental hospital. He had just left court after being bound over on a charge of exposure to children, and was on his way back to the mental hospital, travelling alone in his car. He stopped, approached two female children, aged 8 years, and exposed himself to them. He was frank and co-operative at interview, and described a feeling of excitement at the time of exposure, followed by one of guilt; he stated that he had the same guilty feeling following sexual intercourse. There was a history of being afraid of enclosed spaces and he had on several occasions commenced to disrobe whilst travelling on tubes and buses. His own psychiatrist was 'phoned and stated that he had noted the strong guilt complex, and that analysis had revealed subconscious guilt in addition. The exposures were regarded as obsessive in character in view of the inability to control his impulses, the distress caused and the failure of imprisonment to deter him. The man was so anxious about his continued offences that he suggested castration as the only possible means of ridding himself of his condition. The court again bound him over and he re-entered the private mental hospital as a voluntary patient, being escorted there on this occasion.

Group 2 consists of those who expose themselves as a prelude to obtaining sexual intercourse; that is, to attract, excite and invite the female. Naturally the objects in these cases are adult women or adolescents, often of attractive appearance. In addition the woman is usually alone and the exposure tends to take place in a secluded spot. The male has an erection and goes through the motions of masturbation. This form of exposure is not so common as one is usually led to suppose in the literature; in this series there were only 12 cases.

CASE 2.—Aged 27. Four previous convictions for the same offence. He was a married man, but had been separated from his wife for over a year. From his story he had a voracious sexual appetite and had frequent sexual intercourse. He was invalided from the Forces, and twelve months previously had been a voluntary patient in a mental hospital following impulsive acts of violence to others. He was discharged following an attack on a male nurse; at that time he was not considered certifiable as insane. In this and all his previous charges his behaviour had been identical. He approached an attractive woman, between 20 and 30 years of age in a lonely part of a wood and exposed his erect penis. He admitted that his object was to obtain intercourse and though in most cases the woman ran away, he alleged that on two occasions he had been successful. He was shy and introverted whilst under observation, but his history showed frequent impulsive behaviour. He was considered to be an early non-certifiable schizophrenic.

Group 3 consists of those men who are unable to, or afraid of, obtaining normal sexual intercourse. Most of them are bachelors or married men who are separated. They ask for nothing from the woman and experience a sense of relief and satisfaction, usually at the time of the exposure. There are often

several women and the penis may or may not be erect. Sometimes a spontaneous ejaculation occurs. 21 cases occurred and 3 of these alleged a fear of contracting venereal disease as their reason for avoiding intercourse.

CASE 83.—Aged 29. No previous convictions. He was a married man with two children, and his wife had refused all intercourse for a long period, as she did not wish to have any more children; she thought that contraceptives were unreliable. He had served in the Forces, but was discharged owing to "nerves." On the morning of the offence there had been some "love-play" with his wife, but no intercourse was permitted. Whilst he was dressing he went to the bedroom window and exposed himself to passing women in the street. He was emotionally unstable and showed a very poorly integrated personality.

Group 4 was the largest group and consisted of 45 cases. These were men in whom the exposure was an isolated occurrence due to sudden temptation. They included the alcoholics and those who alleged that they were micturating when the opportunity for exposure was suddenly presented; others were masturbating or about to do so when a female was observed. It includes all the "physical" excuses and indeed most of those who denied the offence. The object was not fixed and the site was varied, but was often at or near a public urinal. Most of the men had no previous convictions.

CASE 84.—Aged 53. No previous convictions. He was a happily married man, who was on excellent terms with his wife, and had no history of any mental disorder. He was walking in the park after visiting a public house and felt a sudden urgent desire to empty his bladder. The nearest urinal was the other side of the park, so he stepped into the bushes and urinated behind a tree. As he stepped out, buttoning his trousers, he saw two girls in their late teens approaching and he exposed himself to them; he had no erection. He stated that the action was impulsive and had given him no satisfaction, at least not a conscious satisfaction.

Group 5 was a small one (5 cases) and consisted only of subnormal or defective persons. They regard exposure as the normal sexual approach to a woman, as to them it is the most easily understood. It resembles the behaviour of animals during mating, e.g. the love dance of the apes.

CASE 82.—Aged 28. Three previous convictions for the same offence. He was a dull and backward man with a mental age of 11½ years. He had been in a mental hospital, but was never considered certifiable under the Mental Deficiency Acts. He pleaded guilty to exposing himself to a girl of about fourteen years of age whom he saw walking in the park. She aroused a desire in him, but he did not really wish for intercourse with her. He had done the same thing on former occasions and failed to regard his conduct as in any way abnormal.

A further *Group* 6 was described by East and Hubert, and consisted of cases precipitated by the commencement of ordinary heterosexual life; there were no such cases in this series.

The above results are tabulated below:

Group 1.	The true exhibitionists	15 cases.
,, 2.	Exposure as an invitation to intercourse .	12 ,,
,, 3.	Substitution for normal intercourse .	21 ,,
,, 4.	Isolated instances due to sudden temptation	45 ,,
,, 5.	Subnormals to whom exposure is the natural approach	5 ,,
Total		98 ,,

Exhibitionism is a product of civilization and does not occur as a rule among naked savages. In such races there is no attraction, for it is that which is hidden, and not that which is exposed, which creates curiosity. The psychoanalysts consider that exhibitionism is the result of the castration complex; Fenichel states that the man exposes himself to prove that he has a penis and subconsciously desires the woman to show him that she had not. Näcke regards it as a form of sadism; whilst Stekel considers it to be essentially narcissistic in origin. Havelock Ellis compares exposure with the actions of the flagellist when the man approaches the woman with a rod representing the penis; he describes exhibitionism as a psychic detumescence. Few cases can be regarded as psychoneurotic in origin. As already stated, only four cases, of which two were compulsive-obsessives, occurred out of 98 offenders. The act of exposure is often impulsive in nature and there is an ever-increasing urge to carry it out; but ordinarily there is no distress at giving way to the desire and no real effort to control the impulse. In addition, as has been suggested earlier, the effect of imprisonment is so frequently deterrent as to contraindicate a diagnosis of neurosis. Masturbation at frequent intervals from puberty onwards is a common history. No less than 34 men in this series volunteered that it was a habit at the time of the offence. The exposing of the organ added an increase to the excitement which they gained from masturbation, the most primitive form of sexual relief. It will be appreciated from the divergent views quoted above and from the study of the present series of cases, that no single aetiological factor can be applied to exhibitionism in general. Numerous factors, constitutional and environmental, are involved; each case must be judged on its own merits, both as regards the personality of the individual, and as regards the environment in which he customarily lives and the circumstances in which the particular offence occurred.

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OBSESSIONAL STATES IN EPILEPTICS.

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THE association of obsessive compulsive states with organic disease is well known and a prolific and abundant literature dealing with it has accumulated in the last twenty years. The combination of obsessive compulsive states with epilepsy, however, has received very little attention and in some of the cases in which it has been reported it has been regarded as a coincidence. This may very well be so, but the case here described is of interest in showing the combination very clearly, and it would not perhaps be very odd if there were a small group of epileptics with obsessive compulsive states, in whom both manifestations were ascribable to a common pathology.

It is not proposed in this paper to survey the literature dealing with organic disease in obsessional states, but since so much of the work done on obsessional states has been of psychodynamic kind, attention may be directed to a few of the more common combinations. Schilder (1938) states that not less than one third, and possibly even two thirds of obsessional states have an organic background, and he draws attention to the necessity, when examining these cases, of looking for signs of chronic encephalitis. He mentions slight degrees of facial rigidity and of rigidity of the flexors of the arm and draws attention to the value of a sign described by himself with Hoff, namely, that when the arms are outstretched with the eyes closed they tend to come together owing to the increased tone in the flexor muscles. Impairment of the accommodation-convergence reaction, tremor, and certain motor urges, particularly an urge to talk, must be looked for. Goldstein (1942) describes obsessional symptoms after brain injury, especially the tidiness and meticulous orderliness of some patients, which he feels subserves a protective function in minimizing the effect of daily adaptation to changing events. Though he does not stress fully developed obsessional states, these sometimes occur after brain injury, and the writer saw such a case a few years ago, following directly upon a cerebral contusion.

Studies have been made of obsessional experience during oculo-gyric crises. These attacks are, it has been pointed out, very frequent in chronic encephalitis if they are sought for, and their character varies very widely. Some have the sudden and unheralded character of epilepsy, and are uncontrollable in their course, while in others the resemblance to a compulsion is considerable, for not only is there a feeling of being compelled to look upwards, but the patient can with an effort direct his gaze elsewhere, though when the

effort is relaxed, the eyes return to their upturned position. Obsessional rumination may accompany the crises, and Wexberg (1937) describes a patient who, during his attacks, felt that two people stood behind him and discussed him, and felt as if he were trying to look upwards and backwards in order to see them. Another patient during his attack continually pondered the question of why an O was round. Creak and Guttmann (1935) have discussed the relationships of tics and compulsive utterances to chorea, stressing the fundamental nature of the motor verbal eruption and the relative unimportance of the words used. It has been thought that those cases of chorea destined later to develop tics, showed differences at an early stage, particularly a preponderance of involuntary movements around the face, and involvement of breathing, phonation and articulation. From these studies and many others the organic basis of many, though not necessarily all, obsessional and compulsive states is clear.

The relation of epilepsy to the obsessional state is, however, much less secure and evidence is of a much less direct kind. Aldren Turner (1907) and Crichton Browne (1895) both observed obsessional doubting states in epileptics between fits; and Jelliffe (1932) noted that convulsions might occur in obsessionals, developing the subject in somewhat the same way as Freud, who believed that epilepsy might represent a discharge through somatic channels of excitation too massive to be mastered in a psychic way. Recently Roubicek (1946) has made a careful study of five cases of compulsive laughter, surveying much of the literature, and drawing attention to the close link between this condition and epilepsy. Cappell and Dott (1938) recorded a case of tumour of the mammillary bodies in which subsequent examination showed that neither cortical involvement nor hydrocephalus was present. In this case frequent fits occurred after a long aura of uncontrollable and inappropriate laughter. Wilder described a case where compulsive laughter gradually merged into the aura of epileptic fits over a period of years. Wilder's case was especially interesting in that one brother of the patient suffered from epilepsy and another brother suffered from compulsive laughter, as also did the son of this brother. Electroencephalographic evidence is conflicting. Pacella (1944) has published observations on a small number of EEGs performed on cases of obsessional state. He examined 31 cases, being careful to exclude any who had had electro-convulsive therapy, or any form of brain injury or disease. 26 of the cases were psychoneurotic and 5 were schizophrenic, and it is interesting to note that two of the former suffered from *petit mal*. He records that 22 cases out of 31 had abnormal tracings and that of these 14 had convulsive type patterns, as shown by frequent runs of 2–4 c/s and potentials of high amplitude after hyper-ventilation. Rockwell and Simons (1947) divided a series of obsessive compulsives into three groups, the second of which, amounting to 10 cases, consisted of patients with severe obsessional symptoms and some affective features. These were inadequate, unstable psychopathic personalities characterized by immaturity and low ethical standards, and all had abnormal records with slow waves, which in two cases were paroxysmal. A further case in which an obsessional state and a tic were combined showed excessive production of waves at frequencies of 5–7 cycles per second. These findings

are of interest, but difficult to assess and are not yet confirmed by other workers.

Literature in the general sense yields at least two notable cases where epilepsy and obsessional states have been combined. John Cowper Powys describes his own very severe obsessional state—handwashing, a fear of knives and forks being allowed to point at his breast which was linked up with an obsessional preoccupation with the possibility of changing sex, and an aversion to cotton fabrics so strong that he was averse to the sight of either himself or another person holding a cotton handkerchief. This author describes in his autobiography how his epilepsy began at the age of eighteen and mentions several attacks which occurred subsequently. Freud tells how Dostoievski had fears of his own death as a child with many compulsive rituals to protect against the fear. His father was murdered when he was eighteen years of age, and thereafter Dostoievski suffered from epilepsy. Freud regarded this as a dramatization of his own punishment or at least as a portrayal of his guilt, and it is interesting to note that while he was incarcerated in Omsk for four years for a political offence, the epilepsy ceased. Freud believed that the imprisonment in Siberia was in itself punishment enough, and it is related that when Dostoievski was freed the epilepsy returned and indeed was worse than before.

My own case, which aroused my interest in the matter, was as follows:

The patient was a poultry farmer, aged 51. He showed no outstanding features in his childhood, which was reasonably happy, though he was a little timid and fearful of the dark, and required a light in his bedroom as late as twelve years old. His father was a well-known county cricketer, and under his guidance the patient devoted much time to cricket and other sports. He passed a scholarship and after leaving his secondary school joined his father in a leather business. He joined the R.A.M.C. in 1915, being invalided seven months later for epilepsy together with recurrent dislocation of a shoulder because of the fits. When he was 32 his father died, and a few years later he sold the business, being at that time concerned about his epilepsy and anxious to work in the open air, which he felt might help him. He and his wife retired into the country to live on a farm with a young female cousin, rendering certain services to her in return for a small grant of land. He lived on the proceeds of some poultry, together with the income from a small estate left by his father. Despite increasing personality difficulties with the cousin, who was described as "somewhat neurotic," he has remained in the same employment for sixteen years.

The family history is as follows: His father was a rigid, strait-laced man, who ruled his household with an iron hand. His mother was a quiet little woman, who died of cancer when the patient was about 20. One brother died soon after the last war, in which he was gassed and is said to have suffered from faints. The other brother still lives and was an unstable and unscrupulous person, who made sustained efforts to defraud the patient during their business partnership. The patient, in relation to his obsessional symptoms described below, said quite spontaneously that he wondered whether his brother's character, of which he was very much ashamed, was the cause of his being so fearful of similar traits showing in himself.

The patient married when he was 27, and the marriage has been successful. His wife describes the patient as quiet and reserved, fond of his cricket, and of stable mood. He has been a strict teetotaller, not because of any prejudice, but because he had been told drinking would influence his epilepsy adversely. He was religious, but not ostentatiously so, and indeed was not a particularly regular attendant at church. Apart from his cricket, he had few outside interests and spent his evenings at home.

His epilepsy appeared at the age of 17, and thereafter he had about five or six

fits each year. He was free from attacks for years before his marriage, but they returned subsequently. He had taken his condition seriously at all times and had taken bromides and barbiturates regularly at least for the last fifteen years. Two years ago his fits ceased and at about the same time he began to feel worried as to whether he had paid his debts. He would go into shops in the village and ask for confirmation that he had paid his bill of a week before, clearly aware that he had done so, but feeling impelled to confirm it. At first one confirmation would suffice, but later several visits might be necessary. At the same time he became fearful of leaving the gates of fields open, and despite the utmost care and repetition in closing a gate, would be tormented by the fear that the catch might have slipped, and he would sometimes return over several fields in order to confirm that the gate was secure. At night he worried lest a passing car should run over someone in the dark, and that the victim would be undiscovered until the morning. During one night he lay awake and on three occasions when he heard a car pass he got out of bed, dressed, and walked two hundred yards down the road looking for the body. His passage through the village was torment to him, for he had at least three separate compulsions to contend with. He had to go into every shop he passed and confirm that he owed no money there; he had to stop and kick every stone off the pavement lest someone should slip and be injured; and he had to pick up and examine any small piece of paper he saw lest someone might have lost something of value. Eventually his anxiety became intense and he felt unable to move out of doors and he was admitted to hospital. There he would ask repeatedly if he were entitled to the cigarettes and stamps with which he was issued, at the same time apologizing for his " stupid behaviour " and asking the nursing staff to be as tolerant of him as possible. When his temperature was taken he felt compelled to ask for confirmation that the thermometer had been properly removed and not allowed to slip down under his clothing. After washing his hands, which he did frequently, he returned repeatedly to be sure he had turned off the taps. He was troubled incessantly by rumination as to whether in a large hospital someone might be buried prematurely because a doctor was not available to confirm the fact of death.

No obsessional symptoms had ever occurred in his life before. He had been an orderly and tidy man, and somewhat " particular " but not to a degree which his family regarded as in any way abnormal. In hospital he was treated with sedatives —regular and slightly increased doses of barbiturates, and by simple psychotherapy. His anxiety disappeared and though not free of compulsions these were less and more in control at the time of discharge. In the short follow-up so far possible, he has remained static and with very little practical disability. Prefrontal leucotomy was considered, but deferred in view of his response to conservative treatment.

Summary.

The combination recorded above may perhaps be more frequent than has been reported, though it is unlikely to be very frequent. It seems at least possible that a single pathology may be responsible for both manifestations, and that from some affected extrapyramidal area, a discharge may spread to both hemispheres, producing a generalized seizure. To speculate further would be profitless. It appears certain now that generalized convulsions may ensue from subcortical disease apart altogether from cortical involvement, as shown for example in Cappell and Dott's case; and it is equally certain that obsessional states are associated with ascertained disease of the brain-stem in its upper part. Certain other conditions, such as Gilles de la Tourette's disease, compulsive utterances and tics, and compulsive laughter might be regarded as sharing some of the features of both. It is possible, therefore, that there is a pathological entity which may produce this quite unusual combination of symptoms.

Acknowledgment.

I have to thank Dr. R. E. Hemphill, Medical Superintendent, for permission to publish this paper, and my colleague, Dr. R. Klein, for his helpful and constructive criticism.

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LEPTAZOL THERAPY IN MENTAL DISORDERS: A MODIFICATION USING SODIUM AMYTAL.

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AT a time when treatment by electrically induced convulsions is attaining a rapid and widespread popularity in clinical psychiatry, it is well to take stock of alternative methods. The purpose of this paper is to describe a method of modifying the treatment of mental disorders by leptazol (cardiazol, metrazol, phrenazol) so as to remove the unpleasantness hitherto associated with this treatment. Though leptazol therapy is still widely employed in psychiatry, its use has, for two reasons, become increasingly restricted. Firstly, it is very unpleasant for the patient; secondly, newer physical treatments, no less empirical, often yield better results in the conditions in which it was used.

In clinical practice it is probable that the first reason has so reduced its popularity that of recent years too little attention has been given to its relative therapeutic merits. If the treatment can be rendered acceptable to the patient, it becomes pertinent to ask if and when it is indicated. There are three possibilities:

(1) Cases in which it is the treatment of choice.

(2) Disorders which have recently failed to improve with other empirical methods, and which often do improve with a course of leptazol; or disorders in which the treatment of choice is contraindicated on coincidental grounds.

(3) Miscellaneous circumstances, such as patients who refuse electrically produced convulsions; situations in which the apparatus for these is not available; or others mentioned below.

It has been advocated as the treatment of choice in catatonic stupors and certain schizophrenic reaction-types refusing food. It has been recommended in some hysterical syndromes with depressive features; in the excitement of mania; and in illnesses characterized by symptoms of self-depreciation and inferiority, or depression with expressed feelings of unworthiness or guilt. Many psychiatrists favour it in various affective disorders, opinions differing as to those in which it is most effective. I have found it very successful in an acute syndrome in young men, possibly seen more often during the war years. It superficially resembles early schizophrenia simplex, but the breakdown seems reactive rather than endogenous; it occurs in a personality previously healthy or perhaps rather inadequate, but not truly schizoid; and the subject

is dominated by ideas of inadequacy, hopelessness or uselessness in society, inferiority, self-depreciation, unworthiness or real guilt. It is the mental trend and content which is predominantly disturbed. Five of my cases were of this type and they responded well.

Other psychiatrists, though not accepting that it should be used first in the above conditions, will agree that in many of them it produces an improvement sufficiently often to make it indicated when other treatments have failed. This provides a large number of cases under Group 2.

Group 3, though not a psychiatric classification, is at the same time much less a matter of personal opinion and cases in this group are not uncommon. I have had two men who refused electrically produced convulsions and would have gone to any length to avoid them because they had seen the fits produced by the apparatus when patients were treated *en masse*. There are other patients who are horrified at being connected to mysterious electrical apparatus, but who fairly readily agree to an injection. Such patients would probably also object to leptazol injections if the usual unpleasant concomitants of these had to be endured; but with the method below, they do not. Other patients in this group are those in whom it is important not to impair their memory; and early schizophrenic reactions, encountered at the out-patient clinic, who will not, or cannot for domestic reasons, consent immediately to a long course of insulin therapy or any treatment necessitating hospitalization.

The Problem.

There are, then, in the present state of our knowledge, definite indications for leptazol therapy. If it could be made palatable to the patient it might be held much more in favour. Reasoning from the fact that in electrical convulsion therapy it is presumably the retrograde amnesia which renders it acceptable to most patients, I sought to produce such an amnesia in leptazol therapy, particularly for the terrifying experiences, cumulative in effect, which occur between the injection and the convulsion, experiences sometimes referred to as the aura. Starting with feelings of apprehension, strangeness or unreality, it progresses to sensations of choking, buzzing and tingling; unpleasant olfactory, gustatory or vivid visual hallucinations; fantasy formations; and, finally, stark terror. The intense struggling and pleading exhibited to avoid this are familiar phenomena. Cook has stated the problem in a paper in which he discusses the role of fear in leptazol convulsion therapy. He remarks that even partial amnesia helps to allay subsequent apprehension, and that a complete amnesia, sufficiently retrograde to include the preparatory phases, should go far to remove one of the greatest drawbacks of the therapy. I feel certain that the whole objection to treatment is due to fear of the aura period, and other writers entirely agree with this. Attempts have been made to dull the patient's perception of the aura by hyoscine hydrobromide, or paraldehyde premedication, induction of insulin hypoglycaemia, administration of nitrous oxide to the point of asphyxia—all of course before the injection of leptazol.

I have experimented with soluble hexobarbitone prior to the leptazol, the aim being to inject this slowly until the patient is practically unconscious; to

wait until he has partly revived; and then to inject the leptazol. Briefly, as hexobarbitone is antagonistic to leptazol, it is not practicable to choose a dose which is large enough effectively to narcotize the subject and yet not large enough to impair the action of leptazol. A small dose of soluble hexobarbitone merely dulls the patient's perception, so that his memories are rather less vivid, but still present; and I abandoned the idea of prior administration of this or any other drug.

Technique.

The method I have adopted is to follow the leptazol convulsion by an intravenous injection of sodium amytal so as to keep the patient fairly deeply unconscious after the convulsion; and in such amount that he remains unconscious for a further half to one hour. There are three simple points to observe:

(1) The time of injection: the sodium amytal is injected immediately respiration becomes regular.

(2) The site of injection: the vein to be used should be selected and prepared before giving the leptazol.

(3) The amount at first injection: it is important to avoid subconvulsive doses of leptazol.

The sodium amytal is not injected immediately after the convulsion, but as soon as respiration becomes regular, usually about 20 seconds later. I have considered it unwise to give an intravenous barbiturate like sodium amytal while respiration is disordered; but there must be no delay when it recovers, for I have found that, if there is, the retrograde amnesia is less complete. Similarly, a subconvulsive dose of leptazol should be avoided, for whether this is followed by a larger dose in order to produce a convulsion, or by the sodium amytal when it becomes apparent that no convulsion will occur, then, in either case the sequence of convulsion—immediate deep coma—light coma, is broken, and there is less likelihood of success. With the sodium amytal the restlessness or struggling which often occur in the minutes soon after the convulsion are completely avoided. After this restlessness the patient does often sleep for a while; but with the sodium amytal the sequence is altered, and the deepest unconsciousness follows the convulsion.

Pre-selection of the site becomes important in patients with bad veins, and in them it may be vital. In such subjects, if only one inadequate vein is found, it is often spoiled by the leptazol and delay in searching for another after the convulsion may lead to failure of the technique. For similar reasons I have a spare syringe already filled with sodium amytal. I also have at hand a syringeful of soluble hexobarbitone ready to inject in cases where a convulsion is not produced. I chose this drug for this purpose because it is more rapid and the amount necessary to get the patient fairly deep is easily judged while the injection is made.

As to the choice of barbiturate for the standard technique, the criterion is that it has the appropriate rapidity of action and of clearance. I have no grounds for believing there can be anything specific about sodium amytal. It has the desirable initial action, and a rate of clearance which from one treatment to the next allows judgment of a dose which will secure the right period of

unconsciousness. The method has been used on out-patients, where it is convenient to have control over the length of unconsciousness.

The dose is adjusted from session to session. After the first injection of leptazol, in a normal adult I used 0·35 gm. sodium amytal. If the patient remained unconscious for much over an hour I reduced it to 0·2 gm. next time. If he could be roused after only a few minutes, I increased the dose next time, up to 0·4 gm. or 0·5 gm. I tended to use a large dose at the first session, as I did also with leptazol, and later to reduce it, rather than the reverse. In this technique, initial success contributes largely to success over the whole course. In two patients who were difficult to rouse after only 0·15 gm. sodium amytal at the third session, I substituted 0·2 gm. soluble hexobarbitone at the fourth session and adjusted this at subsequent sessions to get the desired result.

Further Modification.

I may mention here a recent further modification with an intravenous barbiturate, not before each leptazol injection, but before the whole course of treatment. At the first session the patient is prepared exactly as he will be at subsequent sessions. He is told he is to have an injection which will make him lose consciousness, and as this suggestion is being made he is given 0·4 gm. soluble hexobarbitone intravenously, or a little more if necessary, and allowed to lie until he wakes. At the second attendance he is given 6 to 7 c.c. of "Injection of Leptazol" and is reminded that he will rapidly lose consciousness; this is followed up by sodium amytal and the course continued as above. I have found the suggestive reinforcement of the first "treatment" is effective, and by the third session the patient is accustomed to the procedure and content in the belief that he is having some sort of sleep therapy. I think this further refinement will give optimum effectiveness to the whole technique.

Results.

In all, 34 in-patients and 16 out-patients were treated and I will discuss them in three groups:

	Group 1.	Group 2.	Group 3.	Total.
In-patients . . .	4	22	8	34
Out-patients . .	6	9	1	16

The first group, 4 in-patients and 6 out-patients, had what can be called an amnesia for treatment. By this I mean a retrograde amnesia comparable with that obtaining in a patient having electrical convulsion therapy who cannot remember the nature of the previous treatment. It does not imply amnesia for the entire procedure of coming up and having treatment.

In the second group, of 22 in-patients and 9 out-patients, there was amnesia for leptazol symptoms. Though the patient remembered his preparation and the injection itself, he did not remember what followed the injection or did not associate it with anything unpleasant.

The third group had a partial amnesia. They remembered enough of the unpleasantness of the leptazol symptoms to make them dislike further treat-

ment; but they certainly did not suffer the extreme fear which results from leptazol by itself, and only persuasion was necessary to induce them to continue. Relatively more in-patients were placed in this group because a few could not be regarded as perfectly reliable witnesses; and if there was any doubt they were placed in this group rather than the one above. There was one in-patient in whom we could not be sure that the technique had made any difference.

In no case was there any trace of the restlessness and excitement which sometimes occurs after treatment with unmodified leptazol. Even in Group 3 there were no signs of any of the reactions which may occur in patients recovering from a leptazol convulsion.

The patients were seen after treatment by another member of the medical staff, and we have judged the results from the descriptions and introspection of the patients, on the one hand, and from their reactions to the treatment and to the prospect of more, on the other. Of great assistance was the fact that twelve in-patients had had a previous course of electrical convulsion therapy and four a course of unmodified leptazol; while eight out-patients had had a previous course of electrical convulsion therapy. This provided the background with a measure by which to assess the effectiveness of the present technique. Some patients preferred the course of injections to electrical treatment. In most cases the same sister or charge nurse assisted at both courses and considerable weight was given to their opinion on the reactions of the patients, and especially on what the patients told them about it in the absence of the doctor. In fact, up to the third treatment of each course, I judged the results largely on detailed information obtained from a reliable nurse.

Discussion.

Interesting points emerge from consideration of the patients who actually preferred this treatment to treatment by electrically produced convulsions. I am sure that the preference does not result from an amnesia which in every case was better than that obtaining in electrical convulsion therapy in the average patient. Other factors must be responsible. Now many patients, especially if unaccustomed to the hospital atmosphere or to complicated apparatus, are frightened by the arrangement for electrical convulsion therapy and by the way in which they are prepared for it. If then in leptazol therapy an amnesia can be produced comparable with that in electrical convulsion therapy, so that the patient comes to each individual treatment with the same preconception of it, it is not surprising that many will prefer the more familiar procedure of injection to that of having their head scrubbed, tightly strapped and connected to elaborate electrical equipment. Patients, of all grades of intelligence, know that there is something more in the "electrical treatment" than they have been told.

I suggest that the technique does not necessarily result in a retrograde amnesia as good as that in electrical convulsion therapy; but it does result in one which removes the unpleasant concomitants of leptazol injections. From the figures above it can be seen that 20 per cent. of subjects had an amnesia as good as, or better than, that obtaining with the electrical method. However,

a further 62 per cent., making a total of 82 per cent., could not associate the treatment with any unpleasant sensations. This is all that was aimed at, but the end-results, for reasons advanced above, are better than anticipated. In the remaining cases the aura phase was reduced by varying amounts. Whatever the mechanism, the treatment is rendered acceptable to most patients.

Further, there is more perfect control, from session to session, in a method involving injections of known amounts of a standard solution. In the electrical method, any one voltage and time setting may not produce the result expected by reference to the previous session; and most clinicians are familiar with the growing apprehension of the patient while technical adjustments are being made.

It is also likely that this modification will lead to better therapeutic results. It has been shown by Cohen, for example, that a large element of fear in leptazol therapy considerably reduces its curative effect; and this technique should enhance the therapeutic value of the method.

Summary.

There are several indications in psychiatry for leptazol therapy, but it has fallen out of favour largely because of its very unpleasant concomitants. A method of overcoming these is described, and its results in a series of in-patients and of out-patients are discussed.

This work was carried out at Runwell Hospital, Wickford, and I have pleasure in thanking Dr. Ström-Olsen, Physician Superintendent for his help throughout.

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Part II.—Reviews.

Shock Treatment. By L. B. KALINOWSKY and P. H. HOCH: London: William Heineman, 1946. Pp. xiv + 294. Price 21s.

After some account of the historical development of shock treatment the author deals with insulin shock, convulsive shock, combined insulin-convulsive shock, other somatic non-surgical treatments and prefrontal lobotomy in that order. He gives a good account of insulin shock treatment, including its various modifications. He wisely points out that subcoma doses of insulin should not replace insulin shock in the treatment of the psychoses. He quite agrees with Sargant and Slater in their views on its value in treating psychoneurotic patients, particularly in anxiety states, to make the patient more amenable to psychotherapy.

In discussing E.C.T. he quotes Sogliani as having given as many as five convulsions in from ten to twenty minutes. He gives this intensive treatment to all who fail to recover with the usual treatment. They are most valuable in acutely disturbed patients threatened by the danger of exhaustion.

In discussing prefrontal lobotomy the author quotes Fiamberta as operating through the orbita into the skull. He points out the importance of psychological treatment, post-operative treatment, and that readaptation may take months or years, and then curiously enough says that a decision as to the outcome of an individual case should not be made less than several *months* later. In our experience it is wise to wait five years before giving any hard and fast opinion.

The value of lobotomy in the treatment of psychoneuroses is emphasized, especially as E.C.T. is of little use in these conditions. We should have liked to have seen some mention of the use of lobotomy in the treatment of intractable pain, Freeman and Watts having published some work on this aspect.

The book is very well worth reading and has a good bibliography.

G. W. T. H. FLEMING.

Part III.—Bibliography and Epitome.*

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AM. J. PSYCHIAT.
VOL. CIII. NOVEMBER, 1946.

The Genetic Theory of Schizophrenia.

1. The methods available for genetic investigations in man are the pedigree or family history method, the contingency method of statistical prediction, and the twin study method.

2. A study of the relative effects of hereditary and environmental factors in the development and outcome of schizophrenia was undertaken by means of the "Twin Family Method." The study was organized with the co-operation of all mental hospitals under the supervision of the New York State Department of Mental Hygiene. The total number of schizophrenic twin index cases, whose co-twins were available for examination at the age of fifteen years, was 794.

3. In addition to 1,382 twins, the 691 twin index families used for statistical analysis include 2,741 full siblings, 134 half-siblings, 74 step-siblings, 1,191 parents, and 254 marriage partners of twin patients. The random sampling of these twin index pairs is indicated by the distribution of 174 monozygotic and 517 dizygotic pairs, yielding a ratio of about 1 : 3.

4. The morbidity rates obtained with the "Abridged Weinberg Method " are in line with the genetic theory of schizophrenia. They amount to 1·8 per cent. for the step-siblings, 2·1 per cent. for the marriage partners, 7·0 per cent. for the half-siblings, 9·2 per cent. for the parents, 14·3 per cent. for the full siblings, 14·7 per cent. for the dizygotic co-twins, and 85·8 per cent. for the monozygotic co-twins. This morbidity distribution indicates that the chance of developing schizophrenia in comparable environments increases in proportion to the degree of blood relationship to a schizophrenic index case.

5. The differences in morbidity among the various sibship groups of the index families cannot be explained by a simple correlation between closeness of blood relationship and increasing similarity in environment. The morbidity rates for opposite-sexed and same-sexed two-egg twin partners vary only from 10·3 to 17·6 per cent., and those for non-separated and separated one-egg twin partners from 77·6 to 91·5 per cent. The difference in morbidity between dizygotic and monozygotic co-twins approximates the ratio of 1 : 6. An analysis of common environmental factors before and after birth excludes the possibility of explaining this difference on non-genetic grounds.

6. The difference between dizygotic and monozygotic co-twins increases to a ratio of 1 : 55, if the similarities in the course and outcome of schizophrenia are taken as additional criteria of comparison. This finding indicates that constitutional inability to resist the progression of a schizophrenic psychosis is determined by a genetic mechanism which seems to be non-specific and multifactorial.

7. The predisposition to schizophrenia, that is, the ability to respond to certain stimuli with a schizophrenic type of reaction, depends on the presence of a specific genetic factor which is probably recessive and autosomal.

8. The genetic theory of schizophrenia does not invalidate any psychological theories of a descriptive or analytical nature. It is equally compatible with the psychiatric concept that schizophrenia can be prevented as well as cured.

(Author's abstr.)

VOL. CIII. JANUARY, 1947.

The Genetics of Epilepsy.

Study of the incidence of epilepsy among 12,119 of the near relatives of 2,130 epileptics and among 55 twin pairs affected by seizures, together with analysis of the brain wave records of 470 relatives and of the 55 twins, leads to the conclusion that epilepsy *per se* is not inherited but a tendency or predisposition usually is inherited. The terms, genetic and acquired epilepsy, should replace the meaningless conventional terms essential and symptomatic. Probably in most patients both genetic and acquired factors are present. The incidence of epilepsy is higher among the near relatives of epileptics if pathology of the brain did not antedate the onset of seizures, if the patient's epilepsy began early in life, if he was mentally abnormal at birth, if he has *petit mal* and if the patient is female.

The electroencephalogram is an hereditary trait and brain wave tracings, properly made and interpreted, may be of positive value in visualizing a transmitted quality which (with the possible help of acquired pathology or pathophysiology) may eventuate in epilepsy. The practical value of this evidence is limited, because cortical electrical activity is a fluid trait, dysrhythmia cannot always be demonstrated in patients, and tracings of relatives may display only minor deviations from normal. Therefore, negative electroencephalographic evidence may not be significant. (Author's abstr.)

Dilantin Treatment for Behavior Problem Children with Abnormal Electroencephalograms.

A group of behavior problem children with abnormal electroencephalographic findings were treated with dilantin.

None of the children presented clinical evidence of epilepsy or were known relatives of epileptics. The physical and neurological examination of all the children was negative. None of the patients were adequately controlled by their environment previous to treatment. All were treated on an outpatient basis and showed definite clinical improvement under dilantin treatment.

The results are considered encouraging and warrant further follow-up and study. The implications and significance of recognition and treatment of these cases in terms of prevention or amelioration of adult neuropsychiatric difficulties are discussed. (Authors' abstr.)

AM. J. PSYCHOL.

VOL. LIX. 1946.

Intellectual Functions with Restricted Intakes of B-complex Vitamins.

The chemical, physiological and psychological consequences of varying the intake of the vitamin B-complex on 8 physically normal men (*C. A.*, 20–32) were determined. Following a standardization period of 41 days, they received a diet in which thiamine, riboflavin and niacin were partially restricted for 161 days. Immediately following this, Ss were acutely deprived of these vitamins for 23 days and then received a supplementation of thiamine alone for 10 days. Two general intelligence tests (the ACE and the Ohio State University), the Porteus Maze, Cattell's Cursive Miniature Situations, and various more specific tests (spatial relations, verbal fluency, perceptual speed, number facility, etc.) were used. The tests were given in such a way as to trace the changes in intellectual performance throughout the period of deprivation. The results showed that acute deprivation of the vitamin B-complex resulted in a limited deterioration of performance on the tests demanding speed. Rate of learning was not affected though the level of performance was lowered. Recovery was produced by thiamine supplementation during 10 days. Psychoneurotic scores, especially the depression scale (Minnesota Multiphasic), rose during the period. The significance of these data in relation to other studies is considered. D. E. JOHANNSEN (Chem. Abstr.).

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Psychologic Aspect of Allergic Skin Reactions in Childhood. *Woodhead, B* . 98

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VOL. LXXVI. DECEMBER, 1946.

Behavior and Psychologic Problems of Young Diabetic Patients. *Fischer, A. E., and Dolger, H.* 711

ARCH. NEUROL. PSYCHIAT.

VOL. LVI. DECEMBER, 1946.

Boston Society of Psychiatry and Neurology.

Chicago Neurological Society.

Cerebral Dysrhythmia and Psychopathic Personalities: A Study of Ninety-six Consecutive Cases in a Military Hospital.

Electroencephalographic tracings were obtained from 96 of a series of 104 patients with a disorder diagnosed as constitutional psychopathic state in a military setting. Within the special situation from which the patients were obtained, the sample was unselected. The personalities were evaluated first by psychiatric criteria, so that the finding of electroencephalographic abnormality did not influence diagnostic judgment. The records were classified in accordance with the Gibbs' criteria with the single exception that records showing certain slow dysrhythmias of paroxysmal character were classified with records of paroxysmal activity rather than with those containing slow sequences. The percentage of abnormal records did not greatly exceed the reported incidence of abnormality in normal control groups studied by different investigators, although we did obtain a definitely higher percentage of records with F-2 and S-2 frequencies than has been obtained for normal controls. The authors find no relationship between the severity of different manifestations of psychopathy and the incidence of abnormality in records. (Authors' abstr.)

VOL. LVII. JANUARY, 1947.

NEW YORK NEUROLOGICAL SOCIETY, ETC.

PHILADELPHIA PSYCHIATRIC SOCIETY.

PHILADELPHIA NEUROLOGICAL SOCIETY.

Results of Treatment of Multiple Sclerosis with Dicoumarin.

The evidence that sclerotic plaques arise as a result of venular thrombosis is reviewed.

The results of the treatment of 43 patients with multiple sclerosis with dicoumarin (3,3′-methylene-bis-(4-hydroxycoumarin)) for periods varying from six months to four years is reported.

Doses of dicoumarin sufficient to raise the prothrombin time to thirty seconds continuously were administered, with constant laboratory control.

Twenty-five patients suffering from a remittent form of the disease were adequately treated without interruption for a total period of approximately sixty-one patient years. In this group no fresh symptoms or obvious acute outbreaks occurred. Most of the 16 patients with chronic progressive disease continued in their downward course.

The treatment of two patients was interrupted for one reason or another. The patients were free from new symptoms while taking treatment, but both had acute relapses when it was discontinued. In two patients large doses of dicoumarin failed to produce the expected increase in prothrombin time, and relapses occurred.

(Authors' abstr.)

The Electroencephalogram and Personality Organization in the Obsessive-compulsive Reactions.

The number of patients in this series was relatively small, but since each was thoroughly studied for an adequate period it is felt that certain tentative conclusions may be drawn:

(1) Pathologic findings were present in the electroencephalograms of 13 out of 24 patients who presented obsessive-compulsive symptoms. There did not appear to be a connection between any special type of compulsive psychopathic disorder and the abnormal electroencephalographic findings. There was, however, a high degree of correlation between disturbances of the underlying personality organization and electroencephalographic abnormalities. All the patients with clearcut disturbances of personality organization, i.e. with psychopathic personalities, had abnormal electroencephalograms. Ten of the 11 patients who were considered to be well organized persons had normal electroencephalograms.

(2) Abnormal electroencephalograms, which were found in all the patients with disturbances of personality organization, were characterized by the presence of excessive quantities of slow waves (3 to 7 per second). The consistent finding of slow activity in this series suggests that we are dealing with the same type of neurophysiologic disturbance observed by Simons and Diethelm, who, in their study of psychopathic personalities, reported:

"The majority of abnormal records were those containing sufficient 5 to 7 a second activity of low average amplitude in the frontal and parietal leads to be considered beyond the limits of normal."

(3) If the conclusions drawn from these observations are valid, certain therapeutic implications follow. Any patient who shows electroencephalographic abnormalities of the type presented by these poorly organized psychopathic patients must be suspected at least of having a deficiency in the synthesizing functions of his personality; this point should be investigated further, utilizing both clinical observation and anamnestic data from outside sources whenever possible. In the treatment of a psychopathic patient with obsessive-compulsive symptoms, it has been our experience that more or less passive analytic technics will result in the disappearance of the obsessive-compulsive phenomena, but there remain the manifestations of psychopathic personality, which must be approached with a more active, synthesizing type of treatment. The electroencephalogram is a useful tool in giving an early lead to the presence of disturbances of personality organization, for these disturbances are not always obvious during early contacts with the patient.

(4) The present study gives evidence that certain types of psychopathic personality, described by Simons and Diethelm, are associated with electroencephalographic abnormalities, whether these disturbances of personality organization appear as the leading clinical features or occur in cases in which obsessive-compulsive symptoms dominate the clinical picture. (Authors' abstr.)

FEBRUARY.

New York Neurological Society, etc.

New York Neurological Society.

Effects of Pitressin Hydration on the Electroencephalogram; Paroxysmal Slow Activity in Non-epileptic Patients with Previous Drug Addiction.

The electroencephalograms of fourteen non-epileptic men with previous drug addiction were studied before and after pitressin hydration. No clinical seizures were induced by this procedure.

The alpha frequency showed a tendency to slowing after hydration, but in only three instances was the degree of change greater than that which could be expected from day to day variation. There was no significant change in the percentage of alpha activity.

In half the records there was shift to the slow side of the frequency spectrum.

In half the records paroxysmal slow activity of moderately high amplitude appeared after hydration.

There was some correlation between the appearance of paroxysmal slow activity and the shift of the frequency spectrum to the slow side, but no correlation with the degree of hydration or the amount of pitressin administered.

The possible significance of these observations in their relation to idiopathic epilepsy is discussed. (Author's abstr.)

ARCH. OPHTHAL.

VOL. XXXVI. 1946.

Visual Disturbances Associated with Head Injuries. *Greear, J. N., jun.* .

ARCH. OTOLARYN.

VOL. XLIV. 1946.

Effect of Labyrinthine Reflexes on Vegetative Nervous System. *Spiegel, E. A.* 61

ARCH. PATH.

VOL. XLII. DECEMBER, 1946.

Brain Repair: I. Phospholipid-splitting Enzymes of Brain Phagocytes. *Hicks, H. P.* 564

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VOL. IV. 1946.

*The Prefrontal Leucotomy of Egas Moniz. *Yahn, M.* 213

The Psychological Factor in Bronchial Asthma. *Doyle, I.* 239

Consideration of the Myoclonic Cerebellar Dissynergia of Ramsay-Hunt. *Filbro, R. M.* 260

Post-traumatic Amnesias. *Teixeira, N. L.* 286

Platybasia. *Insausti, T., and Matera, R. F.* 333

Electropyrexia in the Treatment of Neurosyphilis. *Doyle, I.* 349

Electroencephalography in Intracranial Tumors. *Pupo, P. P., and Pimenta, A. M.* 373

Psychotherapy During a First Consultation. *Pacheco, V. C.* 391

Prefrontal Leucotomy.

The author emphasizes the rate of 14 per cent. of recoveries and 6 per cent, of great improvements as the result of leucotomy, notwithstanding the poor condition of the material. Simple leucotomy quietens and produces other minor changes in behavior without any alteration in the structure of the psychosis are not considered. An easy, inexpensive and nearly dangerless method of treatment, leucotomy is doubtless able to improve the conditions of the chronic patients. This was one of the reasons that induced the author to carry out the psychosurgical method of treatment. (Author's abstr.)

ARIZONA MED.

VOL. III. 1946.

AUSTR. J. PSYCHOL. PHIL.

VOL. XXIII. 1945.

AUSTR. NEW Z. J. SURG.

VOL. XV. 1946.

BRIT. J. SURG.

VOL. XXXIII. 1946.

BRIT. MED. J.

1946 (ii).

BRAIN.

VOL. LXIX. SEPTEMBER, 1946.

Fibre Connections of the Subthalamic Region and the Centro-median Nucleus of the Thalamus.

Lesions have been made in the subthalamic region of the brain in five Macaque monkeys. The subthalamic nucleus is shown to project:

(1) On to the external and internal division of *Globus pallidus.*
(2) On to ipsilateral and contralateral red nucleus.
(3) On to ipsilateral and contralateral thalamus.
(4) On to a nucleus dorso-medial to substantia nigra.

The substantia nigra projects:

(1) On to the *Globus pallidus.*
(2) On to the centro-median nucleus.
(3) On to the anterior colliculus.

A pathway from the centro-median nucleus and the dorso-medial nucleus of the thalamus to the central grey passing through the subthalamic region has been demonstrated. (Authors' abstr.)

Nutritional Neuropathies in the Civilian Internment Camp, Hong Kong, January, 1942–August, 1945.

Four diseases affecting the nervous system, and apparently due to dietary deficiency, are described as they occurred in the Civilian Internment Camp, Hong Kong, 1942 to 1945.

(1) Subacute wet beriberi—844 cases, conformed to previous descriptions and, in respect of incidence, prevention and treatment, was apparently due to a pure vitamin B_1 deficiency. The threshold vitamin B_1-carbohydrate ratio was found to be about 0·4 mgm. per 1,000 carbohydrate calories.

(2) Chronic dry beriberi—small number of typical cases responded slowly to treatment with vitamin B_1, but more rapidly to whole vitamin B complex.

(3) " Burning feet " syndrome—756 cases, in 35 per cent. of which dry beriberi was superimposed, were found to show no response to vitamin B_1 or nicotinic acid, but to be slowly cured by food rich in vitamin B complex, the individual factor responsible being probably pantothenic acid.

(4) Amblyopia—370 cases, in which central or paracentral scotoma was the outstanding feature, was generally associated with B complex deficiencies and showed some response to foods rich in these factors, though on the present evidence the causative deficiency might equally be of an essential amino-acid.

(Author's abstr.)

VOL. LXIX. DECEMBER, 1946.

The Problem of Disseminated Sclerosis.

The conclusions reached in this paper may be briefly summarized as follows: The cause of disseminated sclerosis remains unknown, but it would seem to lie either in the direction of a biochemical or enzyme abnormality, of which proof is so far lacking, or on the other hand a toxi-infective process. Our increasing knowledge of the various forms of encephalitis and encephomyelitis in man and the lower animals, and the part played by viruses in certain of them when viewed against the histological background of disseminated sclerosis suggests that this disease is also infective in origin. The results of the clinical approach bring to light no facts which are contrary to this view and some which seem to favour it. The view is put forward that the course of the disease is determined by an immune reaction to an infection, and that the extent of this reaction varies considerably from case to case. The familial incidence of the disease is significant and suggests that an inherited constitutional factor may render an individual more susceptible to it. Pregnancy, trauma and mental stress may, in individual cases, precipitate the disease or may be closely associated with a relapse. These facts are not inconsistent with the theory of an infection, but at the same time a further study of such cases is desirable in order to understand the manner in which symptoms are produced. With the exception of cases in which there are " influenzal " symptoms, the onset of the disease is not generally accompanied or preceded by constitutional symptoms. Thus the possibility arises that invasion of the nervous system and the appearance of the first sign of the disease may not always coincide in time, but that the former may take place months or years previously as in rabies and syphilis. If this premise be admitted, then the question arises at what point in the patient's

life history did the nervous system become infected or sensitized ? In the investigation of a series of 142 cases no single common factor could be found which provided an answer to this question, although the scope of the enquiry may not have been sufficiently wide. Attention was next turned to the portal of entry of the hypothetical agent or toxin, and by analogy with other infections of the nervous system, it was inferred that the skin and the alimentary tract were the likeliest starting points of the invader. Furthermore, from the author's knowledge of the histology of disseminated sclerosis it was necessary to postulate a haematogenous spread from the focus with or without additional local spread by cranial or peripheral nerve pathways.

In a number of cases in this series the clinical onset of the disease was preceded at varying intervals by an infective focus of the skin or subcutaneous tissue. In certain of these cases local pain and swelling persisted, suggesting the presence of a chronic inflammatory process. The fact that the first sign of disseminated sclerosis sometimes occurred at a segmental level roughly corresponding to the infected limb suggests that this sequence of events was no mere coincidence. It is fully realized that the evidence in favour of the skin as an occasional portal of entry in disseminated sclerosis is purely circumstantial, but it seems to warrant further consideration in view of the part played by the skin in other infections of the nervous system. On theoretical grounds the possibility of other foci of infection playing a similar role must be borne in mind. The remaining portal of entry to be considered is the alimentary tract. I have already referred to a small group of cases in which influenzal symptoms immediately preceded the onset of the disease, thus suggesting the throat as a point of entry. The fact that a history of intestinal disorder prior to the onset of the disease is rarely obtained in these patients should not exclude the intestinal tract from consideration in any further research. Finally, the author wishes to make it clear that in the majority of patients included in this investigation no clue could be obtained as to how the disease originated.

(Author's abstr.)

Traumatic Amnesia.

It is naturally important to discuss the significance of the phenomena described above in so far as they may throw light on cerebral mechanisms. In the first place it is clear that traumatic loss of consciousness prevents remembering, and that this inability to remember events persists in most cases until full consciousness has returned. In other words, the recovery of continuous remembering coincides with a late, if not a last, stage in recovering consciousness.

It may also be affirmed that a single blow of varying severity can disturb remembering, as it does consciousness, for very varying periods of time, and that the duration of this period depends usually on the severity of the initial neuronal commotion.

The almost constant occurrence of R.A. indicates that the injury, though it cannot have time to prevent what is last seen or heard from reaching the sensorium, does completely prevent its retention for future recall. The latter process presumably requires a few seconds of time for completion.

The occasional occurrence of a vision of events within the R.A. indicates that in these cases some form of registration has occurred with great vividness which, though it can never be properly retained for later recall, can reproduce itself from a relatively low level in the form of a momentary " vision." This appears to be a striking illustration of different levels of activity in the Hughlings Jackson sense. The injury in such a case appears to have blocked the process of retention halfway.

The variations in the R.A. during recovery of full consciousness seem to be specially significant. Distant memories return first and loss of memories for the previous few years may, for a time, be so complete that the patient believes himself to be several years younger. After severe injuries there may be a permanent R.A. of several days' duration, which may include events of great importance to the patient.

General brain trauma, therefore, has an effect on *recent* memory, which is much greater than its effect on remote memory, and this fact must be closely linked with the physiology of remembering. It is clear that the events forgotten are often of importance to the individual, yet for a time, and sometimes permanently, they are completely erased, while distant memories of little importance are returning freely.

The recovery of this type of memory loss is by shrinkage towards the present time. The long amnestic period recovers not so much according to the relative importance of events occurred. There is thus a vulnerability of memories which depends directly on their nearness to the injury.

The authors are thus forced to the conclusion that as memories become older they become more strongly established irrespective of their importance to the individual, while recent memories are relatively liable to traumatic extinction, however important they may be.

Further, it is clear that a long R.A. is almost always associated with a long P.T.A. The authors have good evidence that a long P.T.A. usually means a very severe injury, hence a long R.A. is observed when severe general neuronal commotion has occurred. It can thus be concluded that a long R.A., whether temporary or permanent, occurs after severe neuronal commotion and that severe neuronal commotion has a much more damaging effect on erasing recent than remote memories.

In the cases with long R.A. which recover spontaneously, it is evident that the effect of this neuronal commotion is reversible, but in some cases the effect is permanent.

In either case the observation demands a physiological explanation. It seems likely that memory of events is not a static process. If it were, then distant memories would surely fade gradually and would be the more vulnerable to the effects of injury. On the contrary, when the brain is injured, these distant memories are the least vulnerable. It seems that the mere existence of the brain as a functioning organ must strengthen the roots of distant memories. The normal activity of the brain must steadily strengthen distant memories, so that with the passage of time these become less vulnerable to the effects of head injury.

The patient with senile dementia may show a very similar loss of recent memory. She may forget the visit of her favourite grandchild within twenty minutes, yet she remembers an unimportant escapade of fifty years before in every detail. The distant memory shows no sign of fading and this suggests that it has received continual reinforcement and has survived not because it was important, but because the brain throughout the decades has strengthened it automatically till it has become highly resistant to cerebral degeneration.

It is tempting to speculate on the possible physiological processes concerned in remembering which could behave in this way. The brain works through chains and circuits of neurones which can set a pattern for automatic responses of infinite variety. Presumably the synapses of such a chain pattern are " opened " to allow the least possible delay and to avoid diversions in other directions. The neuronal system concerned with a certain memory, if it is to behave with the passing of years in the way it does, must then be automatically strengthened or more strongly canalized by the normal activity of the brain, and perhaps indeed this facilitation of the circuit is carried out by the spontaneous rhythm of the neurones concerned.

The recall under barbiturate hypnosis, or occasionally in the state of traumatic confusion, of events which cannot be remembered in the normal state of consciousness is of considerable interest. It seems as if under certain conditions clinically manifest as clouded consciousness, and physiologically determined by impairment of function at Jackson's highest level, pathological recall may occur as a release phenomenon. The twilight states of dreaming and toxic or infective delirium are analogous, and in these also there may be recall of experience not available in the state of clear consciousness. (Authors' abstr.)

BRIT. J. EDUC. PSYCHOL.

VOL. XVII. FEBRUARY, 1947.

BRIT. J. MED. PSYCHOL.

DECEMBER, 1946.

BRIT. J. PSYCHOL.

VOL. XXXVII. 1947.

A Comparative Study of the Level of Aspiration of Normal and of Neurotic Persons.

1. Level of aspiration tests were given to 20 normal men and 33 normal women and to 100 male and 32 female neurotic service patients.

Estimates of future performance (goal discrepancy scores), estimates of past performance (judgment discrepancy scores), responsiveness in the setting of goals to changes in the level of performance (index of flexibility), and the percentage of typical reactions to success and failure were calculated.

2. All four groups overestimated future performance and underestimated past performance.

3. The behaviour of the women differed from that of the men in three respects. They had (*a*) a significantly lower average goal discrepancy score, (*b*) a significantly lower average judgment discrepancy score, and (*c*) a significantly higher index of flexibility.

This sex difference applied to the normal and the neurotic groups.

4. Significant differences were found in the responses of normal and neurotic subjects. The neurotic women had a higher positive goal discrepancy score than the normal women. Normal subjects tended to underestimate their past performance more than neurotic subjects. The spread of scores of the neurotic groups was significantly larger than that of the normal groups. The distribution of the scores of the neurotics was bimodal.

5. A different patterning of the responses was obtained for neurotics in contrast to normals. The correlation between goal and judgment discrepancy was positive for the normal and negative for the neurotic groups. The correlation between judgment discrepancy scores and index of typical reactions was negative for the normal and positive for the neurotic groups.

6. A new code symbol substitution test was used to measure the level of aspiration responses of 29 male and 29 female hysterical patients and of 34 male and 35 female dysthymic patients. The hysterics were found to have a more " realistic " objective goal-setting behaviour than either the normal or the dysthymic subjects. The goal judgment discrepancy scores of the hysterics were small and their indices of flexibility high. The dysthymics showed wide deviations in their estimates of past and future performance from actual performance. Their indices of flexibility were low.

7. Increased motivation was obtained by offering incentives. A comparative study of the behaviour of 20 male hysterical and 22 male dysthymic patients under these conditions was carried out. The increase in ego-involvement led to an accentuation of the response pattern that had been found to be characteristic of these two reaction types. (Author's abstr.)

The Recalling of Thoughts.

The foregoing study is a contribution to the discussion of the old problem: Can we think without images? The problem is approached by considering the process of recalling thoughts. The word "thought" means here a mental content.

1. Introspection shows that there is no direct recall of a thought separated from its verbal expression or any other sensuous support. Contradictory observations seem to confuse the recalling of the thought itself with the direction of the mind towards a previous thought with the help of indicative images.

2. We often forget the original wording when we recall thoughts and replace it by new expressions of similar meaning. In order to explain this fact it is by no means necessary to assume that memory-traces of thought contents can be separated from any traces of words. A much better explanation is provided by the assumption that the traces of thoughts remain in close connection with those of words, and form a unity with them which may be changed with regard to the words or to the thoughts or to both.

3. An interesting problem concerning the dependence of thought upon its verbal expression arises when we ask whether the retention of thoughts is influenced by the way in which they are expressed. A method is indicated which enables us to compare the retention of thoughts which are expressed in the mother tongue of the observer with the retention of those which are expressed in a foreign language. This method was applied to three observers (one of them bilingual) and the results were analysed as a first approach to this problem. Further investigations with bilingual individuals might give us an answer to that problem and provide a new argument for or against the existence of imageless thoughts. (Author's abstr.)

BULL. CANAD. PSYCHOL. ASS.

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CALIF. AND WEST. MED.

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COMP. PSYCHOL. MONOGR.

VOL. XIX. 1946.

*Differential Modification of Post-rotational Nystagmus of Pigeons with Cerebral Lesions. *Yacorzynski, G. K.* . . . . . No. 2

Differential Modification of Post-rotational Nystagmus of Pigeons with Cerebral Lesions.

Two main experimental groups with cerebral lesions were tested for habituation (decreasing duration) of post-rotational nystagmus, one group with and the other without habituation training prior to the operation. Various control groups were also used. Cerebral lesions decreased significantly the usual habituation effects. In animals not previously habituated, the correlation between the size of the cerebral lesion and the degree of habituation was $-\cdot 65 \pm \cdot 129$. Pigeons habituated before the operation showed a greater duration of nystagmus than did normal controls, but animals with the skull trephined and no cerebral operation showed the same modification of nystagmus as the birds with lesions. The results are interpreted as favoring a central theory of habituation, but not a learning theory. Data are summarized which favor the concept that habituation of nystagmus is an homeostatic phenomenon. " The mechanism involved in throwing the homeostatic state out of equilibrium, thus producing nystagmus, involves a pattern of ratios between the neural discharge of the stimulated labyrinthine receptors. Continued stimulation of the non-acoustic labyrinth causes a new level of integration to be reached between the impulses of the eighth nerve and the nervous system." N. L. MUNN (Psychol. Abstr.).

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VOL. III. JANUARY, 1947.

J. CLIN. PSYCHOPATHOL.

VOL. VIII. OCTOBER, 1946.

J. COMP. NEUR.

VOL. LXXXV. DECEMBER, 1946.

The Nuclei of the Human Thalamus: A Comparative Approach.

(1) The cell groups of the rat and monkey thalamus were studied to serve as a background for a comparative approach to the human thalamus. The cell groups of the human thalamus were studied, and a wax model of these nuclei made.

(2) A comparative study of previous investigators' work is discussed.

(3) The nuclei of the rat, monkey and human thalamus are compared in chart form as to terminology and subdivisions.

(4) The nucleus medialis, nucleus ventralis lateralis, and pulvinar are believed to increase in size, due to their connection with the increasing frontal area, cerebellum, and inferior parietal and occipital associational areas respectively.

(5) The divisions of the medial thalamus remain fairly constant in phylogeny in contrast to the very rapidly developing lateral thalamus due to the great elaboration of the associational areas of the cerebrum. The divisions of the lateral thalamus of man are difficult to homologize with lower forms since the changes from one form to the next are complex. (Authors' abstr.)

Retrograde Degeneration of the Thalamus Following Prefrontal Lobotomy.

On the basis of 1 successful and 3 unsuccessful cases of prefrontal lobotomy among the 12 studied at necropsy the conclusion is reached that because of the point-to-point correspondence of cortex and thalamus it is possible to designate areas in the thalamic nuclei that correspond with cortical cytoarchitectonic areas. The central part of the medial nucleus projects to the frontal pole, the lateral portion to the convexity, the medial portion to the base. The anterior nucleus projects to the medial surface of the hemisphere. The lateral group of nuclei projects to the motor and premotor areas and to the frontal adversive field. (Authors' abstr.)

Extracortical Connections of the Primate Frontal Cerebral Cortex. (1) *Thalamocortical Connections.*

The thalamofugal connections to the frontal cortex of the monkey have been restudied and a series of maps of the primate thalamus (in terms of the Brodmann nomenclature) have been prepared. Comparison of these maps with the projections of the human thalamus, as reported by Freeman and Watts ('47), indicates that the basic principles of projection are the same for both primates. The relation of the cortical plan of the human to that of the monkey is similar to that between a fully and a partially opened oriental hand fan. The basic arrangements and relative positions of the elements present in the simian, persist in the human, but there is a separation and interposition of additional material between these basic elements, both in the cortex and thalamus. The separation of elements and addition of new material in the thalamus is much less apparent than in the cortex.

There are three discrepancies between the communication of Freeman and Watts ('47) and the present. The first is that cortex designated as area 8 by Brodmann in the monkey is found by the author to project upon the dorsolateral part of the medial nuclear group, while that designated as 8 by Brodmann in the human is found by Freeman and Watts to project upon the dorsomedial part of the lateral nuclear group. Such a circumstance is far from disturbing. It has so far proved difficult to establish absolute homologies between the cortices of different species. Brodmann himself never envisioned an absolute transfer of this sort. The author regards the discrepancy as a reflection of the probability that what Freeman and Watts are calling 8 in the human is a trifle farther posterior in the cortex than what he calls 8 in the monkey. Such a difference in interpretation would naturally throw the representation of the regions in question to one side or the other of the internal medullary lamina of the thalamus. Even within a

single species, the cortical representation of area 8 is variably represented by different authors.

Another discrepancy between the maps for the monkey and man is the representation of area 12, which in the monkey is rostral but in man caudoventral. Presumably this indicates that the human medial nucleus has been rotated forward along a horizontal axis for a distance of about 90°.

Freeman and Watts' paper contains an incidental note on the degeneration of the centromedian nucleus after striatal injury and sparing of this nucleus after pallidal damage. The author's opinion thus far has been that the centromedian nucleus is devoid of cortical connections and projects upon the pallidum rather than striatum. Review of the original cases (J33, Mettler, '43 and '45a; J100, Mettler, '45 and J148, Mettler, '45b) leaves no doubt as to the accuracy of the first observation, but an absolutely unimpaired pallidum in the complete absence of the striatum is hard to come by and it is more difficult to be certain about the second point.

In a case (J209) at hand, the head of the right caudate, front of the corresponding putamen and the intervening capsule had been destroyed. On the left the lesion removed all of the striatum and the external part of the pallidum. The left but not right centromedian nucleus was very gliotic but, since the specimen was a Marchi, it was very difficult to tell what the condition of its neurocytes may have been. Although gliosis is not an accurate index of retrograde degeneration, this case would suggest that the centromedian nucleus had a dual representation—to both parts of the corpus striatum.

Additional light on the matter may be obtained from the following case (Rhesus J171) in which the left centromedian nucleus was fulgurated (9/15/'44) by means of an electrode carried in the stereotaxic instrument. The animal showed no definite, consistent, physiologic abnormality and was killed 18 days later. It showed a lesion which began at the level of the posterior commissure, just between the medial geniculate and medial longitudinal fasciculus, and extended forward, in the dorsoventral third of the intramedullary lamina, to a level just rostral to the optic chiasm. The centro-median nucleus was practically all destroyed and there was little damage beyond its limits. There were two well-marked groups of degeneration emanating from the lesion. By far the most abundant of these moved directly laterally, through the internal capsule and came to lie in its lateral portion, just medial to that part of the putamen which projects dorsal to the pallidum. This group of degenerated fibers continued backward in this position.

At the level of the caudal part of the optic chiasm a considerable number of degenerated fibers moved into the medullary lamina between the pallidum and putamen. They broke up into smaller elements in this position. A considerable number of these smaller elements became lost in the putamen. None could be traced to the pallidum.

Many large degenerated fibers retained their original position in the internal capsule and, in sections through the level of the preoptic recess, moved farther medially and were joined by degenerated fibers emanating from the site of the needle track through the front part of the dorsal thalamus. These larger fibers, which continued into the corona radiata, must have emanated from that part of the arcuate nucleus which adjoins the centromedian for no fibers from the centromedian nucleus are distributed to the cortex.

It is worth observing that the centromedian fibers to the putamen do not accompany any of the efferent systems from the lentiform nucleus at any place except where these interdigitate with the fibers of the internal capsule.

The second group of degenerated fibers which emanate from the centromedian nucleus consists of a small number of elements which run into the pes pedunculi and run caudally for a short distance. They cannot be traced very far.

The diagrams of the thalamo-cortical systems have, therefore, been modified with regard to the thalamo-frontal projections. Attention should be called to the fact that the centromedian projection is a relatively small one which does not lie in the position of well-defined bundles of heavy fibers. The large fiber mass which passes from the thalamus to the medial segment of the pallidum (Mettler, '45a) must consequently emanate from another nuclear mass of the intralaminary group or in close association with this. This subject may be left for consideration at a later date. (Author's abstr.)

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J. GEN. PSYCHOL.

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J. GENET. PSYCHOL.

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J. GERONT.

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J. MT. SINAI HOSP.

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J. NERV. MENT. DIS.

VOL. CV. JANUARY, 1947.

On the Etiology of Dementia Praecox.

The literature of the past ten years concerned with the problem of etiology of schizophrenia or dementia praecox has been presented. One is impressed with the wide variety of etiological factors reported. While some of the etiological factors presented are almost completely hypothetical and theoretical, others seem to be well founded and of the latter there are many of different etiology. It is difficult for the authors to assume that so many of the investigators based their impression on insufficient evidence. Rather, they are driven to the following conclusions:

(1) Schizophrenia or dementia praecox is not a disease entity, but a syndrome or a reaction-type associated with a large variety of etiological factors. The best common denominator which the authors can find for the syndrome is to call it a deficit reaction. By calling the schizophrenic syndrome or reaction type a deficit reaction, they mean that it is typical of a human organism incapable of adequate social functioning.

(2) The etiological factors of the deficit reaction, known as schizophrenic reaction type or schizophrenic syndrome, may range from a hypothetically completely psychogenic nature to a hypothetically completely organic nature. One can conceive of all the cases actually occurring as being on some points of a continuum from a hypothetical locale of complete psychogenicity to a hypothetical locale of complete organicity of the syndrome. As relatively completely psychogenic one the authors would consider a case in which the early childhood setting is consistent with dynamic conceptualization of a traumatic character formation, particularly in the psychoanalytic sense; where character manifestations can be dynamically understood as forms of maladjustment; where the onset of the disease is more or less manifestly associated with psychological trauma and where many manifestations can be understood, interpreted, predicted, and controlled on the basis of psychological operations. Hypothetically speaking, by completely organic etiology one understands a case in which there is an absence of a psychological background, where the onset is abrupt, sudden and unrelated to mental factors and where there are associated clinical, laboratory data or postmortem data indicative of organic pathology related to the schizophrenic syndrome.

One might wish to consider as a case of predominantly organic causation of an essentially schizophrenic type those cases of mental disease where, with our modern means of diagnosis, we can establish a luetic etiology of the mental picture that otherwise would be definitely diagnosed as dementia praecox. The authors would conceptualize such a case as the schizophrenic type being due to destruction or dysfunction of brain tissue by *Treponema pallida* and corresponding to an organic deficit. However, in such cases they feel—as many investigators do—that the psychotic manifestation of this luetic deficit is definitely determined by the previous

(psychologically caused) personality type. One might compare it to problems of gross brain injury—for instance, the frontal lobe lesions—in which most investigators feel now that the characteristics caused by the brain lesions are mostly accentuations of the previously existing personality type.

And, incidentally, one feels that in this direction those studies concerned with a biochemical aspect of the disease process deserve at present the greatest optimism, particularly those concerned with biochemical processes of an enzymatic nature concerned with the metabolism of the brain tissue.

(3) The authors believe a definite predisposition may be of importance in the etiology of the schizophrenic reaction type and that these predispositions may be of a constitutional nature, somatically speaking or socio-psychologically speaking. However, each case of schizophrenic reaction must be understood as an interaction between somatic or socio-psychological predisposition, and of a precipitating factor on that continuum between complete psychogenicity and complete organicity. The authors believe, for instance, that there may possibly be such a thing as diencephalic asthenia as revealed in electroencephalographic studies; they agree with Grinker that such diencephalic weakness may not at all be the essential determining factor in bringing about the schizophrenic reaction type, but that for instance a traumatic psychological background may be necessary to lead to the insidious onset of the disease symptoms. They also feel that a precipitating somatic and/or psychological factor may be necessary to bring about a deficit reaction superimposed upon a neurological predisposition. The authors believe that each case of schizophrenic reaction type must be considered as a psychosomatic problem of individual unique variations.

(4) Therefore, it is suggested that every case of schizophrenic reaction type be considered on the following four dimensional schemes, namely:

(*a*) Somatic predisposition.

(*b*) Socio-psychological predisposition.

(The two together might be conceptualized as threshold for schizophrenic reaction type liability.)

(*c*) Psychological precipitating causes.

(*d*) Somatic precipitating causes.

For statistical purposes the authors believe that each of these factors should be expressed on a three-point scale or a five-point scale or a seven-point scale, whichever may turn out to be the most practicable. It is suggested that such a scheme be used even in clinical diagnosis and that in the long run, if and when it proves advantageous, it be made part of the nosological classification system and the subtypes officially adopted.

Furthermore, it is suggested that research concerned with the etiology of schizophrenia be organized with such a scheme in mind. It is believed that work on the etiology of schizophrenia failed because of lack of awareness of the multiplicity of causes, and that research concerned with the constitutional background, more specifically the body type associated with the schizophrenic reaction type, may profit from selecting only cases in which apparently the predisposition was the most important factor, that is predisposition of a non-socio-psychological character, and where the precipitating causes were relatively at a minimum. It is felt that under those circumstances much more uniform results will be arrived at than has been possible so far. (Authors' abstr.)

FEBRUARY.

The Pattern of Enzyme Distribution in the Brain and Mental Function.

(1) A pattern of distribution of carbonic anhydrase in the central nervous system is described and attention is called to its consistency of occurrence. In

the human brain changes in its pattern of distribution appear to accompany abnormality in mental function.

(2) A theory is propounded which would account for mental disfunction on the basis of an imbalance in the potentialities for metabolic activity caused by a disturbance in the quantitative incidence of essential enzymes.

(3) It is advocated that the quantitative distribution of enzymes involved in neuron metabolism be comparatively studied in brains which have shown normal and abnormal functioning, in the hope of elucidating the problem of mental abnormality. (Author's abstr.)

MARCH.

J. NEUROL. NEUROSURG. PSYCHIAT., LONDON.

VOL. IX. JULY, 1946.

Effects of Vitamin and Hormone Treatment on Senile Patients.

Small groups of male senile patients were treated: (i) With small doses of vitamins B and C; (ii) with increased doses; (iii) with androgenous hormones. The patients, together with similar numbers of untreated controls, were tested individually with a large battery of mental and psychomotor tests before treatment and during each phase of treatment.

No evidence was obtained of any general improvement in intellectual efficiency or psychomotor capacities as a result of the treatment. There were slight indications of an improvement on general intelligence (g) tests among the more severe cases with vitamin treatment; and among the light and moderate cases the same treatment produced an increase in fluency and a decrease in perseverative tendencies (f and p factors).

Though these improvements amounted to about 10 per cent., they were of doubtful statistical significance and require confirmation with larger and more homogeneous groups of patients. Neither the psychomotor tests nor tests of intellectual deterioration were affected in any consistent manner. The increased vitamin treatment did not yield any more positive results, and the hormone treatment was apparently quite ineffective.

The lack of any clear-cut effects of treatment may have been due partly to the fact that the patients were already on a diet adequate in vitamins, and partly to the unreliability of psychological tests when repeated too frequently over too long a period. (Authors' abstr.)

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VOL. VIII. 1946.

MILIT. SURG.

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MIND.

VOL. LVI. JANUARY, 1947.

The Nervous System as Physical Machine : With Special Reference to the Origin of Adaptive Behaviour.

An outstanding property of the higher nervous system is that, in contact with a new and previously unexperienced environment, it develops and produces behaviour which is adapted to that environment. It is usually assumed that the behaviour depends on the development of an inner, neuronic organization. But considering that the neurons might as easily develop one of the almost infinite wrong organizations, the fact that the right one is developed calls for explanation. Why should a network of neurons produce adaptive instead of chaotic behaviour ? Psychology cannot rest content until it has found a physical answer to this problem.

The author has approached this problem from the point of view that the brain is a physical machine, and that " adaptive " behaviour is that which maintains it in physical equilibrium with its environment. This basic theme has been studied with all possible generality and precision. This has necessitated the construction of a special mathematical technique, and this has led to a number of new theorems on equilibrium and organization in generalized dynamic systems.

The problem of a self-equilibrating physical system can now be attacked with both rigor and generality. The paper then shows how these new methods povide an essentially simple and clearcut solution to the problem. (Author's abstr.)

APRIL.

MSCHR. PSYCHIAT. NEUROL.

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NEDERL. TIJD. GENEESK.

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NED. TIJDCHR. PSYCHOL.

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VOL. VI. 1947.

Emotional Disturbances in Epileptic Children.

Fourteen years after the organization of the Epilepsy Clinic at the Johns Hopkins Hospital, a follow-up study was made of 472 of the children. Among the many objectives of the study was a desire to know how many of them had been able to maintain a satisfactory place in society, and in what measure personality maladjustments accounted for the failures. The study was conducted by a trained social worker, and extended over a period of nearly two years. Every attempt was made to record facts rather than impressions and to draw conclusions in as objective a way as possible. The details of the study have been presented elsewhere, but the central conclusions will be of interest here.

The major handicap of a large group of epileptic children, two to fourteen years after first being seen in the Clinic, was found not to be the seizures themselves or mental retardation, but the personality disorders. In some, the seizure had disappeared after a period of years, but left an individual who was unable to associate with others in a satisfactory way, or to carry on constructive remunerative work. In others, while seizures had continued to recur at intervals, these would not have interfered with employment or home-making had the individual been more stable, and less helpless and resentful when confronted with difficulties. It was also rather startling to find how satisfactory some patients were getting along in spite of recurrent seizures and perhaps some degree of mental retardation, provided their dispositions and attitudes had not been warped by the disease and the problems they had met. In spite of the fact that earlier in this report only 9 per cent. of epileptic children were classified as having serious personality disorders, as years

go by the handicap of this aspect of the disease evidently assumes ever greater proportions. It appears that if the much larger group of epileptic children who show lesser grades of maladjustments are not given the benefit of expert care, the psychological problems tend to mount and eventually become the most serious handicap to normal living.

The outlook for the child with epilepsy is in many ways more favorable than has been thought in the past. Not only is medication more effective, but there is a growing appreciation of the many factors which contribute to the disease in any one individual, and with it a more sound basis for therapy. The realization that personality problems may contribute both to the causation and continuation of the disease has opened the way for preventive measures along these lines. There are at present lacks in facilities, time and interested personnel to carry on such work. However, in view of the obvious importance of such efforts to the individual and to the public as well, it is to be hoped that more emphasis will be placed in these directions in the future. (Author's abstr.)

Rorschach Psychodiagnosis in a Group of Epileptic Children.

In the light of the Rorschach psychodiagnosis, epileptics show a characteristic picture which can be summarized as follows:

(*a*) Deficient intellectual control over the affective emotional and instinctive spheres.

(*b*) Anxiety.

(*c*) Aggressiveness.

(*d*) Predominantly extravert reaction type.

(*e*) Tendency towards opposition.

(*f*) Poor mental efficiency.

(*g*) Slight bradypsychia.

None of the above traits can be considered pathognomonic. The syndrome of *grand mal* can be distinguished from that of *petit mal*. In the former the syndrome of anxiety is very strong; while in the latter, especially in its psychmotor form, the author finds aggressiveness, lack of prudence and of intellectual control over the affective sphere. The mental deterioration is greater in *grand mal* than in *petit mal* and its various forms.

In so far as foretelling behavior is concerned, the author admits that the protocol of the patients with behavior disorders cannot be distinguished from that of persons with deficient learning capacity.

The clinical forms which are revealed through the use of the electroencephalograph can be divided by the application of the Rorschach test into two groups: *grand mal* and *petit mal* with psychomotor disorders.

The Rorschach test shows that in epileptics the light-dark responses are as typical as C and CF.

The division of the epileptics into two groups, A and B, and the one which the author's results show between *petit mal* and the psychomotor form, corresponds to the opinion of Guirdham that there is no fixed type of epileptic reaction.

The author believes that the results permit him to speak of psychic epilepsy without clinical manifestations. This is the form called psychomotor, which corresponds to a definite type of cortical dysrhythmia and to a specific psychic picture as revealed by the Rorschach tests. (Author's abstr.)

Drug Therapy for Epileptic Children.

Successful drug therapy of epilepsy means individual treatment of the individual patient and his particular type of seizure. One or more of eight different types may be present. Convulsive seizures are best treated with dilantin, phenobarbital, mesantoin or mebaral; psychomotor seizures with dilantin (possibly combined with tridione); and the *petit mal* triad with tridione. Attention to dosages and to side-effects is a requisite of success. (Author's abstr.)

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The Nature of the Schizophrenic Process. *Gurevitch, M. D.* 10

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PSYCHOANAL. QUART.

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REV. MED. DE CHILE.

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REV. NEUROL.

VOL. LXXVII. 1945.

1. Psychiatry, Physiology, Biochemistry, etc.

Notes on the Results of Army Intelligence Testing in World War I. [*Science*, **104**, 231–232 (1946).]

It has been argued that although data from the Army Alpha test should not be relied upon too strongly in making statements regarding the relative intellectual status of Negroes and whites because this test depends so much upon educational factors, greater reliance can be placed upon the Army Beta scores, inasmuch as these are presumably not influenced by educational and socio-economic status to so great a degree as the Alpha scores. Rank order correlations between median Beta scores for the various states and median Alpha scores, annual educational expenditures and *per capita* income range between ·50 and ·81. The order of magnitude of the coefficients for whites and Negroes, with respect to these measures are comparable. Such data probably most reasonably warrant the conclusion that Beta scores, like Alpha scores, reflect cultural factors concomitant with the socio-economic levels of the states. F. A. Mote (Psychol. Abstr.).

Aphasic Language Disorders. [*U.S. War Dep. tech. Bull., TB Med.* **155**, 3 (1945).]

The purpose of this bulletin was to establish uniform methods of study and management of aphasic language disorders in military hospitals. The neurological section was responsible for the early study and treatment of cases of disorder. A clinical psychologist was assigned the function of psychological evaluation of the brain-injured patient, and collaborated with the neurologist in the retraining of aphasic disorders. In addition to the usual clinical, neurological survey, mental testing of aphasic patients was done routinely as part of the neurological study. The following mental tests were recommended: (1) Army General Classification Test (retest) or basic battery; (2) Wechsler-Bellevue Intelligence Scale; (3) Goldstein-Scheerer Cube Test of Abstract and Concrete Behavior; (4) additional tests from the U.S. War Department Pamphlet No. 12–9, *Handbook for Clinical Psychologists*; and (5) writing complex sentences from dictation, repetition

of phrases, oral reading, simple arithmetic, clock reading and setting, color naming, naming of common objects, and use, manipulation, and identification of common objects (searching also for apraxia and astereognosis). Suggestions for retraining are included. C. P. FROEHLICH (Psychol. Abstr.).

An Experimental and Comparative Study of Electroshock and of Cortical Epilepsy. [*Rev. Neurol.*, **77**, 57–70 (1945).]

Experimentation is reported to the effect that cortical epilepsy and experimental electroshock constitute one and the same process as far as their manifestations are concerned. While cortical epilepsy affects the cerebral cortex, experimental electroshock affects the pyramidal system. The authors believe the findings warrant a new conception of epilepsy to the effect that epilepsy, whether cortical or electroshock, is a general mode of reaction of nerve cells and not an exclusive property of the cortical cortex as has been believed.

F. C. SUMNER (Psychol. Abstr.).

Mental Breaking Points. [*New Engl. J. Med.*, **234**, 42–45 (1946).]

Two thousand naval service returnees were interviewed and given (1) the Cornell Selectee Index, (2) a psychosomatic inventory consisting of 64 questions, designed to elicit evidence of emotional instability. Of the entire group, 500 were survivors of sunken ships, 1,000 had combat duty, and 500 were overseas but did not encounter combat. Of the 2,000 only 5 per cent. showed evidence of severe nervous symptoms, and only ½ per cent. (10 men) needed hospitalization for mental or emotional disorder. The author points out that 95 per cent. of the returnees were normal, and that the neuroticness of veterans has been overstressed both by the medical profession and by laymen. It is considered unfortunate that the normal 95 per cent. are often treated, upon return home, as if they were members of the 5 per cent group. G. W. KNOX (Psychol. Abstr.).

Further Studies on the Biochemistry of Reflex Activity. III. Creatine of the Central Nervous System and Reflex Activity. Mitolo, Michele (*Univ. Bari, Italy*). [*Boll. soc. ital. biol. sper.*, **18**, 277–8 (1943); *cf. C. A.*, **40**, 6603³; **41**, 193c.]

Freshly isolated toad spinal cord contained, in mgm. per 100 gm. fresh tissue, free creatine, 50·7, combined creatine, 38·7, "residual creatine," 39·6, and total creatine, 129. After 4 hours in repose the corresponding values were 52·7, 32·2, 41·2 and 126 mgm. per cent. After 4 hours of reflex activity provoked as previously described the values were 75·8, 31·7, 44·4 and 152 mgm. per cent. The free and combined creatine were extractable by CCl_3CO_2H solution. The so-called residual creatine was not extracted by CCl_3CO_2H solution and was not creatine, but an unknown substance which gives the Jaffé color reaction like creatine.

L. E. GILSON (Chem. Abstr.).

Swelling of Brain Slices and the Permeability of Brain Cells to Glucose. Elliot, K. A. C. (*McGill Univ., Montreal, Can.*). [*Proc. Soc. Exptl. Biol. Med.*, **63**, 234–6 (1946).]

Brain slices swell considerably in solutions of the common salts and sugars, even though the concentration of the solutions is 2–4 times isotonic with serum. Brain tissue behaves as if freely permeable to glucose, fructose, and sucrose in the absence of electrolyte, but impermeable to sugars in the presence of a small amount of a salt. Small additions of substances known to affect permeability *in vivo* or nervous activity (adrenal cortical extract, acetylcholine, eserine, metrazole, Na pentobarbital) did not significantly affect the swelling in isotonic NaCl solution or in a mixture of 1 volume isotonic NaCl and 9 volumes isotonic glucose.

L. E. GILSON (Chem. Abstr.).

Effect of Excitation on Nerve Permeability. Euler, H. v., Euler, U. S. v., and Hevesy, G. (*Karolinska Inst., Stockholm*). [*Acta Physiol. Scand.*, **12**, 261–7 (1946).]

When the sciatic nerve of the cat is stimulated by condenser shocks 50 times per second, giving maximum motor reactions, the nerve permeability is increased over that of the resting state (as demonstrated by means of radioactive isotopes of K, Na, P and Br) in the ratio of $1·55 \pm 0·10$.

S. MORGULIS (Chem. Abstr.).

Inhibition of the Anaerobic Glycolysis of Rat Brain by Adrenochrome. Randall, Lowell O. (Wellcome Research Labs., Tuckahoe, N.Y.). [*J. Biol. Chem.*, **165**, 733–4 (1946).]

The glycolytic rate of rat-brain homogenates was measured by the manometric method of Utter, Wood, and Reiner (*C. A.*, **40**, 1217⁷). Anaerobic glycolysis of rat-brain homogenates was inhibited by small concentrations of adrenochrome. Adenosinetriphisphate (ATP) increased the rate of glycolysis and partially overcame this inhibition. 0·001 mgm. of adrenochrome inhibited the glycolytic rate by more than 50 per cent., while, in the presence of 1 mgm. of ATP, 0·02 mgm. of adrenochrome was required for a 50 per cent. inhibition. The fact that ATP partially counteracted the inhibition produced by small concentrations of adrenochrome indicates that the latter inhibits the phosphate-transfer mechanism of the glycolytic cycle. Since oxidizing agents, such as iodine, quinone and dichlorophenolindophenol produce an inhibition of glycolysis which is counteracted by glutathione, the possibility is suggested that adrenochrome also produces inhibition by a reversible oxidation of the sulfhydryl groups of the enzymes of glycolysis.

HILDA H. WHEELER (Chem. Abstr.).

Calcium Ions in Neuromuscular Transmission. Coppee, G. (Inst. Leon Fredericq, Liege). [*Arch. intern. physiol.*, **54**, 323–36 (1946).]

Ca ions in physiological concentration assure maximum security for transmission of excitation, for regulation of the voltage of the response of motor bases and of the critical voltage, and for prevention of repetitive response.

H. L. WILLIAMS (Chem. Abstr.).

Asphyxial Depolarization in the Spinal Cord. Harreveld, A. van. (Calif. Inst. Technol., Pasadena). [*Am. J. Physiol.*, **147**, 669–82 (1946).]

The existence of depolarization potentials during asphyxiation of the cord was studied, and an attempt was made to correlate the changes in the polarized structures thus recorded with the changes in the reflex activity during the development of and the recovery from asphyxia. E. D. WALTER (Chem. Abstr.).

Circulatory Modifications in the Brain in the Course of Experimental Pyruvate Poisoning. Dobrovolskaia-Zavadskaia, Nadine. [*Compt. rend.*, **223**, 519–21 (1946); *cf. C. A.*, **40**, 3526⁸.]

Animals were treated with Na pyruvate (I) alone, NaCl (II) alone, or a combination of (I) and (II). The brains of the dead animals were examined microscopically. The hyperemia produced by (I) was slightly less than that produced by (II). Diffuse edema was not observed, but there was a dilatation of the perivascular pericellular spaces. Large veins contained blood, but small vessels were completely collapsed by the pressure of the fluid. This was most marked when animals were treated with (I) and (II). The administration of vitamin B_1 with (I) or vitamin PP with pyruvic acid did not save the life of the animals, but the brain showed less alteration. RACHEL BROWN (Chem. Abstr.).

Chronaximetric Study of Experimental Chronic Alcoholic Intoxication; Attempted Protection by Sugars and Thiamine. Chauchard, Paul, Mazoue, Henriette, and Lecoq, Raoul (Sorbonne, Paris). [*Compt. rend. soc. biol.*, **140**, 47–8 (1946).]

Daily administration of EtOH (5–10 gm./kgm.) to rats caused a decrease in nerve chronaxia and an increase in muscle chronaxia, similar to the changes seen in polyneuritis and acidosis. Feeding glucose or lactose had a slight corrective effect; thiamine or riboflavin or both together had no beneficial effect on chronaxia.

L. E. GILSON (Chem. Abstr.).

Radiopotassium Autography of Rat Brain. Colfer, Harry F., and Essex, Hiram E. (Mayo Foundation, Rochester, Minn.). [*Proc. Soc. Exptl. Biol. Med.*, **63**, 243–4 (1946).]

K^{42}, as chloride, was injected intraperitoneally in rats in a dose of 0·75 millicuries per 100 gm. body-weight. After 12–18 hours the brain was removed and

cut in slices 6–12μ thick. The slices were placed on dental x-ray film for 12–24 hours, then the films were developed. It was found that the distribution of K^{42} in the brain was fairly homogeneous, except for slightly greater concentration in the cerebral and cerebellar cortex, the basal ganglia, and the roof of the fourth ventricle. L. E. GILSON (Chem. Abstr.).

Prolongation of Consciousness in Anoxia of High Altitude by Glucose. Riesen, Austin H., Tahmisian, T. N., and Mackenzie, Cosmo G. (Yale Univ.). [*Proc. Soc. Exptl. Biol. Med.*, **63**, 250–4 (1946).]

Preflight administration of 80 gm. of glucose in water to individuals on a normal diet produced a significant increase in the resistance to unconsciousness from anoxia at 27,000–30,000 ft. The protection afforded flying personnel by the glucose solution was greater 30–50 minutes after ingestion than at 60–80 minutes after ingestion. At 27,000 ft. the average duration of consciousness was increased approximately 40 per cent., or more than 1 minute. Vitamin C, alone or with the glucose, had no demonstrable effect on the duration of consciousness.
L. E. GILSON (Chem. Abstr.).

The Relation Between Sulfhydryl Groups and Pyruvate Oxidation in Brain Tissue. Peters, R. A., and Wakelin, R. W. (Oxford Univ.). [*Biochem. J.*, **40**, 513–16 (1946).]

The pyruvate oxidase system and the pyruvate dehydrogenase component are much more sensitive than succinic-dehydrogenase to Na maleate. Likewise, pyruvate dehydrogenase can be inactivated by cystine and reactivated by cystine ester. These effects are thought to be due to the presence of an essential — SH group in the enzymes. S. MORGULIS (Chem. Abstr.).

Biochemistry of Reflex Activity. I. Phosphorylation of Glucides of Nervous Tissue and Reflex Activity. Mitolo, Michele (R. Univ. Bari). [*Arch. fisiol.*, **42**, 1–24 (1942).]

The distribution of P in cerebrospinal tissue of frogs after 4 hours of apparent repose and after 4 hours of reflex activity respectively was: Inorganic P 32·5 and 35·6 mgm. per cent.; phosphocreatine P 0·00 and 0·00 mgm. per cent.; pyrophosphate P 19·3 and 11·3 mgm. per cent.; difficultly hydrolyzed P 84·8 and 61·6 mgm. per cent.; and acid-soluble P 136·6 and 108·5 mgm. per cent.
H. L. WILLIAMS (Chem. Abstr.).

Intracranial Neoplasms Produced in Dogs by Methylcholanthrene. Mulligan, R. M., Neubuerger, K. T., Lucas, J. T., jun., and Lewis, W. B. (Univ. of Colorado School of Med., Denver). [*Exptl. Med. Surg.*, **4**, 7–19 (1946); *cf. C. A.*, **39**, 744[6].]

Implantation of 100 mgm. methylcholanthrene in gelatin capsules beneath the dura over the right frontoparietal area of the cerebrum led to the production of intracranial neoplasms (extracerebral fibrosarcoma, glioma, and sarcomatous meningioma) in 378–436 days in 3 of 7 young male mongrel bulldogs.
MARION HORN PESKIN (Chem. Abstr.).

Curare and the Rigidity of Decerebration. Minz, B., and Veil, Catherine (La Sorbonne, Paris). [*Compt. rend. soc. biol.*, **140**, 466–7 (1946).]

The body rigidity produced in rabbits by section of the nerve axis between the anterior and posterior corpora quadrigemina disappears immediately after injection of 0·75 mgm./kgm. of orthocurare. Normal respiratory movements continue. Electric stimulation of the sciatic nerve produces muscle contraction, and intra-arterial injection of acetylcholine into a leg artery causes contraction of the muscles served. Since the peripheral sensory and motor apparatus thus remains intact, it appears that the action of the curare is central. An hour or more after the curare injection a state of complete rigidity again gradually develops.
L. E. GILSON (Chem. Abstr.).

Studies of Indophenal Oxidase on the Central Nervous System. II. Indophenal Oxidase of the Various Portions of the Nerves of Animal and Man. Mitolo, Michele (Univ. Bari, Italy). [*Boll. soc. ital. biol. sper.*, **22**, 221–4 (1946); *cf. C. A.*, **40**, 6531[5].]

Different portions of the nerves of 14 species of animal and man were tested and the results charted. There was a great variation in the indophenal oxidase power in the various species. In general the power was less as the animals descended in the zoological scale. The indophenal oxidase activity was always greater in the grey matter of the nerves than in the white.

HELEN LEE GRUEHL (Chem. Abstr.).

The Blood Glucose : Spinal Fluid Glucose Ratio. I. Its Variations in Experimental Hypoglucemia. Tolone, Salvatore (Univ. Naples). [*Boll. soc. ital. biol. sper.*, **19**, 305–6 (1944).]

In normal dogs the blood glucose : spinal fluid glucose ratio averages 1·54, as compared with 1·77 for human subjects. In dogs the hypoglucemia provoked by injection of appropriate doses of insulin, thiamine or nicotinic acid is followed by a decrease in spinal-fluid glucose, but the changes are very slight compared to those in the blood.

II. *Its Variations in Experimental Hyperglucemia.* [*Ibid.*, 306–8.]

Hyperglucemia provoked by injection of glucose, metrazole, adrenaline, or synthetic adrenocortical hormone (cortenil Bayer) was accompanied by relatively slight increases in spinal fluid glucose. The injection of adrenaline into the spinal canal produced the same effects as intravenous injection.

L. E. GILSON (Chem. Abstr.).

Production of Electricity by Nerve. Barnes, T. Cunliffe, and Beutner, R. (Hahnemann Med. Coll. and Hosp., Philadelphia, Pa.). [*Science*, **104**, 569–70 (1946).]

Previously it has been reported (*C. A.*, **35**, 7431[1]; **37**, 1435[5]; **39**, 2298[8]; **40**, 1548[6], 1580[1], 4785[3]) that the chemical mediator of the nerve impulse, acetylcholine (I), sets up a negative phase boundary potential in the lipide layer of the nerve fiber. The lipide-soluble (I) dissolves in the oil layer to a much greater extent than in the saline, thus establishing a true phase-boundary potential, which can be demonstrated on an oil layer several cm. thick, thereby eliminating any permeability changes in an imaginary sieve membrane. When cholesterol is added to the oil layer, the phase-boundary potential is increased. A filtered cat-brain extract with guaiacol gives 45 mv. negative potential with 0·05 per cent. added (I) in contrast to 30 mv. from 0·05 per cent. (I) in guaiacol without brain extract. The addition of human serum, which contains serum cholinesterase and small amounts of cell cholinesterase, to the saline phase brings the oil cell model still closer to living nerve. Four c.c. of human serum added to 200 c.c. of 0·9 per cent. NaCl with $NaHCO_3$ to make pH 8·2, at 37° for 8 hours, destroys the electrogenic activity of 0·05 per cent. (I) as tested in the oil cell. This demonstrates that it is the (I) and not the esterase which produces the electric nerve impulse. The rise and fall of the spike potential in peripheral nerve can be duplicated in the oil cell by placing the (I) first on one side and then on the opposite side of the oil layer. With resin in the oil a film less than 0·1 mm. thick can be formed by pressure on the saline on one side. Under these conditions a potential of 30 mv. produced by 0·05 per cent. (I) falls to 0·0 in 4 hours, due to penetration of the alkaloid to the opposite side. (I) is the only substance so far found capable of producing the action current in nerve. Triglyceride oils establish potentials with sympathomimetic, but not with parasympathomimetic drugs. The study of the phase-boundary potential can be applied directly to nerve. Frog sciatic nerve is immersed in isotonic glucose for 1–2 hours to eliminate short circuits by salts. The ends are tied, and the nerve forms a loop between 2 watch-glasses of isotonic glucose connected to a potentiometer. Addition of 1 : 160,000 (I) to the solution bathing the part of the nerve in one dish sets up a phase-boundary potential of 10 negative mv., the magnitude of which decreases with time. These experiments support the theory that the electric nerve impulse is a phase-boundary potential produced by (I) in contact with nerve lipides.

BRUNO VASSEL (Chem. Abstr.).

Influence of Glucose Loading on the Glucose of Spinal Fluid in Tuberculous Meningitis. Cicala, V., and Robertaccio, A. (Hosp. Domenico Cotugno, Naples). [*Boll. soc. ital. biol. sper.*, **19**, 193–5 (1944).]

The glucose content of spinal fluid is below normal in tuberculous meningitis, and shows little or no increase after oral administration of glucose.

L. E. GILSON (Chem. Abstr.).

Endogenous Purine Metabolism and the Vegetative Nervous System of the Endocrine (Glands). (1) Influence of the Thyroid (Gland) on the Endogenous Purine Metabolism. Rubino, A. (Univ. of Sassari). [*Policlinico (Rome) Med. Pt.*, **48**, 349–68 (1941).]

Four subjects at rest and on purine-free diets were injected with the thyroid hormone preparation elityran (Bayer), 3–4 ampoules per day for 4 consecutive days (strength of dose not given). Diuresis tended to increase after the hormone administration. Uricacidemia, uricaciduria, and total purine substances decreased. The purine bases at first followed the shape of the uricaciduria curve, then instead of a pronounced minimum, showed a sharp maximum. This rise in intermediary products of purine metabolism indicates stimulation of nucleo-protein katabolism under influence of the thyroid and increased rate of oxidative processes. The decrease of uric acid in the blood accompanied by its diminished excretion suggests the strong possibility that it is further decomposed in the human body. These experiments give support to the view that the thyroid gland stimulates uricolysis in the liver.

C. S. SHAPIRO (Chem. Abstr.).

Preparation and Chemistry of Anterior Pituitary Hormones. White, Abraham (Yale Univ.). [*Physiol. Rev.*, **26**, 574–608 (1946).]

The six hormones obtained in the last decade from the anterior pituitary are proteins and appear to be individual hormones. The lactogenic, adrenotropic, growth and luteinizing hormones are the ones most highly purified; the thyrotropic has been highly purified, but its protein purity has not yet been rigidly established, while the gonadotropic or follicle-stimulating hormone must be purified further. The biological activity of these hormones seems to be intimately related to the protein nature of the substance, and the slightest alteration in its protein structure results in partial or compete loss of activity. The adrenotropic hormone seems to be an exception in that it retains biological activity even after a significant number of its peptide linkages have been split. So far it has not been possible to obtain evidence of the existence of some specialized active groups in these protein hormones, although glucide has been recognized as a component of the thyrotropic, gonadotropic, and luteinizing hormones. Enzymes which split glucide inactivate the gonadotropic hormone, and the glucide group may be important in its biological activity, but this conclusion must be regarded as tentative. There are some species differences among the pituitary hormones manifested in their physical and chemical properties, these being most striking for the luteinizing hormone.

S. MORGULIS (Chem. Abstr.).

Mechanism of the Development of Obesity in Animals with Hypothalamic Lesions. Brobeck, John R. (Yale Univ.). [*Physiol. Revs.*, **26**, 541–59 (1946).]

Biochemically the interruption of axons due to hypothalamic lesions profoundly alters the energy balance; this leads to a retention of large surpluses of energy in the form of neutral fat. All other metabolic changes are simply secondary manifestations of the specific deficiency in the regulation of energy intake and output. There is nothing remarkable about the chemical composition of the accumulated fat. The animals utilize it if the food supply is inadequate; besides, the respiratory quotients of fasting obese rats are within the normal limits. There is evidence, however, in animals with hypothalamic hyperphagia that the transformation of carbohydrate to fat is tremendously accelerated. Conclusion: The hypothalamus normally participates in the maintenance of the overall energy equilibrium, and the control of food intake, work output and body temperature may be correlated and integrated within this portion of the diencephalon.

S. MORGULIS (Chem. Abstr.).

Influence of Corticosterone on Neuromuscular Excitability and Fatigability. Borgatti, G. (Univ. Bologna, Italy). [*Boll. soc. ital. biol. sper.*, **17**, 671–3 (1942); *cf. C. A.*, **40**, 5150⁵.]

In frogs and guinea-pigs desoxycorticosterone acetate (in oil) was injected into muscle with connections to the central nervous system severed but circulation intact. The nerve excitability was markedly increased (chronaxia decreased) and the muscle excitability was slightly increased. As shown by the ergograph, the work capacity of the muscle was increased.

Influence of Male Sex Hormone on Neuromuscular Chronaxia and Ergograph in the Guinea-pig. [*Ibid.*, 673–4.]

In experiments similar to the preceding, testosterone produced effects similar to, but less marked than those of desoxycorticosterone acetate.

Modification of Neuromuscular Excitability and Fatigability by Cholesterol. [*Ibid.*, **18**, 3–4 (1943).]

Cholesterol injected into muscles produced effects similar to those of testosterone and desoxycorticosterone. L. E. GILSON (Chem. Abstr.).

The Selectivity of the Inhibition of the Gonadotropic Function of the Hypophysis Caused by Estrogenic Substances. Gaarenstroom, J. H., and de Jongh, S. E. (Rijks-Univ., Leyden). [*Verslag. Gewone. Vergader. Afdeel Naturk. Nederland. Akad. Wetenschap.*, **52**, 446–52 (1943).]

There are at least two substances in the gonadotropic secretion of the hypophysis: one which stimulates development of the interstitial tissue of the testis, and another which initiates growth of the seminiferous tubules. Evidence for the presence of two distinct substances was obtained from transplantation experiments. The authors implanted hypophysis tissue both from rats which had been treated with estradiol benzoate and from untreated rats into the abdominal cavities of hypophysectomized rats. Hypophyses from treated rats produced less effect on the interstitial tissue of the testis of the receptor rats than did hypophyses from untreated rats, but had about the same effect on the seminiferous tubules. Another type of experiment also gave evidence of the plurality of hormones in the hypophysis. Administration of ½ unit of pregnyl (placental gonadotropic hormone) daily for 12 days decreased both the germinal and the interstitial tissue in hypophysectomized rats, but increased both in normal rats; it did not affect the weight of the seminal vesicle. Administration of estradiol benzoate by itself decreased the weight of both interstitial tissue and germinal tissue of the testis of normal rats. Administration of both estradiol benzoate and pregnyl increased germinal tissue and decreased interstitial tissue. N. M. PAYNE (Chem. Abstr.).

The Influence of Vitamin B_1 on the Nervous System. Haex, A. J. Ch., and Gaillard, P. J. (State Univ. Leyden). [*Acta Brevia Neerland. Physiol. Pharmacol. Microbiol.*, **11**, 113–16 (1941) (*in English*).]

Nervous tissue from the optical lobe of chick embryos 7½ to 8½ days old was grown in a medium consisting of 1 volume chicken plasma, 1 volume press juice of chicken embryos 9 days old, diluted 1 : 2 with a physiological salt mixture (Titro salt), and 1 volume of a vitamin B_1 solution which was varied to give 1, 2·5, 5, 10, 12·5, 16·7, 25, 50 and 100 I.U. per explant. After culturing for two 24-hour periods the explants were fixed, cut into 10μ slices and stained with cresyl violet. The control sections remained nearly unaltered. In those where the vitamin had been added to the medium a distinct development of normal fibroblasts occurred. This influence of the vitamin B_1 varied with the concentration, and was absent in those cultures which were grown with the largest amount of the vitamin. An optimal concentration of 10 I.U. per explant was established.

GERTRUDE E. PERLMANN (Chem. Abstr.).

The Influence of Thiamine on the Susceptibility of Chicks to Avian Encephalomyelitis. Cooperman, J. M., Lichstein, H. C., Clark, P. F., and Elvehjem, C. A. (Univ. of Wisconsin, Madison). [*J. Bact.*, **52**, 467–70 (1946).]

One-day-old white leghorn chicks were divided into 3 groups, receiving a low, suboptimum, and optimum intake of thiamine, and inoculated with a virus sus-

pension of avian encephalomyelitis. The chicks receiving the highest level of thiamine were protected to the greatest degree. Another group of day-old chicks were given an optimum level of thiamine for 2 weeks, then divided into the 3 groups for 2 weeks and inoculated. In this case the chicks receiving the least thiamine were protected to the greatest degree.

JOHN T. MYERS (Chem. Abstr.).

Avitaminotic Ailments of the Nervous System in Besieged Leningrad. Razdol'skii, I. Ya. [*Klin. Med.* (*U.S.S.R.*), **23**, *Nos.* 7–8, 14–19 (1945).]

Pellagra was the most common disease resulting from poor vitamin supply during the siege of Leningrad, although other forms of polyneuritis were widespread. Nicotinic acid was very effective as a therapeutic agent, although intralumbar injections of vitamin B_1 served excellently to combat the psychological symptoms of vitamin deficiency. G. M. KOSALAPOFF (Chem. Abstr.).

Effect of Vitamins on Sensitivity of Striated Muscle to Acetylcholine and Potassium. Torda, Clara, and Wolff, Harold G. (*Cornell Univ. Med. Coll., New York, N.Y.*). [*Exptl. Med. Surg.*, **4**, 50–3 (1946); *cf. C. A.*, **40**, 6173^8.]

In the course of an investigation of the behavior of striated muscle in patients with myasthenia gravis, a search for substances modifying the sensitivity of striated muscle to indirect and direct stimulation was undertaken. The acetylcholine sensitivity of frog muscle was decreased in the presence of vitamins A and B_1 (higher concentrations), increased in the presence of riboflavin and menadione (higher concentrations), and not affected by p-aminobenzoic acid, nicotinamide, nicotinic acid, pyridoxine, Ca pantothenate, or vitamins C, D or E. The K sensitivity decreased in the presence of vitamin A and Ca pantothenate (higher concentrations) and increased in the presence of most of the other substances used, especially menadione. MARION HORN PESKIN (Chem. Abstr.).

The Influence of Thiamine on the Action of Acetylcholine on Muscle. Sadhu, D. P. (*Presidency Coll., Calcutta, India*). [*Am. J. Physiol.*, **147**, 233–6 (1946).]

Thiamine in sufficiently high concentration annuls to various degrees the effect of acetylcholine, but not when the Ca-ion level is too low. Thiamine in high concentration annuls the effect of acetylcholine on the heart even in the presence of eserine. It prevents the inhibitory action of vagus stimulation on heartbeats.

E. D. WALTER (Chem. Abstr.).

The Direct Action of Prostigmine on Skeletal Muscle; Its Relationship to the Choline Esters. Riker, Walter F., jun., and Wescoe, W. Clarke (*Cornell Univ. Med. Coll., New York, N.Y.*). [*J. Pharmacol.*, **88**, 58–66 (1946).]

The destruction of muscle cholinesterase was effected by injecting an anticholinesterase, diisopropyl fluorophosphate (DFP), into the artery supplying the muscle. The characteristic contractile responses of cat leg muscle to the intra-arterial injection of acetylcholine or prostigmine (I) were essentially unaltered in the absence of cholinesterase. The effect of DFP on the activity of skeletal muscle differs from that of (I) in that it produces only scattered irregular fasciculations after a latent period of 2–5 minutes. The action of (I) appears to be primarily directly on the muscles and differs from that of an antiesterase. Because of the similarity in structure of (I) and the natural and synthetic choline esters it is reasonable to predicate a common basis of action for all.

L. E. GILSON (Chem. Abstr.).

Action of Cocarboxylase in the Synthesis of Acetylcholine. Minz, B. (*Sorbonne, Paris*). [*Compt. rend. soc. biol.*, **140**, 412–14 (1946).]

The dorsal muscle of the leech, in the presence of air, cocarboxylase, choline and eserine, rapidly forms a substance which causes the muscle to contract. Presumably choline is converted into acetylcholine and cocarboxylase in some manner aids the reaction. L. E. GILSON (Chem. Abstr.).

Oscillations of the Tone of the Respiratory Muscles Provoked by Acetylcholine in Decerebrated Animals. Pupilli, G., and Bottoni, A. Sacchi (*Univ. Bologna, Italy*). [*Boll. soc. ital. biol. sper.*, **18**, 258–60 (1943).]

L. E. GILSON (Chem. Abstr.).

Sulfhydryl Groups in the Action of Acetylcholine and Inhibition of the Vagus Nerve. Koshtoyants, Kh. S., and Turpa'ev, T. M. (Acad. Sci. U.S.S.R., Moscow). [*Nature*, **158**, 837–8 (1946).]

The cardio-inhibitory effect due to vagus nerve stimulation and acetylcholine is abolished after application of 10^{-3} and 10^{-4} $HgCl_2$ to the frog heart. $HgCl_2$ binds SH groups. The effect is restored after the heart is washed with 2×10^{-3} cysteine. The inhibition of acetylcholine action by atropine is not reversed by cysteine. LEONARD J. COLE (Chem. Abstr.).

Action of Acetylcholine on Maximum Tolerance to Oxygen Deficiency. Scoz, G., and Michele, G. De (Univ. Naples). [*Boll. soc. ital. biol. sper.*, **19**, 3–4 (1944).]

In patients with pulmonary tuberculosis the subcutaneous injection of 100 mgm. of acetylcholine increased the tolerance to low concentrations of O but did not increase the total O consumption. Adrenaline had little or no such effect and glycerophosphates had no effect.

Action of Acetylcholine on the Erythrocyte Count of the Peripheral Blood. [*Ibid.*, 4–5.]

In the above experiments the acetylcholine produced a transient rise in the red cell count in the hour following the injection.

Action of Acetylcholine on Maximum Tolerance to Oxygen Deficiency and on the Erythrocyte Count. Michele, G. De, and Scoz, G. [*Ibid.*, 6–7.]

The two effects show no significant correlation.

Action of Histamine on Maximum Tolerance to Oxygen Deficiency. Michele, G. De. [*Ibid.*, 8–9.]

In pulmonary tuberculosis patients the intramuscular injection of 0·5 mgm. of histamine-HCl slightly decreased tolerance to air mixtures with lowered O content. L. E. GILSON (Chem. Abstr.).

The Influence of Sodium Salicylate on the Action of Acetylcholine. Valenzuela, Manuel de Armijo (Fac. Medicina Cadiz). [*Farmacoterap. actual (Madrid)*, **3**, 684–9 (1946).]

Na salicylate in concentrations of 1 : 100,000 to 1 : 10,000 has no influence on the eserinized dorsal muscle of the leech, but it reduces the response to acetylcholine. This effect changes to augmentation at concentrations of more than 2 : 10,000, when the salicylate becomes active directly. The action on the non-eserinized muscle is similar, although at higher concentrations. Continued administration of Na salicylate to humans causes a decrease in acetylcholine activity of the spinal fluid. A. E. MEYER (Chem. Abstr.).

Synthesis of Acetylcholine in Brain. Balbi, R. (Univ. Naples). [*Boll. Soc. ital. biol. sper.*, **18**, 285–7 (1943).]

The synthesis of acetylcholine by rat brain homogenate in Ringer solution containing eserine was demonstrated. The synthesis, at pH 7·4, was accelerated by glucose and Na pyruvate, lactate, acetoacetate, and acetate, the effectiveness decreasing in the order named. L. E. GILSON (Chem. Abstr.).

Acetylcholine in the Blood of Patients with Gastric or Duodenal Ulcers. Al'pern, D. E. [*Klin. Med.*, **23**, *Nos.* 7–8, 52–4 (1945).]

See *C. A.*, **40**, 7361[9]. G. M. KOSOLAPOFF (Chem. Abstr.).

Presence of Acetylcholine in the Blood of Patients with Ulcers. Bykhovskii, Z. E., and Korenevskaya, O. G. [*Klin. Med.*, **23**, *Nos.* 7–8, 54–7 (1945).]

The authors found acetylcholine in the blood of 60·4 per cent. patients suffering from gastric or duodenal ulcers, with the level corresponding usually to the gravity of the case. Most frequent occurrence was observed in cases involving the parasympathetic nervous system. G. M. KOSALOPOFF (Chem. Abstr.).

Apparent Curare Effect of Substances that Decrease Acetylcholine Synthesis. Torda, Clara, and Wolff, Harold G. (Cornell Univ. Med. Coll., New York, N.Y.) [Am. J. Physiol., 147, 384–90 (1946); cf. C. A., 40, 2211⁹.]

Uric acid, pyrrole, alloxan, methylguanidine, vitamin K, NH_3, hydroquinone, α-naphthol, β-naphthol and glyceraldehyde decreased the response of striated muscle to indirect stimulation. Serum collected from the working arm of human subjects also decreased the response of striated muscle to indirect stimulation and decreased the synthesis of acetylcholine without decreasing the response of excised muscle to acetylcholine. It is suggested that an apparent curare effect may be exerted by substances acting, not on some structure or process within the muscle, but on the nerve tissue. E. D. WALTERS (Chem. Abstr.).

Nervous System Changes Produced in Dogs by Choline and Carbamylcholine. Davis, John E., and Fletcher, D. E. (Univ. of Arkansas, Little Rock). [J. Pharmacol., 88, 246–53 (1946).]

Hyperchromic anemia was produced in dogs by daily administration, for several weeks, of choline chloride or carbamylcholine or both. Definite changes in the nervous system were also produced. In the acute phase the lesions were characterized by multiple hemorrhages in the grey substance of the brain and spinal cord, and by a diffuse gliosis and acute neurone changes. After recovery from drug treatment, the lesions were chracterized by perivascular gliosis, glial nodules, diffuse scar formation and neurone depletion. The similarity and differences between these changes and those found in pernicious anemia, and the possible etiological factors responsible for the changes, are discussed.

L. E. GILSON (Chem. Abstr.).

Studies on Choline Acetylase. III. Preparation of the Coenzyme and Its Effect on the Enzyme. Nachmansohn, David, and Berman, M. (Columbia Univ.). [J. Biol. Chem., 165, 551–63 (1946); cf. C. A., 40, 4403³.]

The coenzyme necessary (I) for the activity in nerve tissue of choline acetylase (II) was prepared from brain, liver, heart and skeletal muscle by grinding the tissue in a Waring blender with 1–2 times its weight of water, heating to 100°, and filtering. Proteins were removed from the filtrate by precipitation with AcOH and filtration. The filtrate was neutralized and showed coenzyme activity. (I) can be partially purified by precipitation with $Ba(OH)_2$ and redissolving with Na_2SO_4. Boiling (I) in 0·1 N HCl caused more rapid loss in activity than did boiling in water, while boiling for ½ hour in 0·1 N NaOH caused the disappearance of all the activity. While K and cysteine cause partial reactivation of dialyzed (II), (I) causes complete reactivation. Addition of (I) to undialyzed (II) increased the rate of acetylcholine formation. (II) was shown to be present in sensory nerves. Evidence was also found for the presence of (II) in invertebrates, since the addition of (I) to extracts of lobster abdominal chain caused a large increase in the rate of acetylcholine formation. Diisopropyl fluorophosphate, which inhibits cholinesterase, did not affect (II). Approximately doubled activity was exhibited by (II) if, in addition to (I), Mg or Mn was present. The effect of Mg was the same on dialyzed as undialyzed (II). Mg could not replace K. High-speed centrifugation at 48,000 r.p.m. increased the purity of (II), the activity being found in the bottom layer, which showed only one component. Methylnaphthoquinone and 2-methyl-1,4-naphthoquinone-8-sulfonic acid inhibited (II).

A. JEROME GANZ (Chem. Abstr.).

The Effect of Chloroform and Ether on the Activity of Cholinesterase. Miquel, Ovidio (Cornell Univ. Med. Coll., New York, N.Y.). [J. Pharmacol., 88, 190–3 (1946).]

Ether and $CHCl_3$ in concentrations corresponding to those attained during deep general anesthesia do not inhibit the activity *in vitro* of the nonspecific cholinesterase of cat serum and the specific cholinesterase of eel electric organ. Higher concentrations partially inhibit the activity. The inhibiting action of ether in high concentrations is partially reversible. These observations support the hypothesis that the parasympathetic effects observed during general anesthesia from ether and $CHCl_3$ are not due to inhibition of cholinesterase activity.

L. E. GILSON (Chem. Abstr.).

Cholinesterase and Pseudocholinesterase. Vincent, D., [*Presse med.*, **54**, 571–3 (1946).]

True cholinesterase of the nervous system is effective at a maximum concentration of acetylcholine of 1 mgm. in 100 c.c. The non-specific pseudocholinesterase of the serum and pancreas is most effective at a concentration of 100 mgm. per 100 c.c. Acetyl-β-methylcholine is hydrolyzed by true cholinesterase. Benzoylcholine is split by the pseudocholinesterase.

A. E. MEYER (Chem. Abstr.).

Action of Calcium, Barium and Magnesium on Blood Cholinesterase. Scoz, G., and Michele, G. De (Univ. Naples). [*Boll. soc. ital. biol. sper.*, **19**, 24 (1944).]

In Na barbital buffer solution of pH 8 low concentrations of Ca++, Ba++ and Mg++ increased and high concentrations inhibited the cholinesterase activity of whole blood. Removal of Ca++ from blood (by oxalate) inhibits the cholinesterase activity. L. E. GILSON (Chem. Abstr.).

Anaphylaxis and Cholinesterase Activity. Laborit, H., and Morand, P. [*Press med.*, **54**, 533–4 (1946).]

It is claimed that anaphylactic shock is caused by acetylcholine, and seems to be determined by a deficiency in cholinesterase. A. E. MEYER (Chem. Abstr.).

The Significance of Serum Cholinesterase. Cristol, P., Passouant, P., Benezech, C., and Dutarte, G. [*Presse méd.*, **54**, 557–8 (1946).]

The level of serum cholinesterase is low in uncompensated cirrhosis of the liver, jaundice, active pulmonary tuberculosis, nephritis with edema, and insulin-treated diabetes. It is normal or increased in jaundice caused by biliary obstruction, in inactive tuberculosis, untreated diabetes, and in hypertension.

A. E. MEYER (Chem. Abstr.).

Cholinesterase Determinations. Aron, Émile, and Herschberg, A. D. [*Presse med.*, **54**, 107–8 (1946).]

The determination of cholinesterase does not seem to be of value as a means of differential diagnosis. The cholinesterase is high wherever the acetylcholine activity is increased. Therefore it is high in asthma, spastic constipation, and similar conditions of high parasympathetic tonus. The determination has mainly a prognostic value. A. E. MEYER (Chem. Abstr.).

A New Biological Test: The Determination of Cholinesterase Activity and Its Clinical Importance. Laborit, H., and Morand, P. [*Presse méd.*, **54**, 106–7 (1946).]

The determination is of interest in angina and coronary disease, Raynaud's disease, megacolon, gastric ulcer, insulin-resistant diabetes, bronchial dilatations, and vascular affections of the retina. In asthma hypoactivity of cholinesterase is observed. A. E. MEYER (Chem. Abstr.).

Protection of Cholinesterase Against Irreversible Inactivation by Diisopropyl Fluorophosphate in vitro. Koelle, Geo. B. (Edgewood Arsenal, Md.) [*J. Pharmacol.*, **88**, 232–7 (1946).]

Eserine, by combining reversibly with rat brain cholinesterase, protects the enzyme against irreversible inactivation by diisopropyl fluorophosphate (DFP) *in vitro*. The degree of protection varies directly with the concentration of eserine. This may explain how eserine protects cats against DFP poisoning. Of 19 other anticholinesterase drugs similarly tested, prostigmine and carbamylcholine afforded marked protection; pilocarpine, nicotine, atropine, choline, procaine and morphine afforded relatively slight protection; and methylene blue, strychnine, atebrin, quinine, NaF, thiamine, cysteine, Na p-amino-benzoate, acetyl-β-methylcholine, acetylcholine and curare (intocostrin) gave no protection. The protective property does not appear to depend on the potency of anticholinesterase activity alone, but also on the ability of the compound to compete with DFP for a specific active group of the cholinesterase molecule. L. E. GILSON (Chem. Abstr.).

Action of Atropine on Blood Cholinesterase. Scoz, G., and Michele, G. De (*Univ. Naples*). [*Boll. soc. ital. biol. sper.*, **19**, 5–6 (1944).]

Very small quantities of atropine increased the cholinesterase activity of blood *in vitro*. In normal human subjects the subcutaneous injection of 1 mgm. of atropine sulfate increased the cholinesterase activity of the blood 30–50 per cent. for several hours. L. E. GILSON (Chem. Abstr.).

Ultraspectrophotometric Studies on Cerebrospinal Fluids. Spiegel-Adolf, Mona, and Wycis, H. T. (*Temple Univ. Med. School, Philadelphia*). [*J. Phys. Chem.*, **50**, 447–52 (1946).]

Either a Hilger quartz spectrograph and sector-photometer or a D U Beckman photoelectric quartz spectrophotometer were employed to measure the extinction coefficients of cerebrospinal fluids in the wave-length range 220 mμ to 300 mμ. The results showed a marked selective absorption, with a peak at 265 mμ in cerebrospinal fluids of patients who had sustained a cerebral concussion or been subjected to convulsive disorders. The selective absorption of these fluids has been tentatively explained by the presence of nucleic acids or their derivatives, liberated by cell injury. A comparison of the selective absorption of cerebrospinal fluids with that of pure sodium thymonucleate indicates the presence of an average of 0·1 mgm. of nucleic acid per molecule in the pathological cases.

W. F. MEGGERS (Chem. Abstr.).

Influence of Thiamine on the Nicotinic Acid Content of Cerebrospinal Fluid. Malaguzzi-Valeri, Claudio, and Neri, Ferrante (*Univ. Bari, Italy*). [*Boll. soc. ital. biol. sper.*, **17**, 644–5 (1942).]

In 4 normal subjects the spinal fluid contained 15–19 γ/c.c of nicotinic acid. Parenteral administration of 100 mgm. of nicotinic acid daily for several days approximately doubled the values; 100 mgm. of nicotinic acid plus 12·5 mgm. of thiamine daily for the same period caused a decrease in spinal-fluid nicotinic acid to an average of 10γ/c.c. L. E. GILSON (Chem. Abstr.).

The Copper Content of the Cerebrospinal Fluid. Axtrup-Lund, S. (*Univ. Lund*). [*Ann. Paediat.*, **166**, 259–64 (1946).]

The Cu content of cerebrospinal fluid (measured by the method of Heilmeyer, *Fischer's Verlag*, Jena, 1941) in various diseases averaged 15γ per cent. with a range of 1 to 26γ per cent. In cases of meningeal affection the Cu content is low.

BARBARA R. MURRAY (Chem. Abstr.).

2. Pharmacology and Treatment.

Conditioned Reflex Treatment for Alcohol Addicts. [*Clin. Med.*, **53**, 220–2 (1946).]

Modern Trends in the Treatment of Alcohol Addicts. [*J. soc. Casework*, **27**, 222–9 (1946).] R. D. WEITZ (Psychol. Abstr.).

Fixation of Arsenic in the Central Nervous System During Hyperpyrexia. Untersteiner-Occhialini, L. (*Univ. Genova, Italy*). [*Boll. soc. ital. biol. sper.*, **18**, 197–8 (1943).]

Active hyperthermia was induced in rabbits by injection of a mixture of several species of killed bacteria, or passive hyperthermia was produced by placing the rabbits in a hot chamber; then a solution of arsenite or neoarsphenamine was injected. In no case was there any significant fixation of arsenic by the brain or medulla. L. E. GILSON (Chem. Abstr.).

Penicillin in the Treatment of Neurosyphilis. I. Asymptomatic Neurosyphilis. Moore, Joseph E., and Mohr, Charles F. (*Johns Hospkins Univ., Baltimore*). [*Am. J. Syphilis, Gonorrhoea, Venereal Diseases*, **30**, 405–19 (1946).]

Intramuscular injection of penicillin has a favorable influence on spinal fluid abnormalities and affects, in order, cell count, protein content, colloidal gold curve, and Wassermann reaction. The rapidity and extent of its action depends in the

degree of the spinal fluid abnormality and the duration of the syphilitic infection. The penicillin was administered over a period of 7–10 days. Five of 48 patients with early, and 19 of 41 patients with late, asymptomatic neurosyphilis had abnormally high protein, greater than 38 mgm. per cent., in the cerebrospinal fluid. The protein content fell after treatment and attained a normal value by the sixth month. A. DIETZ (Chem. Abstr.).

Electrical Manifestations of the Cerebellum and Cerebral Cortex Following DDT Administration in Cats and Monkeys. Crescitelli, Frederick, and Gilman, Alfred (Edgewood Arsenal, Md.). [*Am. J. Physiol.*, **147**, 127–37 (1946).]

The alterations in the spontaneous electric potentials recorded from either the exposed or non-exposed cerebral cortex and cerebellum, following the intravenous administration of DDT emulsions into cats and monkeys which had been treated with small doses of Na pentobarbital to suppress the convulsive action of DDT, are presented. E. D. WALTER (Chem. Abstr.).

Action of Magnesium on the Excitability of Nerves and Muscles. Bartorelli, Cesare (R. Univ. Bologna). [*Arch. fisiol.*, **42**, 316–51 (1942); *cf. C. A.*, **40**, 5833[5].]

Muscle preparations, the gastrocnemius muscle of *R. temporaria* and *R. esculenta*, showed shortening of the chronaxia and increase of the rheobase, while nerve preparations showed lengthening of the chronaxia and a similar increase in rheobase. H. L. WILLIAMS (Chem. Abstr.).

Convulsant Action of Pyridoxine. Saviano, Mario (R. Univ. Napoli). [*Arch. fisiol.*, **42**, 375–83 (1942).] H. L. WILLIAMS (Chem. Abstr.).

Change in Neuromuscular Excitability Caused by Quaternary Ammonium Salts. Bartorelli, Cesare (R. Univ. Bologna). [*Arch. fisiol.*, **42**, 189–221 (1942).]

Gastrocnemius nerve-muscle preparations from *R. temporaria* and *R. esculenta* were made more sensitive by the iodides of tetramethylammonium, tetrapropylammonium and tetrabutylammonium, while tetraethylammonium iodide caused an initial diminution in sensitivity followed by an increase. H. L. WILLIAMS (Chem. Abstr.).

Effects of Several Local Anesthetics on the Resting Potential of Isolated Frog Nerve. Bennett, A. L., and Chinburg, K. G. (Univ. of Nebraska Med. Coll., Omaha). [*J. Pharmacol.*, **88**, 72–81, (1946).]

By a study of resting and demarcation potentials in isolated frog sciatic nerves it was shown that cocaine, procaine, intracaine, borocaine, monocaine, pontocaine, metycaine, nupercaine, naphthacaine, γ-phenyl-γ-hydroxy-β-(diethylamino)propyl benzoate, β-diethylaminoethyl-trans-α-ethylcinnamate, β-(N-methyl-N-phen-ethyl amino) ethyl carbanilate, and γ-di-ethylaminopropylphenylurethan block conduction without depolarizing the nerves. This supports the view that anesthetics in general block nerves because they stabilize those conditions, relative to the cell membrane, which normally are sufficiently labile to permit the phasic shift in potential during impulse conduction. L. E. GILSON (Chem. Abstr.).

The Synergism Between the Barbiturates and Ethanol. Ramsey, Helen, and Haag, H. B. (Med. Coll. of Virginia, Richmond). [*J. Pharmacol.*, **88**, 313–22 (1946).]

The administration of EtOH markedly increases the anesthetic and toxic actions of Na seconal (Na allyl-sec-amylbarbiturate), Na phenobarbital, and Na barbital given orally to mice and Na pentothal given to dogs. The disposition of EtOH in the body appeared not to be influenced by the presence of Na barbital; conversely, the blood level of picrotoxin was less efficient as an analeptic in rabbits given Na pentobarbital plus EtOH than in those given Na pentobarbital only. L. E. GILSON (Chem. Abstr.).

Comparative Study of Several Barbiturates with Observations on Irreversible Neurological Disturbances. Krop, Stephen, and Gold, Harry (Cornell Univ. Med. Coll., New York, N.Y.). [*J. Pharmacol.*, **88**, 260–7 (1946).]

Cats show very large individual variations, but the approximate oral LD 50 is, for seconal (allyl-sec-amylbarbituric acid), 50 mgm./kgm.; pentobarbital, 100;

sigmodal (sec-amyl-β-bromoallylbarbituric acid and antipyrine), 110; and pernoston (sec-butyl-β-bromoallylbarbituric acid), 135 mgm./kgm. The course of action after oral administration of the above dosage in cats is, onset of ataxia in about 5 minutes, maximum narcosis in about 30 minutes, duration of full effect for about 18 hours and, if not fatal, disappearance of ataxia after 2–3 days. With phenobarbital (LD 50 = 175 mgm./kgm.) the onset of ataxia is somewhat slower and the ataxia lasts 2–3 times as long. Large doses of sigmodal cause irreversible damage of the central nervous system, resulting in motor, postural and reflex abnormalities in about 8 per cent. of cats, but not in dogs. Large doses of pernoston also sometimes damage the central nervous system of cats. Such action does not occur with compounds not containing the bromoallyl group.

L. E. GILSON (Chem. Abstr.).

Narcosis and Precipitation of Cellular Lipides. Dode, Maurice, Gavaudan, Pierre, and Poussel, Helene. [*Compt. rend.*, **223**, 521–3 (1946).]

A theory of narcosis based on precipitation under the action of narcotic is compatible with the principles of thermodynamics. It is necessary to determine the nature of the precipitation, whether it is truly a precipitation of the lipides of the lipoprotein complexes. RACHEL BROWN (Chem. Abstr.).

Action of Wine on Vestibular Chronaxia. Mouriquand, G., and Coisnard, J. [*Compt. rend. soc. biol.*, **140**, 294–5 (1946); *cf. C. A.*, **40**, 6656[1].]

In human subjects the ingestion of 60–100 c.c. of red wine (9 per cent. EtOH) caused a small increase in vestibular chronaxia; 200–500 c.c. caused a small decrease.

Action of Ingested Insulin on Vestibular Chronaxia. [*Ibid.*, 296–7.]

In men, children, and pigeons, the oral or parenteral administration of insulin caused an important decrease in vestibular chronaxia.

L. E. GILSON (Chem. Abstr.).

Metrazole Epilepsy and the Physiological Basis of Convulsant Coma Therapy. Chauchard, Paul, Mazoué, Henriette, and Lecoq, Raoul (Hôpital de St-Germain-en-Laye). [*Ann. pharm. franç.*, **3**, 143–9 (1945).]

A discussion of results previously obtained by Chauchard *et al.* and others (*cf. C. A.*, **39**, 1642[3]), from which various conclusions are drawn. It is thought that the electroencephalographic manifestations induced by metrazole are not due to a cerebral excitation, but to the repercussion of the excitation of the lower nerve centers on the brain. The resultant bursts of motor nerve impulses are thought to overcome the normal barrier between the cortex and the periphery. For the same reasons as insulin and electric shock, metrazole induces coma by depressing the brain and exciting the lower centers. From a therapeutic standpoint it would be inaccurate to consider this either as a pure convulsive or a pure coma-producing agent. Simple hypnotics or anesthetics do not possess the same properties. Chronaxic measurements show that convulsive coma therapies cause complex changes in the nervous system, which apparently are responsible for their greater effectiveness. The brain is not only subjected to a depressing influence; according to the observation of I. Bertrand *et al.* (*Compt. rend. soc. biol.*, **138**, 143 (1944)) it is affected by the repercussions of the mechanism of the excitation of the lower centers. A. PAPINEAU-COUTURE (Chem. Abstr.).

Tetrazole Derivatives. III. Some Pharmacologic Properties of Aminotetrazoles. Gross, E. G., and Featherstone, R. M. (State Univ. of Iowa, Iowa City). [*J. Pharmacol.*, **88**, 353–8 (1946); *cf. C. A.*, **40**, 6656[4].]

The stimulating and analeptic actions of the HCl salts were studied in rats, and the lethal doses were also determined. Most of them produced convulsions and depressed respiration. The lack of analeptic action is ascribed to the presence of the amino group. The optimum structural factors for central nervous stimulation appear to be the presence of a relatively large alkyl or phenalkyl group in the I position and a small group on the 5-amino group. The unsubstituted amino compound of the series, TT-31, showed no central nervous action, either stimulatory or depressant. L. E. GILSON (Chem. Abstr.).

Tridione: A New Anticonvulsant Drug. **Richards, R. K., and Everett, G. M.** (*Abbott Labs., Chicago*). [*J. Lab. Clin. Med.*, **31**, 1330–6 (1946); *cf. C. A.*, **41**, 212*g*.]

A discussion of the pharmacology and therapeutic applications of tridione (3,5,5-trimethyloxazolidine-2,4-dione). Clinical investigations indicate its usefulness in the treatment of *petit mal* epilepsy, although its site of action has not yet been determined. J. P. CRISPELL (Chem. Abstr.).

The Excretion of Amphetamine. **Harris, S. C., Searle, L. M., and Ivy, A. C.** (*Northwestern Univ. Med. School, Chicago*). [*J. Pharmacol.*, **89**, 92–6 (1947).]

When 30 mgm. of dl-amphetamine (benzedrine) or 15 mgm. of d-amphetamine (dexedrine) was given daily to 10 human subjects for 56 days, the daily urinary excretion of the drug remained essentially constant. The average recovery in the urine was 45·6 per cent. for benzedrine and 47·3 per cent. for dexedrine. These results imply that the rate of destruction (presumably in the liver) remained constant, and that the development of tolerance cannot be attributed to a progressive increase in drug destruction. There was no evidence of a diuretic effect of amphetamine; the excretion of the drug was independent of urinary volume. Amphetamine did not affect the blood level of ascorbic acid.

L. E. GILSON (Chem. Abstr.).

Procaine Therapy. **Velazquez, B. Lorenzo.** [*Farmacoterap. actual* (*Madrid*), **3**, 655–69 (1946).]

The total pharmacology of procaine is discussed, and kymographic tracings are presented to demonstrate, in comparison with p-aminobenzoic acid and diethylaminoethanol, the inhibiting effect on the guinea-pig intestine, the antagonism to the spastic action of acetylcholine, the stimulation of the uterus, especially the enhancing effect on pituitrin, and also the increase of the pressor action of the latter in the spinal cat. The anticholinesterase action is demonstrated in experiments with the leech muscle. Various methods of local anesthesia and nerve blocking are discussed. A. E. MEYER (Chem. Abstr.).

Paralysis by Curare. **Zelikowski-Guttel, A.** (*Sorbonne, Paris*). [*Compt. rend. soc. biol.*, **140**, 451–2 (1946).]

The effects of several kinds of curare were studied in frogs. There was very little difference in the actions of orthocurare and paracurare. The paralysis produced appeared to be due to action on the central nervous system rather than to peripheral interference with transmission from nerve to muscle.

L. E. GILSON (Chem. Abstr.).

Effects of Ether and Curare on Neuromuscular Transmission. **Schalleh, Wm.** (*Washington Univ. Med. School, St. Louis, Mo.*). [*Proc. Soc. Exptl. Biol. Med.*, **63**, 78–81 (1946).]

The response of the gastrocnemius to maximum stimulation through its nerve was studied in rats. During deep etherization there is a depression of 12 per cent. in the muscle-action potential. At the same time the respiration is depressed; anoxia alone due to this may account for 5 per cent. depression. Hence a muscular depression of only 7 per cent. can be attributed to the action of ether, not necessarily involving neuromuscular block. A synergism exists between ether and curare (intocostrin), since the effect of these agents given together is one-third greater than the sum of their separate effects. L. E. GILSON (Chem. Abstr.).

Effect of Pentothal Anesthesia on Canine Cerebral Cortex. **Homburger, E., Himwich, W. A., Etsen, B., York, G., Maresca, R., and Himwich, H. E.** (*Union Univ., Albany, N.Y.*). [*Am. J. Physiol.*, **147**, 343–5 (1946).]

The effect of light pentothal narcosis was compared with that of deep anesthesia, and the av. O intake in the brain of 7 dogs was found to fall from 5·9 c.c. O per dog per 100 gm. of tissue per min. to 2·6 c.c. O. per 100 gm. of tissue per min., a decrease of 56 per cent. The cerebral metabolic rate is higher than that obtained from the brain of man and monkey with the same methods. The difference is laid to the fact that in the dogs the venous blood came chiefly from the cerebral hemispheres, which possess a faster metabolism than the lower parts of the brain.

E. D. WALTER (Chem. Abstr.).

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Part I.—Original Articles.

EXCITATORY ABREACTION: WITH SPECIAL REFERENCE TO ITS MECHANISM AND THE USE OF ETHER.

By H. J. SHORVON, M.B., D.P.M., D.A., and WILLIAM SARGANT, M.B., M.R.C.P., D.P.M.

From the Neuropsychiatric Unit, Sutton Emergency Hospital.

[Received 10 May, 1947.]

THE origin of the term abreaction dates from the time of Breuer and Freud's (1) early studies in hysteria, when they observed that patients were helped by "just talking it out." Later their technique was employed under hypnosis (2). Sadler (3) defined abreaction as "a process of reviving the memory of a repressed unpleasant experience and expressing in speech and action the emotions related to it, thereby relieving the personality of its influence." Miller (4) quotes Freud as holding that experiences shall be recalled with emotional vividness. "Affectless memories are almost useless," said Freud.

Freud himself soon abandoned this hypnotic method of abreaction in favour of free association and the psychoanalytical technique. However, during the First World War it became apparent that abreaction had a very definite place in the treatment of acute "traumatic neuroses" (5). Millais Culpin (6) stated, "Once the man's conscious resistance to discussing his war experience was overcome, great mental relief followed the pouring out of emotionally charged incidents. It was as if the emotion pent up by this conscious resistance had by its tension given rise to symptoms. The memory, usually of a nature unsuspected by me, then came to the surface, its return being preceded perhaps by congestion of the face, pressing of the hands to the face, tremblings, and other bodily signs of emotion." William Brown (7) pointed out in 1920 that the improvement was often solely dependent on the abreaction obtained and

not on suggestion. "Suggestion removes the symptom, abreaction removes the cause of the symptom by producing fully adequate re-association."

As previously indicated by Freud, Millais Culpin (8) stressed, from his experiences in treating traumatic neuroses, that an incident may be remembered, but the emotional content may be separated from it and repressed. Thus with the passage of time the word abreaction has taken on a wider and more elastic significance, including the reliving with affect of conscious and unconscious material. In fact it is in this wider sense that we use the term in this paper.

Between the two World Wars the lessons of abreaction were largely forgotten, but a new approach was opened by the introduction of the use of barbiturates in psychotherapy by Blackwenn (9) in America in 1929. Lindemann (10) and Wagner (11) using sodium amytal and Stockert (12) and Campbell (13) using sodium evipan were a few of the pioneers in this field. Horsley (14) in 1936 elaborated the method of employing intravenous nembutal or pentothal to facilitate discharge of repressed emotion and memories while the patient was in a suggestible state induced by the drug. This method was only slowly adopted by psychotherapists, but in 1940 Sargant and Slater (15) reported on its value in the treatment of the acute Dunkirk casualties, among whom were a very high proportion of cases with gross conversion symptoms, particularly amnesias (16). Discussing their findings in this group, Debenham, Hill, Slater and Sargant (17) advised that under the barbiturate the patient should be encouraged to "re-experience the violent emotions that battle scenes have aroused."

Following these reports, drug abreaction became widely adopted in the treatment of military casualties in Great Britain. Further interest was stimulated among American workers by Grinker and Spiegel's (18) use of this technique in North Africa in 1942, though some confusion was added by the adoption of yet another name, "narcosynthesis." At the same time Palmer (19) was achieving interesting results by employing ether instead of a barbiturate. Still later Rogerson (20) substituted nitrous oxide.

It is the intention of this paper to discuss some of our findings in the abreaction of patients with ether, which we started to use in 1944, following the method developed by Palmer. It is, however, worthy of note that Hurst and his collaborators (21) made use of "etherization" in the treatment of hysterical conversion symptoms in the 1914–18 war. His clinical accounts frequently describe the induced excitement, but the method, not specifically recognized as abreaction, was only occasionally used, and generally after firm suggestion or persuasion had failed. Also Penhallow (22) in Boston reported "a case of mutism and deafness due to emotional shock cured by etherization" in 1915. Prior to our use of ether techniques, we had been using barbiturates for four years on a variety of cases among the many thousands who had passed through the unit for treatment during that time. Comparison between the two methods revealed some remarkable differences which led us to speculate and experiment on the whole mechanism of abreaction. The subject has been surrounded for so long by so much psychological theory that certain basic physiological principles may have become obscured.

To arrive at a physiological basis for the use and understanding of abreaction it is first necessary to study the work of experimenters in higher nervous activity. Pavlov's experiments have, despite their limitations, the advantage that they can be repeated and few have been inclined to dispute their accuracy. We therefore wish to recapitulate a few of his findings which we believe are relevant to the problem of abreaction. Just as it is now generally accepted that those who break down even under severe battle stress generally have evidence of constitutional predisposition, so Pavlov found he could divide his dogs into those with ill-balanced nervous systems liable to excessive excitation or inhibition, and those whose nervous systems were with difficulty upset by stimuli, maintaining a steady balance between excitation and inhibition. In 1924 many of Pavlov's dogs were nearly drowned in the Leningrad floods. When rescued at the last moment from their cages, in which they were trapped and swimming about with their heads just above water, some were in a state of acute excitement, which was succeeded by a phase of " collapse " or stupor. This in turn gradually passed off. Pavlov discovered by experiment that this terrifying experience, which had produced great nervous excitement and what he described as " ultraparadoxical " cortical inhibition, had destroyed a series of conditioned responses which he had implanted in these dogs by months of patient work. Other more stable dogs were less affected, did not exhibit such marked excitatory and inhibitory phenomena, and did not lose similar conditioned responses in face of similar psychological trauma. This dramatic extinction of recently acquired conditioned reflexes interested us in relation to the mechanism of abreaction, as also did the fact of its special occurrence in dogs with " weak nervous systems," who were liable to go into cortical transmarginal inhibition under exciting stimuli. For the rest of this paper, when the term transmarginal inhibition is used, we mean the final ultraparadoxical phase of cortical inhibition following an overwhelming stimulus. This may break up recently acquired conditioned behaviour, and is what we wish to suggest may have some relation to the therapeutic value of emotional abreaction in psychotherapeutic techniques.

Pavlov's laws governing the phenomena of nervous excitation and inhibition, their irradiation, concentration and mutual or reciprocal induction, and his demonstration of the " equivalent," " paradoxical " and " ultraparadoxical " phases of inhibitory cortical activity are well known, and can be read in books on conditioned reflexes and their relation to psychiatry (23, 24, 25). He postulates that morbid states of brain activity can be brought about by the collision of excitatory and inhibitory processes, as a result of which a dynamic stereotypy of abnormal behaviour may develop which needs less and less work to sustain it. The normal regulation of excitatory and inhibitory balance may quickly become chaotic, especially in those with unstable nervous systems. Many of the apparently inexplicable behaviour patterns seen in acute war neuroses were faithfully reproduced in Pavlov's dogs under experimental conditions, and are understandable if reference is made to the laws established by Pavlov in twenty years of experimental work. We have discussed this together with some preliminary observations on abreaction in a previous publication (26).

To return to the problem of abreaction. In abreacting patients with ether we immediately noticed a great difference from similar cases we had previously abreacted with barbiturates. Ether produced much more easily a far greater degree of excitement. The same effects were achieved by barbiturates, and by hypnosis for that matter, but the recital of events was usually less intense. Another striking observation is one to which we will refer constantly in this article; that is, the more frequent occurrence of sudden states of "collapse" in the course of an emotional outburst of particular severity when ether is employed. Again this can be obtained under barbiturates or hypnosis, but only occasionally so. We believe the phenomenon corresponds to Pavlov's observation in some of his dogs, that the production of acute excitement leads to a phase of transmarginal inhibition in which the cortex is momentarily incapable of further activity and, as happened in the Leningrad flood, there may result an abolition of recently implanted conditioned behaviour patterns. During abreaction our patients could be made to reach a pitch of terror, anger and excitement, and then suddenly collapse and lie motionless, unmoved by ordinary stimuli for a minute or so. On coming round they would often burst into a flood of tears, or state that outstanding symptoms had gone. A patient might describe his mind as being freed of ideas that had dominated it. He could still think of them, but without associated anxiety or hysterical responses. On several occasions—and this we considered one of our most important observations—when simple excitement at the recital of experiences was produced without a resultant end-stage resembling transmarginal inhibition, little or no improvement occurred. When abreaction was repeated and total inhibition produced by stimulating further excitement, recovery ensued.

Such a technique was not necessary in all types of case. Some cases of recent amnesia, for instance, required but little barbiturate to bring about cortical relaxation, and for a memory then to come flooding back without further effort on the part of the doctor or patient. Ether proved useful for cases in which this was not sufficient. These were the cases in which abnormal behaviour had become more organized and fixed, and had taken on the quality of a stereotypy which needed less and less work to sustain it. Such conditions often became chronic, disabling, persistent, and resistant to simpler measures. But with the massive excitation aroused under ether ending in a transmarginal inhibition, the whole recently built up pattern of behaviour could be disrupted with ensuing rapid recovery.

Pavlov found that some of his dogs were capable of being reconditioned after their experiences in the Leningrad floods, whereas in those with the weakest type of nervous system reconditioning was always unpredictable and sometimes impossible. In the better "inhibitory" type of dog, with the cortical slate wiped clean, the therapist could again write on it. In the weaker animals no stable patterns of behaviour could be re-implanted. The similarity to therapeutic reconditioning in a transference situation enhanced by a dramatic emotional abreaction, in the course of an analysis, is too striking to need further emphasis. It was also exactly what we found in our patients.

Technique of Ether Abreaction.

Ether has proved to be a suitable and useful medium for the facilitation of excitation. Its pharmacological action is to depress the most highly evolved psychic centres first, thus producing disinhibition (27). The amount we administer is far short of the anaesthetic stage, and the open mask method obviates the irritation and suffocating sensations of the closed method, as used in anaesthesia. In this manner it acts as a mild intoxicant and produces a sensation of warmth (the cutaneous and cerebral vessels are dilated), some confusion of thought and loss of self-control. The exhilarating properties of ether have long been known, and the use made of it for pleasurable purposes largely contributed to its discovery as an anaesthetic. Keys (28), in describing its use at parties or "ether frolics," says, "These young participants became pleasantly drunk. They lost their sense of equilibrium, talked foolishly, and sometimes laughed with complete abandon." F. W. Cock (29), in his graphic description of the first operation under ether in Europe (amputation performed by Robert Liston at University College Hospital on 21 December, 1846), relates how a preliminary trial was carried out in the operating theatre on one of the hospital porters, Mr. Sheldrake, before the great Liston arrived. "So the porter lies down on the table and sucks away at the tube, young Squires holding his nose. But after a minute or two, Sheldrake jumps off the table quite intoxicated and making a tremendous to-do, climbs on to the railings and plunges into the mass of students, who are like a flock of sheep when a dog chases it, separating right and left, and letting him nearly reach the door."

There have been numerous accounts of the techniques of abreaction under barbiturates and the methods adopted to stimulate excitement. Roughly the same technique is used with ether; it is essentially simple, but the results depend to a large extent on the experience and personality of the doctor. It is best to warn the patient beforehand that there is no intention whatever of anaesthetizing him or putting him to sleep, as the fear that the "mask treatment" or "ether treatment" is given for such a purpose may diminish the patient's co-operation. We explain to the patient that the treatment is given to allow the freeing and release of emotion or tension that is "locked-up" inside him and giving rise to symptoms. A firm well-padded couch or bed is essential or the patient may hurt himself during his excitement, and it is a wise precaution to have a sufficient number of nurses or doctors present to control the patient. If this is not done, it may be impossible to carry on the abreaction if the patient is violent or struggling and shouting. In powerful muscular individuals some form of mechanical restraint may be an advantage, and in such cases a restraint jacket used in E.C.T. (Sargant and Slater (30)) has proved valuable in the absence of sufficient staff. A Schimmelbusch mask with about 8 layers of gauze is best used, together with an ether drop bottle. The patient lies flat and is first talked to in an informal way about events prior to the onset of his illness, or prior to the incident over which he is to be abreacted. Care should be taken not to drop any ether into the eyes, and a pair of dark goggles is a useful protection. The mask should be sprayed with a liberal quantity of ether from the start, and although held away

from the face during the first few whiffs and the preliminary talk, it should be quickly approximated to the face, except in bronchitic subjects. A preliminary injection of atropine sulphate, gr. $\frac{1}{100}$ is given to the latter type of patient. Soon after the preliminary discussion the patient is brought back to the scene of the breakdown or to a past incident that had been accompanied by much emotional significance. It is important not to administer the ether too slowly nor to use too little at a time, as this method will result in a gradual anaesthetization, with the patient tending to exhibit a prolonged drunken phase in which it is difficult to establish contact with him. If the light etherization (there is no anaesthetization in the accepted sense) is done successfully, the patient usually becomes quickly and wildly excited and begins to abreact. The voice becomes louder, the face reddens, and the flush becomes deeper as the emotional release occurs. Much depends on the way in which the physician handles the situation. Often the trigger stimulus only becomes apparent during the treatment, and one has to be on the alert to seize on this and press it home. The therapist may have to enter into the spirit of the particular situation recalled or created. Thus he may have to shout or whisper, or swear or imitate certain noises as the case may be, and it may well be an exhausting business. With ether the recital of events is often more dramatic than with barbiturates, and the patient is more likely to behave as though those same events were happening now. He is of set purpose encouraged to cry, shout and struggle, as the greater the degree of excitement the better may be the eventual therapeutic result. The onset of excitement from the commencement of treatment varies from about a minute to ten minutes or more. It may be necessary to probe, encourage and coerce, and a case that is seemingly too inhibited to abreact may suddenly do so. The excitement varies in intensity and duration; some patients keep up a level of excitement for a time, others may quickly stop and appear to become inhibited, but soon resume again, and yet others show a rising pitch of excitement and suddenly fall back at its climax into an inert state. For a few minutes they remain flaccid and quiet, as though felled into unconsciousness. A mixture of fear and released aggression, constantly stimulated by the therapist, produces the most satisfactory terminal emotional collapse.

It is generally easy to produce an emotional release in an individual suffering from a recent acute traumatic neurosis (Kardiner places this group as occurring roughly within a week or two of the precipitating incident), but in a long-standing illness, particularly one in which reactive depression has become a prominent symptom, the patient may have the utmost difficulty in relaxing and reliving the traumatic situations. He tends to answer in the past tense and in an impersonal manner, and some of the emotion displayed does not ring true, i.e. it is done to satisfy the therapist. It is often in these cases that some therapists will succeed in producing a useful abreaction with ether, whereas others will fail. In such cases ether shows its superiority over barbiturates.

After the abreaction and removal of the mask the patient may weep or burst into laughter or alternate between laughter and tears. He is encouraged to talk, and so may perhaps continue the uncovering of an amnesia or relate

further incidents of importance. He frequently volunteers the statement that his mind feels relieved and easier. " Something has lifted " or " My head feels clearer " or " I have lost my tension " are expressions often heard. It is our practice, if very emotional incidents have been revealed and the patient continues to be somewhat excited, to follow the abreaction with sedative or sleep treatment for a day or more, depending on the patient's stability.

Experimental Observations Relating to Excitatory Abreactions.

Our experiences early on in the war, with Dunkirk casualties and those from the London blitz and Battle of Britain in 1940, showed that immediate first-aid sedation, or the injection intravenously of a barbiturate drug, would at once break up many acute hysterical reactions to traumatic experiences and prevent a fixation of abnormal patterns of behaviour. Excitatory abreaction was sometimes necessary, and in recent cases this was fairly easy to produce with barbiturates (17). Anxiety was just below the surface and traumatic memories were fresh. When we experimented with ether in the acute Normandy cases and patients from the V-bomb attacks on London, we investigated more fully acute hysterical reactions that failed to respond to ordinary abreaction or suggestion under barbiturates ; we found some could be more easily helped by the far greater degree of excitation released by ether. Case 1 is a good example of this, but a satisfactory result might also have been obtained had a more deliberate excitatory technique been adopted under barbiturates.

Case 1.—I. U—, male, aged 26, was admitted to hospital in 1945 complaining that he was unable to stop shaking. There was nothing relevant in his family history. He had chorea at the age of 11, and described himself as one who " always worried inwardly," nervous, afraid of the dark and prone to headaches. In the Army he drove Diesel engines loaded with ammunition and was continually frightened by the possibility of an explosion. His home was badly damaged in the Battle of Britain in 1940.

Patient stated that two days before admission he was in his bedroom when a rocket exploded approximately a mile away. He " felt something hit him," heard his wife calling him downstairs, and when he got down he collapsed and was unable to stop shaking. On examination he appeared extremely anxious. There was a very gross tremor of the arms and legs ; the arms moved through a wide angle, and he was unable to walk without support because of the tremor of his legs. His face was anxious and drawn with an expression of distress and his forehead was wrinkled.

Suggestion under intravenous sodium amytal slowed down the jerkings and tremors, but this recurred as soon as the effect of the amytal wore off. A violent abreaction over the bomb incident was then carried out under ether, and a rapid improvement ensued. After a few days' continuous narcosis he was discharged substantially recovered.

It was in patients with good previous personalities showing the more chronic hysterical reactions that ether was found more useful than barbiturates. Such patients were treated at a stage when excitement had given place to lethargy and neurotic patterns had started to become stabilized. There was a tendency for such patients to give a rather dull recital of events under amytal, as it was more difficult for them to relive exciting episodes which had become clouded by subsequent events and symptoms. With the use of ether we began to

obtain more dramatic abreactions more easily. Case 2 is quoted to illustrate some most important findings in this group. In this case the abolition of an associated amnesia did not relieve the patient's symptoms, nor did a moderate degree of excitement released by ether. It was when excitement under ether was stimulated to a climax and the phase of temporary transmarginal inhibition brought about that symptomatic recovery was produced.

CASE 2.—E. C. C—, male, aged 47, was seen in a psychiatric out-patient department in December, 1944, when he complained that he had lost the use of his right hand since the previous June after a flying bomb incident.

There was nothing relevant in his family or early personal history. He had served in the 1914–18 war without breaking down, although gassed. In 1925 he attended hospital for a month because he had lost his sense of taste, and he has not recovered from this. Although a government clerk for many years, he was transferred from the permanent to the temporary staff in 1930 because of depression and inability to concentrate. His wife died a week before the bombing incident, but he had been separated from her for two years before this and his twin children were brought up by his mother-in-law. Patient was living alone. During the blitz in 1940–41 he showed no signs of nervous trouble, despite the fact that he had witnessed many distressing sights when working in a first-aid party attached to a local borough council.

He stated that he was quite fit before the flying bomb incident. His right hand was hit by some debris whilst he was helping to rescue some buried air-raid wardens, and he remembered no more till he found himself in his depot some ten minutes later. The total injury was a bruised right thumb and a sprain of the second metacarpo-phalangeal joint. A few days later his hand began to shake, and as there was no improvement it was put into plaster, and he attended hospital daily for 5 months for treatment with massage, hot and cold baths, and rug-making in the occupational therapy department. He continued to complain that he was unable to grip with his hand, which was cold and shaky, black and blue in cold weather. He was receiving a 25 per cent. disability pension.

Treatment under intravenous sodium amytal was twice carried out in out-patients and the short amnesia was clarified, but the shaking hand only stopped momentarily. On admission to hospital in February, 1945, the right hand showed a gross tremor, was cold, congested and bluish-red in colour. He could adduct and oppose fingers and thumb, but was unable to grip, and any voluntary movement caused an extreme increase in the tremor. He had a dilapidated run-down appearance, was mildly depressed and querulous, and complained also of a blurring of vision.

There was a moderate emotional display in the first abreaction under ether when he described some bombing experiences. As there was little improvement he was again abreacted under ether. This time he became violently excited, and the abreaction terminated in a phase of transmarginal inhibition. The hand stopped shaking and assumed a normal colour and temperature. The grip returned, and after some rehabilitation he was discharged.

We found that it was the chronic hysterical "stereotypies" of behaviour or thought that did best when excitement was stimulated to the point of transmarginal inhibition. Case 2 was motor stereotypy of six months' duration, while Case 3 is quoted to show that the same effect can be obtained in a stereotypy of thought of similar duration associated with features of depression and hysteria.

CASE 3.—F. P—, female, aged 55, stated on admission: "I keep on going so funny and seeing different incidents with rockets that I have been through."

Family and personal history were normal, but she "has always been on the nervous side." There was no history of any previous breakdown. Her personality was described as very active and rather obsessional, with a tendency to

depression. She had been married 31 years, and her husband was a docker who drank heavily and was on strike at the time of her admission to hospital. They had no children. She had a hysterectomy in 1932. In 1939 she became a full-time air-raid warden, served in Dockland for 6 years and kept well despite numerous incidents. The symptoms began after her job as a warden became unnecessary with the ending of the war.

In March, 1945, she was involved in a rocket explosion, when her helmet was blown off and she felt something hit the back of her head. A lump came up, but she took no notice and helped in the rescue work. " I saw terrible sights ; plenty of people cut to pieces under the debris " (there were 50 casualties). A few months later she began to picture the incident, saw people cut and bleeding all over again, and could not get it out of her mind. If she closed her eyes she pictured the terrible sights, and had bad dreams. The symptoms were of 6 months' duration when she was admitted to hospital. At interview she was depressed and anxious, unable to concentrate, had lost considerable weight and complained of fainting attacks and giddiness. She had feelings of unreality, felt that people were talking about her, slept badly, and had almost completely lost the use of her legs. A neighbour stated that whereas she had been a very energetic and bright person, she was now forgetful and " flat."

Under light etherization patient relived the rocket incident with great emotional intensity and described how she was buried under the debris with her husband and brother. Her brother rescued her (he was decorated for his work), and then, during the abreaction, she frantically called and shouted for her husband : " Charlie ! Where are you, Charlie ? " she repeatedly shouted at the top of her voice, at the same time clawing with her fingers as though searching in the debris. The climax of the abreaction occurred when describing his rescue and she suddenly fell back and lay inert. This was a most dramatic result for, when the patient came round she had complete use of her limbs, said her mind was clear and that she had lost her fears. She remained active, well and cheerful, and regained her weight with the aid of modified insulin.

Another interesting finding was that it was not always essential, when doing an abreaction, to recall the precise incident or trauma that may have precipitated the breakdown. An artificial creation of stimuli of a more general kind may be sufficient. Thus one can use phantasy to create excitement, invent false situations or distortions of actual events when the uncovering of a true amnesia or the reliving of an actual experience has not brought about sufficient emotional release to disrupt a deeply ingrained neurotic pattern. Case 4 is quoted to illustrate this point. In this case it will be seen that when the reliving of the actual experience was insufficient, we deliberately distorted the actual experience under ether to produce the required degree of excitement in the subsequent abreaction.

CASE 4.—A. H. H—, male, aged 29, complained, on admission to hospital in July, 1946, of insomnia, headaches, depression, attack of unconsciousness, loss of 1½ stones in weight and battle dreams, with nightmares about becoming blind.

He showed some neurotic traits in childhood. After a normal schooling he ran away to join the Navy in 1933 at the age of 17, but was invalided from the submarine service in 1938 following chlorine gas poisoning from leaking batteries. He was granted a gratuity. His domestic situation was complicated ; he divorced his wife in 1943, after five years of married life, because she had an illegitimate child (there is one child of his own), and he was unable to break away from his parents as he was an only son and his father was well-to-do. Although his general health was good he complained of abdominal pain and attacks of vomiting on and off since a cholecystectomy in 1942. He described himself as a good mixer, normally happy-go-lucky, fond of sports and reading, but very dependent on his parents and devoted to his mother.

Patient volunteered in September, 1939, rejoined the Navy and kept symptom-free until 1942, when he went down with the aircraft-carrier Hermes, but was rescued after some minutes' immersion. A few weeks later he had an attack of amoebic dysentery and was treated in hospital in Colombo for five months. During convalescence he developed acute abdominal pain, headaches and vomiting; the symptoms were relieved when his gall-bladder (said to have been perforated) was removed. As he had a recurrence a few weeks later of diarrhoea with blood and mucus he was invalided back to England in 1943. He soon volunteered for Naval Commandoes and took part in the landings in Sicily and Italy; his worst experiences were at Anzio. He remained free from illness during his 14 months in Italy, but in a rough sea *en route* to England vomiting began again and was followed by diarrhoea. Despite this he took part in the Normandy landings on D Day, but fell ill a week later with diarrhoea and was sent back. Frequent attacks ensued, and he was invalided from the Navy in December, 1945, with the diagnosis of "amoebic dysentery." He began work as a technical representative in his father's engineering firm, but three weeks later lost consciousness in the street, since when he had complained of frontal headaches. He again collapsed in April, 1946, and is said to have shown an icteric tinge of the conjunctivae. All physical investigations proved negative, and he was transferred to the psychiatric unit. At interview he was tense, sweating, restless and fidgety, and reproached himself for letting down his family and employers. He stated there were no gaps in his memory.

Patient was treated for several weeks by psychotherapy and modified insulin, and his weight increased by 10 lb. He expressed a desire to take up forestry work instead of returning to his father's employ, but as he continued to be tense and agitated with recurrent dreams of a flash and blindness, it was decided to carry out an ether abreaction. He said he was most affected by incidents in Italy, and by the fact that his ship went down off Walcheren and his mates were drowned whilst he was in hospital in Scotland, some months before the end of the war. At the abreaction, an incident, the bombing of Cape Passerole (1943), was chosen. He described how he was coxswain of a ship with an inexperienced crew and that he was the only one able to steer the vessel. At the time of the incident she was at dropped anchor. They were waiting for orders to go into action and patient was sun-bathing whilst he could hear bombers attacking the land. Suddenly a look-out man spotted an enemy plane, and when the order "action stations" was given he ran towards the bridge, but the ship was bombed. A bomb hit the bows, the captain and gunnery officer were killed and patient's leg was trapped under the collapsed chart table. He violently abreacted this episode, calling loudly for the sick-bay attendant during the abreaction, "Get me out. I can't use my leg." In the abreaction he kicked wildly with his right leg, but the left leg was immobile. In the actual incident he was released and able to steer the ship to safety. When the abreaction was over he continued details of the incident, for which he had previously a complete amnesia. He had no knowledge that his leg had been trapped and could now see the reason for complaints of a weak leg which he had frequently made after the incident. This trauma was not the precipitating incident of his neurosis.

A second abreaction was then carried out with the patient restrained in a jacket and during which he was even more violent. It ended in a "collapse" when he was told he was trapped and could not get away, so that he and his ship were doomed (in the actual incident he got away easily). Thus in the first abreaction an amnesia was uncovered with release of emotion and reproduction of details, but although he remembered all, he was no better. In the second abreaction an artificial situation was created, namely, that he was trapped and could not get away, with an artificial stimulation of anxiety terminating in a phase of total inhibition. On coming round he said, "The War has lifted. Something has lifted from my mind." Some days later he said he kept thinking about the events he had forgotten and other incidents, but he could now do so without worrying. He was soon fit for discharge.

Case 5 is quoted as a second example of this important finding. Here it was not till the patient was induced to abreact over being in a burning tank (in actual fact he was only near one) that a successful transmarginal inhibition was finally brought about with improvement.

CASE 5.—L. T—, male, aged 22, complained, on admission in May, 1946, of terrible depression, inability to concentrate, loss of confidence, and that all he could do was to sit around.

His father was an alcoholic and a man of violent tempers; his mother is a nervous worrying type. Patient was a rather nervous, timid, unsettled youth and apt to be bullied, but described himself as generally cheerful, fond of company, music and sport, sensitive, easily upset and prone to worry. He found it difficult to settle down at work, and did numerous jobs before his conscription in July, 1942.

He was quite well until his Normandy experiences. He landed on D plus 3, went into action the next day as a tank gunner and was not unduly nervous until he saw an Allied tank knocked out. From that time he was constantly waiting for a shell to come through and hit him, as he saw one tank after another destroyed and knew it would be his turn sooner or later. Even when he was withdrawn from action he would dive for cover if a shell landed as far as a hundred yards away. He ate little and hardly slept, but did not complain of his nerves. One particular incident worried him; when S.E. of Caen he jumped into his tank, as the shells were falling nearby, locked himself in and refused to come out. He was there for two hours waiting to be hit, was very scared, and did not want to see what was going on around him. When he did come out his mates just laughed it off. He did not think he could last much longer. The next day practically the whole of his regiment was lost in action. His tank was six miles inside the enemy's lines, but he did manage to get back. Soon after the tank was hit and set on fire, but he was outside it at the time. He found his way back to the allied lines and thought he was safe, but he was dive-bombed and wounded as he stood between some gliders. He hid under a disabled tank, and remembered the sound of the dive-bomber and the scream of the bomb. Something hit him in the face and arm, and he ran round in circles making a noise in an effort to get a bandage. He could not speak because his teeth were chattering; he was driven back to the R.A.P. and evacuated home. After four months' treatment in hospital for his wounds and a month's convalescence he returned to training duties, but found he could not swing across a river on a rope during a battle exercise. Then he realized he was not the same man, as such an exercise would not have given him any qualms prior to his Normandy experiences. A psychatrist sent him to a military neurosis centre, where he was re-graded C2 after several months' treatment, and he was transferred to general duties, but the symptoms persisted, and he had to rely on alcohol to help him carry on. On examination he was very tense, tearful, tremulous, agitated, restless, and preoccupied with memories of and dreams about Normandy, particularly the dive-bombing incident.

Under ether there was an extreme emotional display; short lived amnesias were revealed without relief. Finally he went into a state of transmarginal inhibition when he was deliberately induced to abreact his being trapped in a burning tank. There was an obvious relief of tension after this, and he said he felt free and relaxed. This improvement was maintained although he showed a slight jumpiness, so he was treated with modified insulin, regained his former weight, and left hospital well.

We also found, following this clue, that not only may distortion of real incidents be as effective as the abreaction of the incidents themselves in bringing about relief, but that successful abreaction can be carried out around non-specific incidents whose only use is that they can release a sufficient degree of excitement. Thus Case 6 shows that a patient may be relieved by using as an exciting stimulus an incident unconnected with the onset of the illness, and only occurring incidentally in its course. This is a case of depersonalization, the symptoms of which were finally resolved by an ether excitation when other treatments had failed, and the incident used to arouse the necessary excitement was the patient's experience of a mental hospital during the course of the illness.

CASE 6.—T. W—, male, aged 26, stated on admission to hospital in July, 1946, that he had remained in a daze since undergoing an operation for circumcision in India in the previous January.

He had been a rather nervous child, with fears of his father, who drank heavily and was quarrelsome at those times. He did quite well at school and, after four years as a shop assistant, joined the Army in 1940. His Army record was good and he was soon promoted to corporal (tradesman). Up to some months before the onset of his illness he was a cheerful, sociable person, with obsessional traits, but he became very worried when his fiancée wrote terminating their engagement. He was beginning to settle down and forget this before the operation.

A spinal anaesthetic was administered. Soon after, his head "went funny" and this feeling persisted. He said on admission, "Up to this very day I have not come out of that dazed condition. It seemed to dull my senses. I have not felt myself since. I am more or less in a different world. Everything seems unreal and I feel unreal. Things do not seem to be so distinct outside. I have no conception of time; it is not so precise as it was. Everything is automatic although I do my work. I can't grasp things." He also complained of headaches, pains at the back of his neck, loss of interest, inability to concentrate, and a feeling like a film over his right ear. When interviewed he was restless and tense, complained of palpitations, insomnia and fears of insanity. Prior to admission he had been sent to a mental hospital in error, but was discharged after a few days. Nevertheless this had increased his worry and unhappiness.

Patient had already been treated in India with E.C.T. and psychotherapy without success. A course of treatment with benzedrine, sedation and modified insulin was also ineffective. He was then abreacted under ether, but there was little emotional release until he was induced to relive his mental hospital experience, with emphasis on his fear that he would never get out again. This produced an emotional storm, and after the abreaction he said the tension had lifted. "I feel carefree." A few days later he became anxious again and lacked confidence. A second abreaction revolving entirely around the mental hospital incident produced further relief and he lost his symptoms of unreality.

Repeated abreactions under ether may be necessary in some cases. As many as four or five abreactions have often been given about the same remembered incidents before sufficient excitation has been achieved and for the patient to feel better. Repeated abreactions are often needed in reactively depressed patients, or those showing a general state of inhibition following an accumulation of stresses or blast. These patients may only require a simple re-excitation to break through inhibition, and do not always need the culminating transmarginal inhibition that proves helpful in the motor or sensory stereotypies as reported in Cases 1 and 2. Case 7 is quoted as a good example of those requiring two abreactions.

CASE 7.—J. H—, male, aged 26, complained of headaches, inability to tolerate bangs, trains, etc., and pains in the lower back, which at times spread all over the body.

There was nothing relevant in his family history. He was "the ruffian of the family," and was nearly drowned when five years old. After two appearances in a juvenile court he settled down in adolescence and volunteered at the commencement of war. Before the onset of his illness he was a very happy person, fond of company and a good swimmer, and although he had a bad temper, it was under control.

Symptoms began in 1942, when a bad parachute jump resulted in a fall on his back and a dislocated shoulder. After some time he returned to the Parachute Regiment feeling fit, and went to Sicily in August, 1942. His plane was hit and he hurt his back as he baled out through the door, and he made a bad landing. Since then his "nerves began to go." In the Italian campaign he was dropped behind the German lines at Mount Etna, and found himself, with a broken knee and only able to crawl, alone between opposing barrages that went on for five days. He eventually reached the Eighth Army, and was sent in a highly nervous state to a Naval hospital.

After a period of remustering in Africa and further action in Italy, he returned to England in December, 1943. He had treatment for his back and was then

prepared for Arnhem, which he dreaded, but managed to conceal his fears. At the landing he fell across his wireless set and again hurt his back, but proceeded to Arnhem and experienced all the horrors of the fighting. He was the only survivor of his group of 17 and " then went mad." A house he was in was blown up and he had to run from house to house to escape German tanks and shells. He was accompanied by two other soldiers, but one was killed and the other wounded; he carried the latter on his back. When he could no longer endure the conditions he remembers standing up, rushing across the road in front of a German column waving his hands and shouting, " Kill me, you bastards ! " Despite this he managed, under constant sniping, to dash across the Rhine, but was eventually captured. He was then subjected to ill-treatment for propaganda purposes and was compelled to crawl and be photographed. An S.S. officer blacked both his eyes, and the prisoners were marched many miles and jeered at *en route*. They then had six days without water in a cattle truck and reached " a louse-ridden camp." Here they lived on turnip-tops for 14 days; he developed dysentery and was sent to another Stalag, where he had his first bath. Later he joined a working party in Berlin, but was sick with abscesses most of the time. He was working in coal mines when liberated by the Americans in April, 1945.

Patient was on a compassionate posting when admitted to hospital in March, 1946. He was tense, anxious, restless, irritable, sweating, and a stone under weight. He was suspicious, felt people were talking about him and was constantly ruminating over his experiences.

The first ether abreaction was only moderately successful, as he was unable to let himself go. He wanted to swear, but was subdued and inhibited and could not really place himself back to some of his terrible experiences. There was, however, some benefit, and he said, " I am on top of the world to-day," but he continued to complain of headaches and pains in his back. A week later he said, " I feel that if I could have a damn good scream I would be all right," and he remained tense and anxious. He put on 4 lb. in weight. In the second abreaction, incidents were clarified and there was far greater excitement with a better therapeutic result. After it he said, " I feel lighter in mind; something has lifted." The next day he affirmed that something had definitely lifted from his mind and he felt better. A week later the improvement was maintained. " I feel a hundred per cent. better." He was soon fit for discharge.

In many patients excitement is stirred up by making use of suppressed aggression and fear. For instance, in Case 8 intravenous amytal showed that much aggression could be mobilized to create excitement. Going over the same ground with ether released this and produced the desired result.

Case 8.—S. W. E—, male, aged 26, complained, on admission to hospital in December, 1945, that he had become increasingly depressed for a year, was slow, unsociable, very concerned about his eyes and had headaches and suicidal thoughts.

His mother is highly strung, and a sister had been treated for depression in hospital. A maternal aunt is " hypochondriacal " and is in a mental hospital. In his early years he had no friends, as he was " kept behind bars " by his parents; he was told that others in the house might upset his mother. After matriculating he studied business methods for two years, and had begun a business of his own before joining the R.A.F. in 1942.

He became a corporal-instructor in radio-mechanics and enjoyed 17 months in Iceland. When home on leave his house was bombed and he was buried under the debris. About that time he had been working long hours, as he felt " over-conscientious " during the flying bomb period, and he became very depressed. He was sent to Germany, where he finally broke down.

A course of sedation helped him to sleep better, but he remained depressed and retarded. Intravenous sodium amytal was then administered, and he talked with much affect over the unjust treatment meted out to the men by officers in Germany. He was on a welfare committee and tried to stand up for the men, but could do nothing. He accused the officers of " all sorts of things," was obviously much upset and displayed aggression and hatred. He failed to release much excitement.

As there was no change after this treatment, he was abreacted with ether on

the same topic. He was encouraged to shout, struggled violently when describing the attitude of the officers and released a good deal more aggression. There was intense relief after the abreaction and this was reinforced by psychotherapy. Three weeks later he complained only of a mild headache and occasional depression and returned to his unit.

There is no doubt that for uncovering an amnesia the use of an intravenous barbiturate, such as sodium amytal or sodium pentothal, is an excellent procedure. The same result may be attained by light etherization, but the barbiturate method is generally preferable as the excitement under ether often interferes with a full recital of events, and there is a tendency for an emotional climax to occur before the whole of the amnesia has been laid bare. Although it is frequently found that the patient, after an ether abreaction, goes on talking and completes the details of an amnesia, a prolonged amnesia is better dealt with under barbiturate administration. Nevertheless, one of the drawbacks of the barbiturate method is that if the patient is allowed to fall asleep after his treatment he may deny any knowledge of what has been uncovered whilst under the influence of the drug, i.e. the memories have not become integrated into consciousness. This disadvantage does not occur with etherization, as the patient does not usually fall asleep after the abreaction and is therefore able to retain and keep the memories in consciousness. Occasionally, however, we have failed to break through an amnesia under barbiturates, but succeeded with ether. In Case 9, after numerous attempts with intravenous barbiturates had failed, ether proved successful. Presumably in this case the inhibition and resistance could only be disrupted by the intense excitation produced under ether.

CASE 9.—M. C—, male, aged 24, was first admitted to hospital in May, 1944, when he complained of slight headaches, dizzy attacks, forgetfulness, and a "browned off " feeling. His early history was uneventful, and he served for three years in the Irish Army before joining the British Army in 1942. There was a history of previous nervous breakdowns. Symptoms first began during the Italian campaign when he went to Tunis on leave and remembered nothing more till finding himself in hospital three weeks later. His papers stated that he had an acute hysterical breakdown following a period of severe stress in action. From this time he was constantly in trouble because he forgot things and could not tolerate anybody shouting at him. He was evacuated home, but as he pleaded to be retained in the Army his discharge was postponed and he was graded Category C, but failed to adjust. On admission to hospital he appeared anxious and depressed, but denied this and said he only objected to being shouted at or punished. He made little progress on routine treatment, and was invalided out of the Army in May, 1944.

Patient was readmitted in August, 1945, complaining of headaches, a fed-up feeling, and worry over his inability to recall events following the onset of his amnesia in Tunis. Several unsuccessful attempts had already been made to uncover the amnesia, including the use of intravenous barbiturates. He stated that he was involved in heavy fighting in which there was a large loss of life. Three of his mates on the machine gun he operated were killed on separate occasions. Soon after this he was given leave and went to Tunis. The last thing he could remember was coming out of a church and passing, on the church steps, a soldier offering shoe-laces for sale. Patient showed considerable distress when discussing this at interview, and burst into tears. He also said that after leaving hospital in 1944 he felt fed up for weeks at a time, was irritable and bad tempered as never before, and derived much relief from alcohol.

Intravenous sodium amytal was again tried on a few occasions in hospital, but failed to reveal details of the amnesia, although he displayed much aggression and some weeping when describing the fighting. A course of benzedrine and epanutin

failed to benefit him, and he became aggressive and unco-operative, refused to go to occupation classes and sat about reading. He expressed a constant anxiety about the recovery of his loss of memory, and appeared tearful, although he denied it, when remarks were made about his behaviour. An ether abreaction was then attempted, but he threw off the mask as he reached the events immediately leading up to the amnesia, and struggled so violently that the treatment had to be suspended because of insufficient staff to hold him down. A further attempt was made by administering intravenous sodium amytal followed by ether, but after a considerable abreaction over an incident unconnected with the amnesia, he again struggled too violently when the subject of the amnesia was approached. There was a subjective improvement, so it was decided to try another ether abreaction—this time with sufficient staff present to ensure any necessary restraint. There was a tremendous abreaction and the details of the amnesia were revealed. Briefly, he was accosted by an Italian who uttered some offensive remarks and patient "saw red," knocked the man down and trampled all over him until he lay motionless. Patient was stricken with the idea that he had killed the Italian, and in a panicky state he wandered about for a time, finally returning to his unit. His brother, who was also his commanding officer, covered his absence. Patient tried without success to obtain news concerning the man he had assaulted. When the ether abreaction was concluded he continued to fill in the details. It was considered that, in view of the nature of the material uncovered and which had been so strongly repressed he might not be able to cope with the knowledge, and he was therefore treated with a course of continuous narcosis for ten days. He was very restless and unco-operative, with aggressive outbursts, but the symptoms gradually abated and he was much improved when discharged from hospital.

Endogenous depressives can rarely be made to release emotion even under ether. Despite all attempts to stimulate excitement a dull recital of events is often the only result. But this is the sort of case which responds to the much greater degree of non-specific excitation obtained by electric shock therapy. Depressives responding to E.C.T. are generally stable personalities in a state of profound widespread inhibition. The disruptive stimulus of E.C.T. may prove too much for the less stable nervous system showing hysterical and reactive depressive features. The latter type of case can be re-excited with ether, whereas the endogenous depressive fails to respond. Ether in turn, as we shall show later, can be too disruptive for the chronic constitutional hysterical personality. Thus various types and degrees of excitation may be needed for the different types of nervous system. One is tempted to search for an explanation of the differences in action of E.C.T. and ether abreaction. Some differences, no doubt, are independent of the strength of stimulus, and one can but speculate, for instance, on whether the action of ether abreaction is more cortical, whereas E.C.T. acts more powerfully on the whole brain and particularly the autonomic nervous system. The latter suggestion is the belief of Gellhorn (31) based on his experimental work on rats. Whatever the explanation, it is significant that abreaction, E.C.T. and insulin, are treatments which, at different levels of nervous activity, produce their best results by an initial excitation carried to the point of temporary cortical inhibition. A subshock E.C.T. may be as ineffective as an incomplete insulin coma or an ether abreaction which does not reach the stage of collapse.* These comparisons need further investigation and study before any conclusions can be drawn, but two cases are worth quoting. In Case 10 E.C.T. succeeded where abreaction failed in

* In our experience the best results from E.C.T. treatment generally occur in those showing the profoundest relaxation after the fits. Likewise, E.C.T. given under insulin sopor may sometimes produce better results than E.C.T. alone, perhaps due to the greater final relaxation obtained in this manner.

an endogenous depressive, whereas Case 11 illustrates a successful result with abreaction in a patient suffering from reactive depression after E.C.T. had produced no change.

CASE 10.—W. D—, male, aged 48, a police inspector, was first seen in out-patients in January, 1946, when he complained of depression.

There was nothing relevant in his family or personal history, and he had a good record. His previous personality was that of a rather rigid obsessional with a hasty temper at times, but fond of company and fairly happy.

His symptoms began in 1940 after he was buried in his home when it received a direct hit from a bomb. He was trapped for some hours with his head " doubled under him " and he felt himself slowly choking. In addition he sustained injuries to his right shoulder and ribs and concussion; despite three months in hospital he felt " a bag of nerves," was sleepless, tense, giddy, tremulous and tearful. A course of analytical treatment failed and he returned to work in a tense state and lacking confidence. His work entailed supervising bomb incidents. " I felt like crawling under the ground. Knowing other people were trapped in these incidents had a hellish effect. I lived it all over again." Although he carried on he became increasingly depressed. On examination he was depressed, anxious, tired, and found it an effort to concentrate or maintain interest. He felt people were looking at him and that he was misunderstood, and became impatient and resentful. There was a recent marked increase in weight, and it was thought that the depression was either complicated by myxoedema or of a menopausal type.

An ether abreaction produced little emotion and there was a rather dull recital. He did, however, become flushed and a little excited when describing the bomb incident. There was some improvement, and ether was tried a second time, but produced no real break through his depressed state. It was therefore decided to try the effect of E.C.T., as testosterone, thyroid and benzedrine had also failed to effect an improvement. He was able to return to work in a fit condition after four E.C.Ts.

CASE 11.—H. L—, male, aged 44, gave a history, when first seen in out-patients in August, 1945, of a feeling that there was something over his face all the time, and that he was unable to feel over it.

There was nothing of note in his family or personal history. He was a professional boxer of some standing and had never been knocked out. His previous personality was that of an obsessional though cheerful individual.

The duration of symptoms was six years without fluctuation, and he became increasingly worried and depressed. The onset was sudden, whilst he was working in a conservatory. " I will never forget it. I was planning a fire curb when I suddenly felt as though something hit me in front of the head. After that everything seemed different. I am there and yet I am not there. I feel there is no world around me. There is a strip in front of the face and all feels black before me. It feels like a lump in the forehead, and I have an empty feeling in the pit of the stomach as though the breathing centre is not there." Before the onset of symptoms he was unable to rid himself of an attack of pediculi pubis. This worried him greatly, as he was scrupulously particular about personal cleanliness. The condition was eventually cured by his doctor and the depersonalization followed. On admission to hospital he was depressed, anxious, unable to concentrate, had bad dreams, and was preoccupied with ideas of suicide. Five E.C.Ts. produced little change. He was then abreacted under ether. There was an extreme emotional outburst over the " crabs " incident, but the symptoms remained unaltered. He was immediately abreacted again, this time to the stage of transmarginal inhibition. On coming round he stated " There was something round my head which has now gone. My head is relieved. I have lost the feelings of unreality. I feel different altogether." This was maintained, and he was discharged from hospital free of symptoms.

We have learned as much about the mechanics of abreaction from our many failures as from our successes. For instance, we have tried the effect of ether abreaction in a small number of cases of chronic obsessional neurosis. We

wished to find out if we could produce in such cases a state of excitation followed by transmarginal inhibition and whether it might be possible to disrupt the pattern of rumination around a particular idea or fear. We did not succeed. It is difficult to excite or abreact such patients, as they are too precise, rigid and meticulous to picture with emotion an incident not happening at that particular moment. They tend to answer "Yes, doctor," or "No, doctor," when attempts are made to induce them to re-enact certain events. If, however, they do become excited they may be made temporarily worse by the abreaction. This result is not surprising in the light of Pavlov's concepts. In such case there is often already an abnormal predominance of the excitatory process, an abnormal "inertness" or "pathological inertness" in points or areas of the cortex. We have found that when there is a useful response to abreaction there are generally hysterical or reactive depressive components to the total picture, or an accompanying state of depersonalization—all these suggest the presence of inhibitory phenomena which excitation under ether may loosen. In Case 6 we have already described a case of depersonalization with obsessional rumination relieved by abreaction, and in Case 12 an obsessional phobia occurring in a setting of depression was disrupted by one E.C.T. followed by a particularly severe ether abreaction which produced a transient state of dissociation yet lead to recovery.

CASE 12.—T. H. A. M—, male, aged 32, said, on admission in December, 1945, "I am convinced I have syphilis. I was depressed, but accept it now."

Patient's mother was nervous, and one of his sisters was in a mental hospital. He had been a sensitive, timid youth, did well at school, gained a University Scholarship and had a First Class Honours degree in Engineering. He had no sexual experience, and though engaged at one time, he terminated it because of his ideas. His previous personality was described as anxious, shy, solitary, and a ruminative obsessional.

He first thought he had syphilis when, in adolescence, his penis was tender after ejaculation, and he kept this knowledge to himself. Two years later he suffered from dysuria and a retracted testicle. This increased his fears about syphilis, but he carried on "normally" until 1941, when he had a feeling of falling to one side. His memory began to fail, and in June, 1945, his libido diminished and his skin became anaesthetic in parts. His brain felt "clogged with thoughts like treacle," and he lost interest. Before June he was "keyed-up" by strong sexual feelings, but since then everything was flat. He experienced a clear discharge after an erection and this meant syphilis. Throughout the illness he carried on as a Post Office engineer and first consulted a doctor four months before admission. Several Wassermann reactions, done privately and in hospital, were negative, but this, and the fact that his C.S.F. was negative, made no difference to his symptoms. On admission he was very dull and apathetic, sat in a chair most of the day, and believed that his syphilis was either due to the fact that his father was a bailiff in a mental hospital, or that he had contracted it from the lavatory seats in Portsmouth dockyards. He blamed himself for not mentioning it when he first contracted it, and showed practically no insight. There were also some hypochondriacal symptoms, which he attributed to syphilis, such as the dead feeling of his skin, and he said he was emotionally dead, had ceased to worry and was sleeping badly.

This man was suffering from an obsessional neurosis with severe depression, and it was decided to try E.C.T. Unfortunately he sustained a vertebral crush fracture at the first treatment and refused any more. Nevertheless, he said that on the day of the treatment and the next he felt alive again, but this wore off. He was then abreacted under ether, using, as stimuli, his fears of syphilis and his bombing experiences. He abreacted for a time with considerable force, and then appeared to go into a dissociated state. This lasted a few hours and there were marked fluctuations in awareness. He insisted on staring out of the window, talked

random nonsense, and would then appear normal for a while. Although he said he was improved, it was difficult to assess the extent. There was no doubt about this later on, as he was much happier, active, mixed for the first time with patients in the ward and attended the occupational departments. The following week he was " more alive although the skin was partially dead," but he said that he hardly gave a thought to syphilis, despite his absence of libido. A fortnight later he was no longer depressed, called his old ideas " rubbish " and returned to work.

If severe chronic hysterics are treated by excitatory abreaction they rapidly become inhibited or dissociated when any strong stimulus is applied. As soon as they show an emotional release, or attempt to relieve incidents that have produced distress in the past or artificial situations of some emotional significance are created, they inhibit or dissociate. As with Pavlov's weaker dogs, they show chaotic cortical function or total inhibition again and again following slight excitation, and their past record shows little stability in response either to upbringing or environment. Never having had a stable balance, continual re-excitation only makes them more unstable. Thus severe chronic hysterics do not as a rule benefit from ether abreaction. If at all, they are helped more by gradual release of tension under barbiturate. Benefit from ether is confined to the previously stable person who has developed hysterical symptoms following severe stress.

In mixed cases, showing for example stammers, amnesias, tremors and anxiety, the combined use of barbiturates and ether has often been necessary to produce a good result, either alone being insufficient. At various stages of therapy it may be necessary to damp down or re-excite in treatment. Case 13 is also a good example of the combined method, each type of abreaction being used at different stages of treatment. Barbiturates at first were used to get rough details of the traumatic incident. Then ether was used to produce a high degree of excitement and restore the use of a limb paralysed for one year. Finally, barbiturates were again employed to complete a more exploratory type of abreaction, and round off the recovery with additional psychotherapy and reassurance.

CASE 13.—W. F—, male, aged 35, complained of " black-outs " of three years' duration and which were becoming more frequent. He also complained of depression, insomnia and nightmares, and made a mention of his paralysed left arm.

There was nothing of note in his family history. His early home life was difficult because of the frequent absence of his father, and financial difficulties. He was a good scholar and, although shy, enjoyed games and took a great interest in physical training. He became an instructor at a boys' club, and did some short-term jobs before joining the Army in 1940. He volunteered as a Commando, took part in the Dieppe and other Commando raids, and was wounded through the left shoulder in June, 1944. When admitted to our unit a year later he still had shrapnel behind the scapula and in the pectoral muscles. Physical examination showed multiple scars round the upper left arm and scapular regions where operations for the removal of shrapnel had been carried out. There was wasting of muscles, and the left hand was cold and apparently useless. Patient said he was " desperately worried about being unable to use his arm," although he also said, " I realize it is a psychological paralysis."

Under intravenous sodium amytal he became upset when describing a number of incidents as a Commando, including the shooting of a child and the loss of a friend after he had promised this man's wife that he would look after him. Patient felt much improved after this treatment, and said he was " lighter " and better than he had been for months. He used his left hand a little, but free movement was very limited, although he " felt sure it would come." There was a reluctance

to discuss his experiences, about which he showed evident guilt feelings. An ether abreaction was therefore carried out, and he reacted very strongly to the death of his friend and the shooting of the child. He explained that he had to kill this child in a Commando raid to prevent her giving the alarm. After the abreaction there was almost full range in movement of the left shoulder for the first time, and he was able to engage in a sparring match with one of the doctors. A week later, though cheerful, the movement of his arm was somewhat limited. At times he felt " very scared and tense inside " and had four " black-outs," but they did not last so long as before, and there were now no violent outbursts during the attacks. A further intravenous sodium amytal injection was carried out, to which he reacted immediately and violently, and relived several commando raid experiences. He returned to the incident of the child, and for the first time disclosed that he had strangled her with his left hand. He felt intense guilt, but knew he had to commit the act to save his men. As a father he could not forgive himself, nor could he bear to see children suffer. There was also some discussion about a very unhappy childhood and his upbringing by a strict grandmother. He had seen so much suffering by children on Tyneside that he could not tolerate thinking about it. Suggestion and reassurance under amytal relieved considerable guilt feelings, he appeared able to forgive himself and used his arm quite freely. From this time he was completely at ease and talked without excessive emotion.

Finally a note of caution is necessary. We have stressed the many failures in treatment by abreaction. A serious aspect is that in inexperienced hands ether abreaction may precipitate a temporary psychotic episode requiring the patient's removal to an observation ward. This has happened on only one occasion in our series of several hundred abreactions despite the uncovering of many severe traumatic incidents. Hence the importance of suitable selection of cases, necessitating first a careful assessment of the patient, his past history, personality and the psychopathology of his illness, together with skill in controlling disturbing symptoms by other methods of treatment.

Discussion.

Throughout the war, especially during the times that our hospital unit of neurotic soldiers was subjected to intermittent bombing, we were impressed with the fact that many barbiturate " narcoanalysis " recoveries were in part physiologically determined. The brain was being influenced by a drug in a way that made it readily give up its patterns of hysterical behaviour, especially before they had become deeply ingrained (30).

We gained this impression even more forcibly with our experiences of ether abreaction. Therefore we have searched back through other disciplines for instances of similar happenings, each given by their exponents a different metaphysical explanation. It seems to us that the phenomena we observed in their extreme form in ether abreaction are very similar to phenomena seen throughout the ages, when the brain of an individual has been subjected to emotional excitation, often leading to a phase of temporary cortical inhibition with " rupture" of pre-existing patterns of thought and behaviour. There seems to us to be a basic physiological pattern running through procedures as far apart as the rites of the Corybantes and the catharsis of Freudian psychoanalysis. Within its scope are religious conversions, orgiastic rituals, tribal dancing, the use of mescaline in primitive religious ceremonies, and other methods of producing rising emotional excitement, leading to exhaustion followed by changes in mental outlook.

In primitive medicine sufferers from mental disease were thought to be possessed by a spirit or demon, and were treated by purifications and incantations. Aristotle, in his account of Greek tragedy, is quoted as saying, "Tragedy is a representation . . . which by means of pity and fear effects the purgation of such emotions." Thomson (32), in *Aeschylus and Athens*, discussing this says Aristotle implies that before the morbid affections can be expelled, they must be first artificially stimulated. In primitive Greek magico-medical secret societies, such as those of the Corybantes, "madness" was induced and cured by a ritual of incantations and an orgiastic dance to the accompaniment of flutes and drums. The spirit was first roused into activity and then expelled. It is interesting that the exorcists were selected from those initiates who had experienced the privilege of exorcism. Aristotle, in this connection, said, "The initiates were not required to learn anything, but to experience certain emotions and to be put in a certain disposition." This certain disposition was the artificial excitation of fear, whereby the emotions were then released.

Celsus, the recorder of medical thought in Roman times, in common with the majority of Greek and Roman physicians, recommended dungeons, fetters, purgation and starvation of the mentally deranged. He claimed by these means that certain memories were refreshed, and said, "It is also beneficial to make use of sudden fright, for a change may be effected by withdrawing the mind from that state in which it has been" (Zilboorg, 33). Magic and superstition reigned throughout the Dark Ages; the mentally sick were in the hands of the priest, and treatment was based on ideas of treatment of the devil. Here again excitation was a prominent feature. Nolan Lewis (34) describes three main groups of curious mental reactions in Central Europe in the Middle Ages: "(1) Epidemics of flagellants who gathered into large processions and travelled over the country bearing crosses, banners and candles, doing public penance for their sins; they marched, prayed, sang and shouted and flogged the upper parts of their bodies until blood came. . . . (2) The 'dance mania' characterized by an urge of dance, laugh, sing and make other noises until completely exhausted. . . . (3) Devil possession; the devil was supposed to choke, push, pull and throw its victim about, causing him to become excited, violent and froth at the mouth. It was then up to someone with spiritual power to exorcise the demon. During this procedure, if successful, the devil jumped out with a sudden jerk."

Symptoms of neurosis were regarded as manifestations of the influence of Satan, and almost all mentally sick were accused of being witches or sorcerers. This continued to the eighteenth century, and the theologians alone could fight the menace. Bromberg (35), in *The Mind of Man*, gives an account of a notable exorcist, St. Norbert, who attempted to exorcise a possessed woman. Resemblance to modern excitatory abreaction is obvious. He made repeated attempts in the presence of the people but "the devil mocked him." Further attempts with the girl immersed in water and her hair cut off also failed. The Saint thereupon fasted and prayed. "On the following morning he prepared to say Mass; the girl was again brought, and the people gathered to witness the combat between the priest and the demon. Norbert ordered two men to hold

the possessed not far from the altar . . . and several passages were read over her head. The demon still mocked, and when the priest next elevated the Host, it cried out: 'See how he holds his little god between his hands!' This made the priest of the Lord tremble, and gathering up all his strength, he began to attack the demon in his prayers and to torment him. Then the demon cried out through the mouth of the girl: 'I burn! I burn!' Then the voice howled: 'I die! I die!' Then a third time: 'I want to go! I want to go! Send me away!' Two men held the possessed woman strongly. But the demon did not let himself be stopped. He escaped, abandoning the vessel he had possessed, and leaving behind him nauseating smells. The girl fell to the ground. She was taken back to her father's house, took nourishment and soon completely returned to health."

In the eighteenth century, although chains and fetters were beginning to be abolished, even Christian Johann Reil recommended "non-injurious torture." He considered it legitimate to throw patients into water, and fire cannons to bring patients to their senses, and believed it was useful to arouse anger, disgust and pain in certain cases.

The short history of a variety of conditions already mentioned suggests that the phenomenon of massive excitation, especially when carried to the point of collapse, is possibly one of the underlying mechanisms of relief. Many other examples can be quoted.

Franz Anton Mesmer's remarkable results, for instance, are generally attributed to suggestion, but, although doubtless this played a part, we suggest that the excitation produced was one of the important factors in the production of results. Mesmer used the baquet, a large wooden tub filled with bottles in and around which was "magnetized" water. Patients sat round this holding rods protruding from the baquet and they were touched by a "magnetized" wand held by Mesmer wearing a lilac silk coat. "Soon signs of restlessness appeared, the patients would twitch and tremble violently, while convulsive movements of the hands and body muscles increased in tempo, until palpitating and convulsed they achieved the 'grand crisis', ('crisis of exaltation'). Without a crisis there could be no cure" (35). Mass convulsions were produced under mesmerism. An eye witness described it thus: "Some patients remain calm, and experience nothing; others cough, spit, feel slight pain, a local or general heat, and fall into sweats; others are agitated and tormented . . . by involuntary jerking movements in all the limbs, and in the whole body, by contraction of the throat, by twitchings in the hypochondriac and epigastric regions, by dimness and rolling of the eyes, by piercing cries, tears, hiccough and immoderate laughter. . . . They are all so submissive to the magnetizer that even when they appear to be in a stupor, his voice, a glance or sign will rouse them from it. . . . When the agitation exceeds certain limits the patients are transported into a padded room; the women's corsets are unlaced, and they may then strike their heads against the padded walls without doing themselves any injury." A lengthy report by the Academy of Science vividly describes the state of excitation induced, and continues: "This last stage, which terminates the sweetest emotion, is often a convulsion. . . . To this condition there succeed languor, prostration, and

a sort of slumber of the senses, which is a repose necessary after strong agitation" (35).

Similar techniques have played a prominent part in movements concerned with religious conversion or salvation. It was, and still is at the present time, common for abreaction to occur to groups or individuals at revivalist meetings. In 1820, Charles G. Finney, an American evangelist and self-styled "Brigadier-General of Jesus Christ," had grasped the fundamental principles of excitatory abreaction, when he would exhort his audience with violent gestures to "Agonize, I tell you; why don't you agonize?" Searching through the literature we find many reports of acute excitement followed by collapse resulting in profound alterations of thought and behaviour, particularly in accounts of sudden religious conversions of various kinds. James' *Varieties of Religious Experience* (36) contains records of this. John Wesley, in the eighteenth century, insisted that effective conversion is usually accompanied by a profound emotional experience, and his diary contains a mass of factual data. Using a fear-provoking technique in preaching, he records detailed descriptions of individuals or groups showing increasing excitement and collapse leading to instantaneous and unexpected conversions (37).

Thomas Butts (38), writing in 1743 about these conversions, says: "As to persons crying out or being in fits, I shall not pretend to account exactly for that, but only make this observation: It is well known that most of them who have been so exercised were before of no religion at all, but they have since received a sense of pardon, have peace and joy in believing, and are now more holy and happy than ever they were before. And if this be so, no matter what remarks are made on their fits."

John Wesley suspected a physiological component to the phenomena that occurred with his preaching. He is quoted as saying: "They can be accounted for on principles of reason. How easy is it to suppose that a strong, lively and sudden apprehension of the hideousness of sin and wrath of God and the bitter pains of eternal death should affect the body as well as the soul, suspending the laws of vital union, and interrupting or disturbing the ordinary circulation and putting nature out of its course" (39). And he also found by experience the necessity of stabilizing the change to prevent relapse. While insisting that the initial change should generally be an instantaneous process, he then divided the converts into small groups under a leader to meet once a week. His rules for the conduct of these groups can be profitably studied to-day by those interested in the group treatment of neuroses (40). Historians now recognize that by this combined technique he was able to change the face of England at a critical era.

Arriving at the present century we find, in psychoanalysis, where there occurs a slow and prolonged mild abreaction, critical periods arise in which there is a much more powerful abreaction. This may sometimes terminate in a phase of temporary collapse and sudden progress in treatment.

Modern psychotherapy and religion bear out Pavlov's observation that once an animal or human being is "changed" by such a process, new patterns of

behaviour or new ideas may often be implanted on the altered soil. Further individual or group psychotherapy is generally necessary to achieve this. New aims may be given once the patient is released from his old neurotic adjustments. Patients must be reconditioned. They are often left in a temporarily suggestible state, particularly if the abreaction has culminated in an ultra-paradoxical phase. A transference situation is established, corresponding to that of the positive transference created by the analysts. They are thus open to new ideas, and in a position to accept what is held out to them. However, like Pavlov's dogs, weaker individuals relapse and may even become worse, but the better type of personality remains steadfast in a subsequent adjustment.

Attempts in the past to account for the beneficial effects of emotional release in psychopathological or metaphysical terms alone seem inadequate to us. McDougall (41) insists that the essential therapeutic step is the relief of a dissociation such as an amnesia, and assigns a very subordinate role to the emotional excitement. Kardiner (5) considers that in the traumatic neurosis there is a disorganization or contraction of the ego, the primary symptom being inhibitory and later symptoms adaptive attempts. In the acute cases (before the ego structure has been altered) abreaction assists in bringing about a re-integration, but, says Kardiner, "the therapeutic measures used successfully in treating these neuroses had very little to do with the conception of the psychopathology." Grinker and Spiegel (42) believe that a progressive weakening of the ego occurs in its relationship with the sources of anxiety, ending finally in a complete elimination of normal ego mechanisms. In some cases the anxiety is concentrated and the remainder of the ego is allowed to function in a stable and efficient manner. Abreaction allows a freeing of the ego. Some consider that in the course of an emotional abreaction the patient is placed in a hypnotic or "hypnoidal" state, and that the abreaction which takes place and its beneficial results are due to suggestion. Our findings suggest that simple physiological mechanisms may play a larger part than has hitherto been stressed.

Summary.

1. The literature on abreaction, and the Pavlovian physiology with a possible bearing on the mechanisms involved, are reviewed.

2. The use of ether in facilitating excitatory types of abreaction and comparisons with the barbiturates are discussed.

3. Experimental observations arising out of the use of excitatory abreaction for the relief of various types of neurotic illness are reported. Indications and contra-indications to the employment of this treatment are given. Relevant case histories are quoted.

4. The findings in modern drug abreaction are compared to other similar findings reported in the various forms of religious and psychological healing throughout the ages.

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THE EXISTENCE OF CRITICAL LEVELS FOR THE ACTIONS OF HORMONES AND ENZYMES, WITH SOME THERAPEUTIC APPLICATIONS.*

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Does convulsive therapy in the depressive states produce its effect by some action on the pituitary and hypothalamus? This is a question which we at Barnwood House and at the Burden Neurological Institute are trying to answer.

That this working hypothesis is not unreasonable is suggested by a variety of facts, to some of which I may make a brief reference. There is, for instance, the well-marked tendency for depressive states to occur at the menopause, that is, when there are qualitative changes in the gonadotropic hormones secreted by the pituitary. There is the resemblance between the retardation and apathy of the depressive states and the loss of spontaneous activity shown so markedly by the rat after hypophysectomy. There is the observation of Hemphill, Macleod and Reiss (1942) that after convulsive therapy there is an increased excretion of ketosteroids, the latter's production being probably dependent on the corticotropic hormone of the pituitary. There is the transient improvement sometimes seen after the exhibition of sodium amytal, whose main effect falls probably on the diencephalon. There is the profound affective disorder of the depressive state, suggesting disorder at a thalamic or lower level. There is Masserman's work (1939) which shows that the hypothalamic centres are highly sensitive to cardiazol, and there is the observation that subconvulsive doses of cardiazol lead to an intense affective disturbance, suggesting action at a thalamic or lower level. Finally, it is possible that the depressive states and the effect of convulsive therapy are expressions of metabolic change: no regions of the body are richer in centres of metabolic control than the pituitary and hypothalamus.

Be this as it may, the relation of pituitary function to convulsive therapy is being studied here by a variety of methods. In this paper, however, I shall be concerned with only one small aspect of these investigations.

The pituitary works, of course, by the action of its hormones. Pituitary action is hormone action. Now there is a growing conviction among biochemists that hormones, as well as vitamins and many drugs, produce their effects primarily by influencing specific enyzmes. Enzymes are being dis-

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covered in greater and greater numbers, and almost every metabolic step seems to be controlled by a specific enzyme. Thus the burning of glucose to carbon dioxide and water is now known to involve many dozens of enzymes, each playing a small but essential part in the intricate processes of this change. Further, whatever controls these enzymes controls the processes.

The possibility that these enzymes might be controlled or affected by hormones was suggested long ago, but this remained an idle speculation in the absence of actual examples. The last decade, however, has been one of rapid advances, and actual examples are now being discovered with increasing frequency. Of the vitamins, four are now known to be essential component parts of certain enzymes, so that lack of the vitamin causes lack of the corresponding enzyme. Of drugs, at least fourteen are now known to produce their characteristic effects by inhibiting a particular enzyme. The hormones have been slower in revealing their relationships to the enzymes, but a start has been made by Cori's discovery (1945) that a hormone from the anterior pituitary inhibits the enzyme hexokinase—an enzyme essential in carbohydrate metabolism. It seems probable, therefore, that the other hormones will also be found to produce their effects by acting on particular enzymes. Green (1946) summarizes the modern outlook by saying, "All dynamic activities of the cell must be reducible to terms of enzyme chemistry. Physiological function and enzyme chemistry are two sides of the same coin." *The concept of metabolic change or disorder therefore implies change or disorder in the body's systems of enzymes.*

Now it is well known that an enzyme controls a chemical process by altering only the velocity with which the process occurs. Lack of an enzyme, or a hormone, can therefore produce directly a change in velocity only, and if it is suggested that some psychiatric disorders are associated with metabolic changes, it may be objected that a simple change of velocity is quite inadequate to explain the great changes of behaviour seen in the psychoses. Is it possible that a mere decrease of some hormone or enzyme could produce in behaviour a change gross and catastrophic? Would not the lack of some enzyme lead merely to a general slowing down of the brain's activity, so that the person's behaviour would be merely slower while still remaining essentially normal in type? Is not this, in fact, what is observed to happen in the milder degrees of hypothyroidism?

The aim of this paper is to show that this line of argument is unreliable. *I shall show that if the amount of some hormone or enzyme is gradually reduced, there is no limit to the suddenness with which an effect may appear nor to the intensity of catastrophic change which may occur.* This paper is intended to demonstrate this fact and to indicate its consequences.

* * * * *

The first point to be noted is that, though controlled by enzymes, the metabolic systems are dynamic by their own activity. The amount of enzyme present acts like a tap, controlling the rate at which the atoms proceed from one molecular arrangement to another, but once the atoms are past the control their behaviour depends only on their own activity. We see a similar state

in the Bunsen burner where the tap, corresponding to the enzyme, regulates the flow of gas, but the subsequent combustion of the gas depends on its own chemical nature and owes nothing to the tap.

A system containing enzyme, substrates and products, being dynamic, is subject to the general principles of dynamic systems (Ashby, 1946, 1947). One of these principles is that, in a dynamic system of any type whatever, a change of velocity, far from being trivial, may have the most widespread effects and may lead to behaviour of very different type. A simple illustration is given by the Bunsen burner when it " strikes back." What happens is as follows: In a burning mixture of gas and air, the flame is propagated with a velocity depending on the proportions of gas and air. The edge of the flame is shown visually by the blue cone. The position of the cone depends on the opposition of two dynamic factors: on the one hand the mixture of gas and air travels up the tube with a movement which tends to blow the flame away from the top of the tube, while on the other hand the flame burns downwards into the rising mixture. Ordinarily the two are in a dynamic equilibrium, the two velocities are equal and opposite, and the position of the cone is steady. If now we alter the flow of the mixture through the tube by slowly turning the tap, altering only the velocity, we find that little happens until the velocity falls below a critical value. When the velocity falls below it the system becomes unstable and passes over catastrophically to a different way of burning.

It will be seen, therefore, that in a dynamic system a change of velocity is in no way restricted to producing only a proportional slowing of the other events in the system. On the contrary, a slowing down may render a stable system unstable, and may result in a change both sudden and catastrophic. I do not, of course, suggest that this sensitivity to velocity is shown by *all* chemical reactions. But where it does occur it is usually important. Here I am concerned only to demonstrate its existence.

Having given this example in the Bunsen burner in order to show the generality of the principles involved, I will now turn to an example in chemical dynamics. The system I shall describe shows some interesting features not, so far as I am aware, previously described. The system has been discovered primarily because the basic dynamic theory has been established (e.g. Ashby, 1946, 1947), and it is easy to find something when one knows what one is looking for. I select an example as simple as possible.

We start with two reactions progressing autocatalytically:

$$A \rightarrow B$$
$$A \rightarrow C$$

a substance A turning monomolecularly into two others, B and C. To keep the reaction going, we assume that there is a steady addition of A to the system from some outside source, as a substance might be supplied to a tissue from the blood stream passing by. To prevent B and C from accumulating excessively we suppose they are removed from the system at rates proportional to their concentrations, as would happen if they diffused away into the blood stream. (These last two assumptions are not important, and could be varied without affecting the argument). We now assume that the reaction "$A \rightarrow C$"

is catalyzed by an enzyme, and therefore is partially controlled by it. (This is really quite a simple type of system, and the assumptions involve nothing unusual. It is certainly simple when compared with, say, the oxidation of glucose with its many dozens of enzymes acting in complicated chains and cycles.)

I may now proceed to demonstrate the behaviour of this system. Its "behaviour" is defined as the variations in time of the amounts of substances A, B and C. Owing to the chemical transformations which occur, these amounts will change with time: we shall follow these changes, noting particularly how they are affected by the enzyme.

In the simplest case, the system will behave according to the equations

$$\left.\begin{aligned} \frac{dx}{dt} &= a - kxy - lxz \\ \frac{dy}{dt} &= kxy - my \\ \frac{dz}{dt} &= lxz - nz \end{aligned}\right\}$$

where x, y and z are the concentrations of A, B and C respectively; a is the rate of addition of A; k and l are the velocity constants of the two reactions; and m and n are the coefficients of proportionality of the diffusions of B and C. The equations are non-linear and therefore cannot be solved explicitly, but they are easily solved numerically by the Adams-Bashforth process; this has been done here.

The results show that this chemical system, however started, soon settles to an equilibrium, after which all three constituents remain at constant concentrations. (Although the concentrations remain steady, yet there is a continuous flow of actual substance occurring—just as the cone of a Bunsen burner is steady in position, although a flow of gas molecules through it is occurring continually. Substance A, for instance, is continuously augmented by the steady inflow, but is continuously diminished by the transformation to B and C. When the gain and the loss are equal, then the amount of A remains steady.) The first characteristic of this system, then, is that it settles down to a steady state.

We now ask how this steady state depends on the amount of enzyme present, and we shall find the effect to be striking and peculiar.

Suppose we set up a series of experiments keeping all conditions constant, but starting each experiment with a different amount of enzyme. Considering only substance C for simplicity and graphing the results in a typical case we get the curves of Fig. 1. The ordinate measures the amount of C present, while time progresses from left to right. Six different curves are given on the same diagram, each showing what happens to the concentration of C with each amount of enzyme. E gives the amount of enzyme in arbitrary units for each curve. Thus, with 2 units of enzyme present the quantity of C increases to a maximal value and then remains steady. The essential point is that whatever amount of enzyme is present, the number of possible end-

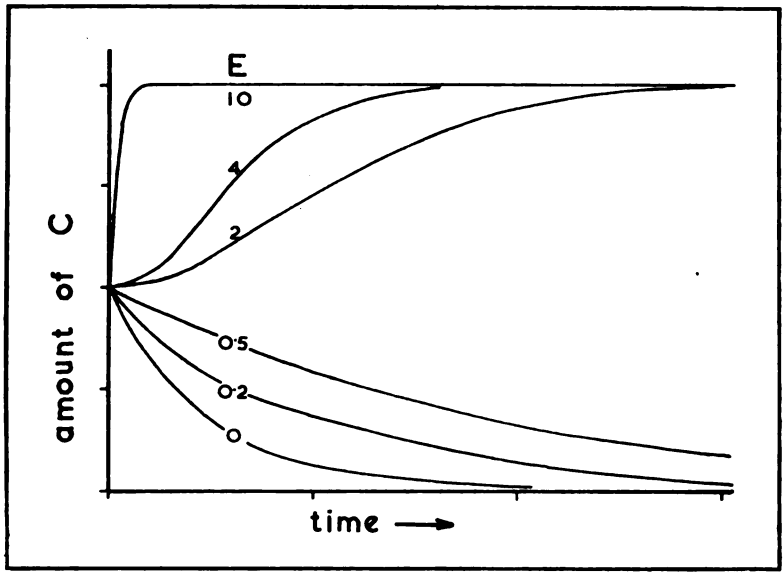

FIG. 1.—Varying amounts of E (shown in the column of numbers) results eventually in C changing to one of only two values.

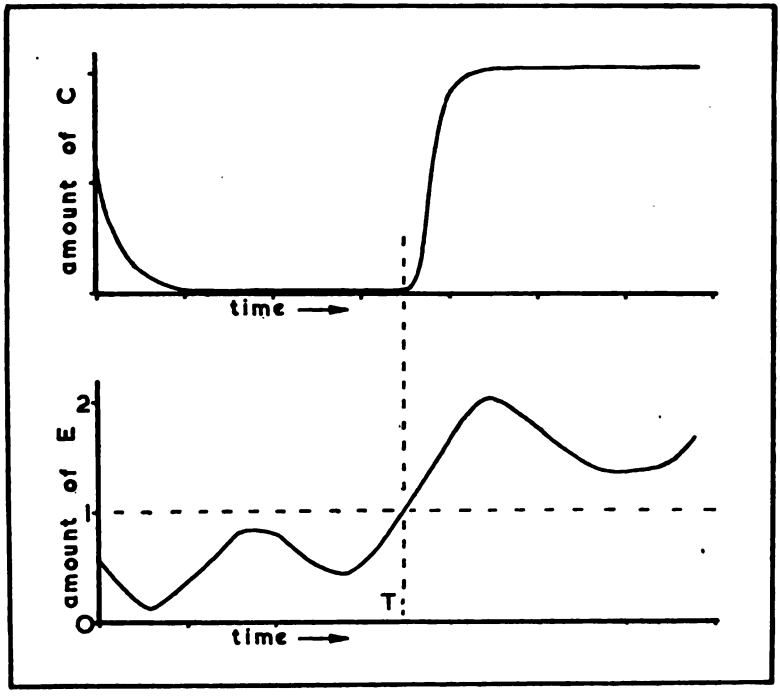

FIG. 2.—The effect on the amount of C of changes in the amount of E. (The time-scale is the same in both).

values of *C* is only two. Thus, when the amount of enzyme is over a critical amount (given as one arbitrary unit in the diagram), the quantity of *C* rises to a maximum, but if the system contains less than this critical amount of enzyme, then the quantity of *C* falls to zero. If the amount of enzyme undergoes variations which do not cross the critical amount, then the effect on the quantity of *C* is only to alter the velocity with which *C* attains the upper or lower limit, but the limit to which *C* is tending does not alter. It will be noted that at these limits *A* is being converted either wholly into *B* or wholly into *C*.

It is, therefore, possible to have a metabolic system controlled by an enzyme such that if the amount of enzyme present is more than a certain amount, then substance *A* is converted wholly into *C*, while if the amount of the enzyme is less than this amount, then *A* is converted wholly into *B*. So an enzyme, affecting primarily only a velocity may yet cause a metabolic process to change to an " all or none " degree.

The same system and the same essential fact can be shown from another aspect. Such a system shows the phenomenon of " threshold." For if we make the amount of enzyme vary, watching the effect on the quantity of *C*, we shall get something like Fig. 2. We start with the amount of enzyme lower than our arbitrary one unit and *C* therefore falls towards zero—that is, *C* disappears from the system. After this, *C* stays absent no matter how the amount of enzyme fluctuates, provided the critical amount of one unit of enzyme is not exceeded. But if, as at time *T*, this amount is exceeded, then *C* will be formed and will increase to the maximum. The enzyme's critical amount of one unit is therefore a threshold for the enzyme's effect on the quantity of *C* present.

It should be noted that were we observing the system to test whether the enzyme had any effect on *C*'s production, then if we added less than the critical amount of enzyme we would get no change in the amount of *C*. We might deduce that the enzyme had no effect at all on *C*'s production, but not until the enzyme had been increased beyond the critical amount would the true effect be revealed.

* * * * *

Finally, has this demonstration any clinical or therapeutic import ? I will conclude by giving four instances where this knowledge may be of use :

The first is in questions of aetiology. It is sometimes thought that a metabolic disturbance, if due to lack of a hormone, vitamin or enzyme must produce symptoms approximately in proportion to the lack of the essential substance concerned. I have tried to show that this proportionality is not at all necessary : that an essential substance can have a critical amount for the production of its characteristic effect. Lack of an essential substance may cause no effect if the lack is only moderate, but when the lack becomes more marked the abnormal symptoms may appear suddenly and in almost maximal degree. Conversely, in such a state the replacement of the missing hormone or vitamin may produce a result only when the amount given exceeds some critical amount.

The second aspect also concerns aetiology. Knowing that enzymes affect directly only the velocities of metabolic processes, we are apt to think that lack of a hormone, vitamin or enzyme can lead only to a mild slowing of the metabolic processes, a change from a normal to an abnormal process not being possible. I have tried to show that this is false. There is no limit to the degree or type of change which can be induced by alteration in the amount of an enzyme.

Thirdly, the method I have used above leads also to a clear understanding of the question of whether the deviation of metabolic processes can be irreversible. But an attempt to discuss this adequately would exceed the limits of this paper.

Finally, the meaning of this knowledge in therapeutics is clear. If we have some reason to suspect that a given syndrome is due to lack of some hormone or vitamin or enzyme, then finding that small doses produce absolutely no effect should not be considered as proof that the substance is unrelated to the syndrome. A further increase of the dose or a more effective method of administration may yet cause a sudden and marked improvement. Treatment has, of course, often been guided by the possibility of this event. Here I have tried to demonstrate the underlying principle.

Summary.

Enzymic systems are responsible for most, if not all, of the body's metabolic processes, and hormones probably control these processes by affecting specific enzymes. Enzymes control only the velocities of chemical reactions, but this does not imply that the results of enzymic alteration are limited to quantitative changes only. On the contrary, it is shown that changes in the concentrations of enzymes and hormones may lead, as the concentrations pass certain critical levels, to changes sudden and catastrophic.

Some therapeutic implications are discussed.

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THE 700TH ANNIVERSARY OF BETHLEM.

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THIS year marks the seven hundredth anniversary of the founding of the House of Bethlem. Seven hundred years! It takes us back to the very beginnings of English culture. Much in our constitution that we hold dear dates from this thirteenth century, which saw the foundation of Bethlem. In 1215 King John signed the Magna Carta, and in 1265 Simon de Montfort summoned not only the knights of the shire, but for the first time two representatives from each of the chartered boroughs, the precursor of the House of Commons. It was between these two dates on the Wednesday after the Feast of St. Luke the Evangelist, which in the year 1247 fell on 23 October, that Simon FitzMary, a citizen of London, signed the deed-poll which founded this hospital. He had given and granted to God and the church of St. Mary of Bethlem all that land of his which he had in the parish of St. Botolph without Bishopsgate London, to wit, all that he had or might have there, in houses, gardens, orchards, fish-ponds, ditches, marshes and all other things appertaining thereto as defined by their boundaries. These extended in length from the king's highway on the east to that ditch on the west which was called Depeditch, and in breadth to the land which belonged to Ralph Dunning on the north and to the land of St. Botolph's church on the south. The gift was for the formation of a priory under the rule and order of the church of Bethlem, the brothers and sisters to wear publicly upon their copes and mantles the badge of a star. He further declared in the deed poll that: "For the greater security of this gift I have placed myself and mine outside the said property, and I have solemnly put in actual possession of it, and have handed over the possession of all things aforesaid to the lord Godfrey of the family of the Prefetti of the city of Rome, at this time bishop-elect of Bethlem (as by our lord the pope confirmed) and at this time actually in England, in his own name, and in that of his successors, and in the name of the chapter of the church of Bethlem. And he has received possession of the said property, and has entered upon it in the form prescribed."

We know little of the first century of our history, but we do know that during this period there occurred two of the worst famines in English history. The first lasted from 1257 to 1259. It was due to a succession of bad harvests, following either cold and backward springs or wet autumns. But the scarcity and dearness of corn would hardly have had such disastrous effects if the country had not been short of circulating coin, which had been drained by levies for the Roman See and its use in bribing electors in the king's brother's candidature for the crown of the Holy Roman Empire. Sixty shiploads of grain were

brought over from Holland and Germany to feed the starving Londoners. The famine was of course followed by a pestilence. The next famine occurred in 1315–1316. Measures were taken then, as now, to restrict the amount of grain turned into malt. In London 55 persons, children and adults, were crushed to death in a scramble for bread doled out at the Blackfriars.

In the third year of the reign of Edward III, 1330, the house was described as a hospital in a licence granted by the king to the master and brethren to collect alms in England, Ireland and Wales. There was no mention in this record of sisters or canons, but, of course, the use of the term hospital was very broad at this time. In the same year the Archbishop of Canterbury wrote to the clergy granting an indulgence of 40 days to all who had "contributed, bequeathed, or in any manner assigned any of their goods in contribution and support of the brothers, proctors, and other poor infirm, dwelling in the said hospital." By the year 1346 the priory appears to have been so poor that the Master, John Matthew de Norton, and the brethren petitioned the Mayor and Aldermen of the City of London to be received under their protection. An agreement was made that two Aldermen should be chosen each year, one by the Mayor and Aldermen and the other by the Master and brethren of the house. These were, in effect, the first governors, and apart from supervising the master and brethren they instituted a biannual audit.

In 1348 the Black Death struck England. It was believed to have started in China, and by 1348 it had spread all over the shores of the Mediterranean. By August it had arrived at Melcombe Regis in Dorsetshire. It appeared in London on 1 November. April the following year was the worst month, judging by the number of wills proved, and by Whitsun it was on the decline. In London the highest mortality was over 200 a day, which, according to Creighton, must have represented a total mortality of 20,000, or half the population. The whole of England lost a third to half its inhabitants and did not recover until the reign of Elizabeth. This bubonic plague was the same as the later great plague of London, which occurred in Pepys's time. There was a second epidemic in 1361, a third in 1368–1369, a fourth in 1375, a fifth in 1382, and a sixth in 1390–91. That Bethlem also suffered from the plagues is apparent from the fact that the Pope granted a petition from the hospital at Avignon, 1363.

In 1375 in the forty-eighth year of the reign of Edward III, Bethlem was seized by the Crown as an alien priory. Disputes afterwards arose between the Crown and the City as to their right to appoint the master of Bethlem, but the Crown triumphed, and Richard II, Henry IV, Henry VI and Henry VIII insisted upon and exercised their right of presentation.

The date at which Bethlem first housed mental patients is not known to any degree of accuracy. Stow, in his *Survey of London* states: "Then had ye 'the chapel of our Lady called the Pew with an house, wherein sometime were distraught and lunatick people, of what antiquity founded, or by whom, I have not read, neither of the suppression, but it was said that sometime a king of England, not liking such a kind of people to remain so near his palace, caused them to be moved farther off to Bethlem without Bishopsgate London, and to that hospital the said house

by Charing Cross doth yet belong." The Royal Commission of 1632 stated: "When the hospital was first employed to the use of distracted people appeareth not. The first mention of it to be employed so was in the beginning of the reign of Richard II." This would make it about 1377. We know for certain that six men who were of unsound mind were confined there in 1403, as the Royal Commission of that date mentions sex homines mente capti as well as instruments of restraint. It is to this Commission, formed to enquire into the defalcations of the porter, one Peter Taverner, that we owe the preservation of a copy of our foundation deed.

In the year 1538, between the act for the suppression of the lesser monasteries and the final dissolution, the Mayor, Aldermen and Commonalty of the City of London petitioned the king for three hospitals and an abbey, not for priests and monks, who, they stated, presumably to get on the right side of the king, had been living carnally and had done "nothing regarding the miserable people lying in the street, offending every clean person passing by the way with their filthy and nasty savors," but that "a greater number of poor and sick persons should be refreshed, maintained, healed, and cured, frankly and freely by physicians, surgeons and apothecaries, who should have stipends to attend for that purpose, so that impotent persons should be relieved thereby and sturdy beggars, not willing to labour, should be punished, and so few or none be seen abroad to ask alms." No attention was paid to this attempt to transfer the administration of the revenues of several establishments to the corporation of the City of London until 1546, and finally on 13 January, 1547, in the 38th year of his reign, Henry VIII granted by royal charter to the Mayor, Commonalty and citizens of London, St. Bartholomew's Hospital, to be called "The House of the Poor, in West Smithfield, near London, of the Foundation of King Henry VIII," and the house and hospital called Bethlem, situate without and near Bishopsgate of the said City of London. The charter of Henry VIII was confirmed by another granted by Charles I, dated 1638. In 1553 Edward VI granted by Royal Charter the three hospitals, Christ's, Bridewell and St. Thomas the Apostle to the Mayor, Commonalty and citizens of the City of London. At a general court, held at Christ's Hospital, 27 September, 1557, separate governors and four several treasurers were appointed for the hospitals of Christ's, St. Thomas, St. Bartholomew, and Bridewell, to which latter hospital the house of Bethlem, though totally distinct in its object, was annexed, one treasurer and the same governors being appointed for both. The union between Bridewell and Bethlem has continued to the present day, and was confirmed by the Act 22, George III. By an order of Common Council, 1587, it was laid down that the unemployment problem of the time should be dealt with in the following way:

"The stout and strong vagabonds to labor in scowring the towne ditches and their diet to be provided for a time by the governors of Bridewell until further orders be taken.

"The sick, sore and lame, which are cureable, to be sent to the hospitals of St. Bartholomew's and St. Thomas.

"The small children, which are infants and not able to work, and born in the city, to be kept in the Christ Hospital.

"The women and others of small strength to be employed in the work of the house of Bridewell, or otherwise, at the discretion of the governors.

"And such and so many as have not been resident in this city and liberties aforesaid, to be conveyed from constable to constable according to the statute."

Pope, in the "Dunciad," mentions Bridewell:

> "This labour past, by Bridewell all descend,
> (As morning prayer, and flagellation end)
> To where Fleet-ditch with disemboguing streams
> Rolls the large tribute of dead dogs to Thames."

He makes a note to the effect that it was between eleven and twelve in the morning, after church service, that criminals were whipped in Bridewell.

As early as 1603, when Stow published his *Survey of London*, the surroundings of Bethlem appear to have been none too savoury. He writes of St. Botolph's Church, mentioned in our foundation deed: "The parish church of St. Buttolph without Bishopsgate, in a fair churchyard, adjoining to the town ditch, upon the very bank thereof, but of old time inclosed with a comely wall of brick, . . .

"Now without this churchyard wall is a causeway, leading to a quadrant, called Petty France, of Frenchmen dwelling there, and to other dwelling houses, lately built on the bank of the said ditch by some citizens of London, that more regarded their own private gain than the common good of the city; for by means of this causeway raised on the bank, and soilage of houses, with other filthiness cast into the ditch, the same is now forced to a narrow channel, and almost filled up with unsavoury things, to the danger of impoisoning the whole city.

"Next unto the parish church of St. Buttolph is a fair inn for receipt of travellers; then an hospital of St. Mary of Bethlehem, founded by Simon FitzMary, one of the sheriffs of London, in the year 1246 (he got the date wrong), he founded it to have been a priory of canons, with brethren and sisters; and King Edward III granted a protection, which I have seen, for the brethren, Miliciae beatae Mariae de Bethlem, within the city of London, the 14th year of his reign. It was an hospital for distracted people . . . the church and chapel whereof were taken down in the reign of Queen Elizabeth, and houses built there by the governors of Christ's Hospital in London. In this place people that be distraight in wits are, by the suit of their friends, received and kept as afore, but not without charges to their bringers in. In the year 1569, Sir Thomas Roe, merchant-tailor, mayor, caused to be inclosed with a wall of brick one acre of ground, being part of the said hospital of Bethlem; to wit, on the west, on the bank of Deep Ditch, so called, parting the said hospital of Bethlem from the More field: this he did for burial and ease of such parishes in London as wanted ground convenient within their parishes. The lady his wife was there buried, (by whose persuasion he inclosed it), but himself, born in London, was buried in the parish church of Hackney.

"From this hospital northward, upon the street's side, many houses have been built with alleys backward, of late time too much pestered with people

(a great cause of infection) up to the bars." The earliest description of the hospital which has been found is in an entry made in the muniment book, 1632:

"Bethlem, wherein the poor distracted persons are kept.

"One messuage newly builded of brick at the charge of the said hospital, containing a cellar, a kitchen, a hall, four chambers, and a garret, being newly added unto the old rooms.

"Item, the old house, containing below stairs a parlour, a kitchen, two larders, a long entry throughout the house, and 21 rooms wherein the poor distracted people lie, and above the stairs eight rooms more for servants and the poor to lie in, and a long waste room now being contrived and in work, to make eight rooms more for poor people to lodge where they lacked room before."

In the minutes of a court held in 1644 it stated that 44 lunatics at least were kept continually at Bethlem with diet and physic and other relief, and that the rents and revenues did not amount to two-thirds of the yearly charge.

The first or medieval Bethlem is coming to its end. The second hospital in Moorfields was started in 1675 and completed in July, 1676. It is a convenient moment to ask what views were held on medicine and physiology during these first centuries of Bethlem's history. We could do worse than go to John Donne, who flourished, if such a word can be used of that gloomy dean, during the early part of the seventeenth century:

"Thou art to narrow, wretch, to comprehend
Even they selfe: yea though thou wouldst but bend
To know they body. Have not all soules thought
For many ages, that our body' is wrought
Of Ayre, and Fire, and other elements?
And now they think of new ingredients,
And one Soule thinks one, and another way
Another thinks, and 'tis an even lay.
Knowst thou but how the stone doth enter in
The bladders cave, and never breake the skinne?
Know'st thou how blood, which to the heart doth flow,
Doth from one ventricle to th'other goe?
And for the putrid stuffe, which thou dost spit,
Know'st thou how thy lungs have attracted it?
There are no passages, so that there is
(For ought thou know'st) piercing of substances.
And of those many opinions which men raise
Of Nailes and Haires, dost thou know which to praise?"

When we come to the more nearly psychiatric angle, we have the hypothesis of vapors:

"But what have I done, either to breed, or to breath these vapors? They tell me it is my Melancholy; Did I infuse, did I drinke in Melancholy into my selfe? It is my thoughtfulnesse; was I not made to thinke? It is my study; doth not my calling call for that? I have done nothing wilfully, perversely toward it, yet must suffer in it, die by it; There are too many Examples of men, that have bin their own executioners, and that have made hard shift to bee so; Some have always had poyson about them, in a hollow ring upon their finger, and some in their pen that they used to write with;

some have beat out their braines at the wal of their prison, and some have eate the fire out of their chimneys; and one is said to have come neerer our case than so, to have strangled himself, though his hands were bound, by crushing his throat between his knees; But I doe nothing upon my selfe, and yet am mine owne Executioner. And we have heard of death upon small occasions, and by scorneful instruments; a pinne, a combe, a haire, pulled, hath gangred, and kill'd; But when I have saide, a vapour, if I were asked again, what is a vapour, I could not tell, it is so insensible a thing; so neere nothing is that that reduces us to nothing."

The last years of the old hospital saw the Great Plague of 1665, and the Fire of London in 1666, which however spared Bishopsgate. Pepys made a note in his diary 19 February, 1669, that he spent the day at the office and the young ones went to Bedlam. This habit of treating the hospital as a peep-show continued well into the eighteenth century, and in Hogarth's painting of 1735 (the last of The Rake's Progress) a lady and her maid are shown going round the male side, the lady modestly hiding her face behind her fan, while the maid describes to her the appearance of an almost naked male patient.

The second Bethlem in Moorfields was a building of considerable architectural merit, as one can see from the many prints of it still in existence. It was said to have been built in imitation of the Tuileries. It was described in the 1754 edition of Stow's *Survey* as consisting of two galleries over the other, 193 yards long, 13 feet high, and 16 feet broad, not including the cells for the patients, which were 12 feet deep. These galleries were divided in the middle by two iron gates separating the male and female sides. These gates and the cells appear in Hogarth's celebrated print. It was of this building that Gay wrote:

> "Through fam'd Moorfields, extends a spacious seat;
> Where mortals of exalted wit retreat;
> Where, wrapp'd in contemplation and in straw,
> The wiser few from the mad world withdraw."

Two wings were later added, one in 1725, the other in 1733, for male and female incurable patients. The Moorfields hospital was in continuous use until 1815.

Pope not only makes a number of references to this hospital, but also mentions one of the physicians of the time:

> "And when I flatter, let my dirty leaves
> (Like journals, odes, and such forgotten things
> As Eusden, Philips, Settle, writ of kings)
> Clothe spice, line trunks, or fluttering in a row,
> Befringe the rails of Bedlam or Soho."

In another imitation of Horace he wrote:

> "Sure I should want the care of ten Monroes,
> If I would scribble rather than repose."

Actually there were four Monros at Bethlem, to whom I will refer later.

In 1800 the architects reported the hospital to be in an insecure condition, and in 1815 the patients were transferred to the third Bethlem in St. George's Fields, which was begun in 1812. This building with the dome, which was completed in 1846, was in use until 1930, when we moved to Monks Orchard. The central part of the old hospital including the dome is all that is now left and serves as the Imperial War Museum.

It is difficult, when covering seven centuries in half-an-hour, to give more than an impressionistic picture, but there are several examples of the impact of Bethlem on the outer world which are worth mentioning. Langland apparently considered the wandering monks of Bethlem to be a nuisance as he wrote :

"A peril to the popes and prelates that he maketh, that bear bishops names of Bedleem and Babiloigne, that hop about in England to hallow men's altars, and creep about among the clergy, hearing confessions, which they have no right to do."

Later there was the nuisance of the Bedlam beggars, who pretended to be ex-patients. You will remember how the fleeing Edgar in *King Lear* cried :

> " I heard myself proclaim'd ;
> And by the happy hollow of a tree
> Escaped the hunt. No port is free, no place,
> That guard and most unusual vigilance
> Does not attend my taking. Whiles I may 'scape
> I will preserve myself ; and am bethought
> To take the basest and most poorest shape
> That ever penury in contempt of man
> Brought near to beast : my hair I'll grime with filth,
> Blanket my loins, elf all my hair in knots,
> And with presented nakedness out-face
> The winds and persecutions of the sky.
> The country gives me proof and precedent
> Of Bedlam beggars, who with roaring voices
> Strike in their numb'd and mortified bare arms
> Pins, wooden pricks, nails, sprigs of rosemary ;
> And with this horrible object, from low farms,
> Poor pelting villages, sheep-cotes and mills,
> Sometime with lunatic bans, sometime with prayers,
> Enforce their charity. Poor Turlygod ! poor Tom !
> That's something yet : Edgar I nothing am."

Another impact of Bethlem on the outer world, altogether beneficial this time, was the patronage by the second Monro, Dr. Thomas Monro of the brilliant English school of water colourists, probably, outside the Chinese, the greatest water-colourists the world has seen. Alexander Cozens, who had come from Russia to England and taught drawing at Eton, had a son J. R. Cozens, who had a complete nervous breakdown and died under Dr. Monro's care in 1799. According to Faringdon, " Turner and Girtin told us they had been employed by Dr. Monro three years to draw at his house in the evening . . ." Girtin drew in outlines and Turner washed in the effects. They were employed chiefly in copying the outlines and unfinished drawings of Cozens, etc., of which copies they made finished drawings. Girtin, Turner, Cotman, Varley and de Windt all worked at Dr. Monro's, copied Cozens and stimulated one another, yet retained their individuality.

The first physician to be connected with the hospital was John Arundell, not apparently in his capacity as a physician, but as master of the hospital in 1457–1458. Previously in 1453 Henry VI had lost his reason, memory, and powers of speech and movement, and Arundell, who was his chaplain, confessor, and first physician, was authorized with other physicians and surgeons to administer head purges, and to shave the king's head, and to give him baths.

From 1619–1634 Hilkia Crooke was physician and Keeper, but he appears to have been largely an absentee placeman. From 1634 a regime was instituted in which there was a non-resident physician, an apothecary and a visiting surgeon. Of the earlier non-resident physicians, the best known is Edward Tyson, whose name is commemorated in our present acute block. He was physician from 1684–1708. The remarkable family dynasty of Monro's, in which son followed father for four generations, lasted from 1728–1853. A descendant of this family was still a licensee of Brooke House up to its bombing in the late war. Thomas Monro, the art patron, has already been mentioned. Henry Monro, the son of the last Monro, did not get on the staff but was trained in the wards of the hospital. In 1851 he published *Remarks on Insanity, its Nature and Treatment.* In this book he proposed the hypothesis of positive and negative symptoms which Hughlings Jackson adopted with acknowledgments, and elaborated so successfully. So that the family, which enjoyed the fruits of office for so long, helped materially to contribute to the foundations of modern neurology.

John Haslam, apothecary to the hospital, in his *Observations on Madness and Melancholy*, 1798, described a case of general paralysis of the insane without recognizing it as a specific entity.

In 1853 the custom of having non-resident physicians ceased, and William Charles Hood became the first resident physician as opposed to resident apothecary. He raised the social standard of the patients, and was instrumental in having the criminal patients removed. The present type of regime is a direct continuation from his day.

While many things have been improved since those days, it is sad to recall that in 1823 the butter ration was 16 ounces per week, that the patients had half a pound of corn beef on Sundays and a roast on two other days of the week. Excellent table beer was served without any stint of allowance, but the average quantity did not exceed a quart per patient per day.

A tendency to undue reminiscence is a sign of approaching senility. Old we may be, senile we are not, so I will make an end. "Do on then fast, I pray thee. Look now forwards and let the backwards be."

CEREBRAL SYMPTOMS IN THROMBO-ANGIITIS OBLITERANS.

By DAVID PERK, M.D., D.P.M.,
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VON WINIWARTER, in 1879, published his pathological findings in a case in which there was obliteration of the vessels of the leg due, as he considered, to a proliferative process in the intima, that is to say, an "endarteritis obliterans." Other views on the pathology came to be propounded, notably that of van Manteuffel, who considered that consequent upon arteriosclerosis of the popliteal artery a white thrombus formed, which, spreading peripherally and becoming organized, produced the picture of an obliterative endarteritis. Twenty-five years after Winiwarter's paper Buerger published his observations based on 30 cases, with pathological studies on the vessels obtained from eleven amputated limbs. He disagreed with the views of both von Winiwarter and von Manteuffel. He found that besides an extensive obliteration of the larger arteries and veins there was a varying degree of peri-arteritis and arteriosclerotic thickening of the vessel wall, and concluded that the condition was a thrombotic process occurring in the arteries and veins, followed by organization and canalization, and not an obliterating endarteritis. He absolved the intima from any "considerable role in the genesis of the thrombotic process," and attributed the thickening of the intima and the cellular infiltration and vascularization of the media and adventitia to the agency producing the coagulation of the blood and to the changes in the thrombus itself. He saw the final lesion as a vessel obliterated by dense connective tissue, canalized, together with some residual cellular infiltration and capillarization of the media and greater or less thickening of the adventitia and periarterial tissues, the thrombus having disappeared in the course of the development of this final result. He proposed the term "thrombo-angeitis obliterans" for the condition, and with the general adoption of the term Buerger's name came to be linked with it.

Some authors have considered that the condition is inflammatory in nature. Scheinker, however, states that he found no inflammatory changes either within or surrounding the vessels. He considered that this feature helped to distinguish thrombo-angiitis obliterans from periarteritis nodosa, with which, in his opinion, some observers were apt to confuse the condition. In periarteritis nodosa marked inflammatory changes were to be found extending through the entire vessel wall.

He describes thrombo-angiitis obliterans in the cerebral vessels as beginning with small intramural haemorrhages. The extravasated intramural blood,

confined to the subendothelial tissue of the intima and the muscularis, detaches the endothelial lining and pushes it into the lumen of the affected vessel. The subendothelial cells of the intima, and to a lesser extent the muscularis, undergo necrosis. Later, with the absorption of the extravasated blood, there is a fibroblastic proliferation in the subendothelial tissue, followed by a proliferation of connective-tissue fibrils, ending in the formation of scar-tissue. The thickening of the vessel wall leads to narrowing of the lumen of the affected vessel, and total occlusion occurs with thrombus formation induced by degenerative changes in the endothelium. He found recanalization in the older lesions. The vascular lesions in his case were confined to the medium sized veins and the smaller arteries. Larger blood vessels and capillaries were not usually affected. There was destruction of the nervous tissue supplied by the affected vessels.

He quotes Marchesani, Stander and Ludwig, who observed recurrent haemorrhagic extravasation into the retina and vitreous humour associated with vascular lesions of thrombo-angiitis obliterans in the extremities and other parts of the body as parallel instances of haemorrhage into the vessel walls of the brain which, he believes, is a recurrent phenomenon. He considers these haemorrhages set up reversible disturbances of the vessel walls—spasm and paralysis—and when these are repeated or protracted the reversible changes become permanent. The remittent character of the earlier cerebral symptoms he ascribes to the presence of reversible changes. In support of this contention he quotes Foerster and Guttmann, who had observed transient vasoplastic phenomena in the retinal arteries ophthalmoscopically in a typical case of thrombo-angiitis obliterans. Hausner and Allen have offered an alternative explanation for the remission of symptoms in the rapid development of collateral circulation after thrombosis.

Bauer in 1935 drew attention to Winiwarter's prior claim to the distinction, and the condition is sometimes referred to in the literature as Winiwarter-Buerger's disease. The credit for recognizing that cerebral symptoms may occur in the course of thrombo-angiitis obliterans conceded by some to Foerster and Guttmann, who called attention to this observation in 1933, is challenged by Bauer, who points out that they were preceded in this by Cserna in 1926, Friedman in 1931, and Bauer himself in association with Recht in 1932. There were, in fact, others besides those mentioned by Bauer. Hausner and Allen mention Merkelbach (1933), Livingston (1933), Jäger (1932), Lilienthal and Barron (1929), Stahnke (1928), Lewis (1927), Buerger (1924). There is not, however, an abundance of references to the cerebral manifestations in Buerger's disease in the literature, and as Scheinker observes, there are even fewer histopathological studies of the brain and cerebral vessels to support the clinical observations. Apart from his own studies (also in association with Sträussler and Friedman (1937)), he mentions by name those of Spatz (1935) and of Lindenberg (1939).

Hausner and Allen, reviewing the literature in 1938, found 23 cases recorded of involvement of the cerebral arteries in association with thrombo-angiitis obliterans of the extremities. Their review was not, however, an exhaustive one, and there are a good many more cases available in the literature up to

1938. Scheinker mentions that in the 7 years 1937–44 only 3 cases of cerebral thrombo-angiitis obliterans reached the laboratory of neuro-pathology, Cincinnati General Hospital. Hausner and Allen found 11 cases of cerebral involvement in a group of 500 with thrombo-angiitis obliterans of the extremities at the Mayo Clinic, giving a percentage incidence of 2·2.

In their review of the literature Hausner and Allen found that the commonest cerebral symptoms were transient hemianopia and transitory, constant or recurrent hemiplegia. In their own 11 cases the duration of the peripheral disease varied from 5 months to 20 years. The cerebral lesion preceded the peripheral symptoms by 1 to 14 years in 3 cases; in the others it followed them. The outstanding symptom was transient or permanent hemiplegia; other symptoms were transient confusion, disorientation, aphasia, loss of memory. Hemianopia was present in 2 cases, and cleared up in 1 case following sympathectomy. One of their cases had had recurrent mental disturbances for 17 years prior to the onset of the thrombo-angiitis obliterans, but Hausner and Allen do not claim a common pathology for the two conditions. In some of the cases recorded by other authors a connection between mental changes and thrombo-angiitis obliterans can be clearly discerned. In the case reported by Scheinker, for instance, there can be little doubt that the mental disturbance in the form of a sudden alteration of behaviour on the part of the patient, and the first symptom manifested by him, was occasioned by the same condition that 3 months later produced various cerebral symptoms, and 6 months later still a sudden right hemiplegia with motor aphasia. Scheinker confirmed the diagnosis as that of thrombo-angiitis obliterans by post-mortem histological study of the cerebral vessels. It will be noted, however, that there is no report of peripheral vascular obstruction having occurred. The fuller clinical history of the case is as follows:

The patient, a policeman, aged 43, suddenly left his job and home and went to another town. Three months later localizing cerebral symptoms were noted: the patient began to have attacks of weakness and myotonia affecting muscles of face, speech, deglutition and arms; also attacks of numbness, dizziness and generalized weakness. They occurred frequently—as often as twice a week—preceded by twitching of eyes. Nine months after the commencement of symptoms he suddenly developed a right hemiplegia with motor aphasia and died 5 weeks later.

Guttmann's case is an instance where the mental symptoms followed the manifestations of the disease in the extremities. Though the age of his patient, 61 years, suggests that the mental and cerebral symptoms might have been produced by cerebral arteriosclerosis, especially in view of the high blood pressure recorded, the nature of the pathological condition in the cerebral vessels was confirmed post-mortem as that of thrombo-angiitis obliterans. His patient had suffered from intermittent claudication for 21 years, and in the year prior to examination, when it was noted that pulsation was absent in the extremities and accompanied by acrocyanosis, the patient had suffered from confusion and excitement. There were other evidences of cerebral involvement such as slight paresis of facial expression, increased reflexes, amnestic aphasia and apraxia. After coming under treatment, and with the

improvement of the neurological symptoms, the patient developed a paranoid psychosis.

The literature provides evidence that any neurological symptom may be produced by thrombo-angiitis obliterans of the cerebral vessels: muscular spasms ranging from tics to epileptiform convulsions, palsies ranging from weakness to complete paralysis, either localized to a group of muscles, commonly in the face or in an extremity, or affecting half the body (hemiplegia), sensory disturbances, commonly hemianopia and numbness, affections of speech (aphasia), memory (impoverishment) and higher cerebral functions (apraxia), and interruption of consciousness (unconsciousness). In addition, mental symptoms may occur, though less frequently than neurological symptoms, ranging from transient confusion or excitement to full-fledged psychoses. Neurological and mental symptoms may precede, though more commonly they follow manifestations of the disease in the extremities and other parts of the body, commonly the heart, mesenteric vessels and eyes. In the earlier manifestations the cerebral symptoms tend to transcience and recurrence, later to permanence.

Several authors (Meves, Hausner and Allen), alluding to the long interval that may occur between the onset of cerebral symptoms when they precede the manifestation of the disease in the extremities and peripheral symptoms, point the need to bear thrombo-angiitis obliterans in mind as a possible diagnosis for cases of cerebral vascular disease occurring in the absence of a presenting aetiological background. This applies especially to cases occurring in early adult life. Later, sclerosis of cerebral vessels offers an alternative explanation; and a mixed pathology—as, for example, the presence of both peripheral thrombo-angiitis obliterans and cerebral arteriosclerosis—may account for the association of cerebral and peripheral symptoms.

The case described in the following notes came to the present author's attention when the man's clinical documents were under scrutiny for consideration of his claim to a pension.

The patient enlisted in the Royal Navy in November, 1940, in sound condition, and did not come under medical observation until 3 years later, when he was admitted into the sick bay of his ship for inflamed areolar tissue of the right great toe. He was then 29 years of age. There was inflammation and pain of the toe with slight inguinal adenitis. He reported that he had dropped something on his foot, breaking the skin of the toe. The inflammation quickly subsided under treatment, and the patient was discharged back to duty after 3 days. He did not again come under medical care until 11 months later, when his behaviour in the ship's galley led to his referral to a psychiatrist. Apparently normal and giving satisfactory service up to the time of the galley scene, he had sat up reading all night, and in the morning prepared breakfast in a slapdash manner, and placed notices outside the galley in reference to the breakfast that the troops could "take it or leave it." On admission to hospital he was found to be elated, and within a few hours he became extremely noisy and restless, throwing bedding about, talking incessantly and incoherently, breaking into song, and showing aggression to staff when being attended to. Sustained conversation with him was impossible because of flight of ideas running into incoherence. His talk showed a grandiose vein with referencing of events to himself—the war was being fought on his account, he started the civil war in Greece, etc. He was disorientated to time, place and person. Physical examination was negative, other than that it

was noted he had flat feet with hallux valgus and plantar callosities. There were apparently no signs of vascular obstruction in the legs at that time.

Information from the family revealed that an elder brother had committed suicide and that the patient had recently suffered several bereavements—a brother was killed in Sicily and a sister and her child in a flying bomb incident—which, it was stated, had upset him considerably. Though not a heavy drinker, he had recently been drinking more than usual.

When after 3 weeks of continued restlessness, noisiness and destructiveness and incoherence he became more rational he confirmed the above particulars given by the family, and revealed that for some days he had felt worried about his family and blamed himself for his failure at work, and was restless and sleepless. It would seem then that though his mental state did not appear as suddenly as the earlier reports made out, it developed rapidly, probably over a few days. He also recalled some of the delusional ideas that entered his mind during the acute phase—that he could make a fortune at the " dogs," at which he was a regular attender, that he was being televised through a vent in the room—and affirmed that he had had auditory hallucinations. Though rational, correctly orientated and in full contact with his environment, he was euphoric and circumlocutory in conversation. The improvement lasted about 5 days, when he relapsed by rapid degrees into an acute manic condition (wildly elated, constantly talking and manifesting flight of ideas and extreme distractibility, too busy to eat and taking little fluid or food, voice hoarse) which exhausted him, so that he collapsed, pulseless, after about 7 days. He was comatose for 2 days, during which time the pulse was 110, his lips were cyanotic and his heart sounds were noted as " weak but closed, with tic-tac rhythm. Aortic second sound slightly accentuated." It was now observed for the first time that the toes of his feet were all cyanotic and showing early dry gangrene. Pulmonary consolidation was not found at any time, and there was no dyspnoea. When he regained full consciousness he made no complaint of pain in the feet or elsewhere. He remained cyanosed, and his heart sounds were weak for 4–5 days after the collapse. The dry gangrene of the toes continued to advance, oedema of dorsum of both feet up to and including the ankles developed and clear blisters formed on the dorsum of the right foot. There was good capillary circulation above the mid-tarsus and no palpable thrombosis. The posterior tibial and dorsalis pedis pulses of both legs were absent. The demarcation developed progressively at the tarso-metatarsal joints, and after three weeks sepsis developed at the line of demarcation. The sepsis cleared in the left foot after a few days but was followed by sloughing of the toes of the right foot. Mentally there was no change. From the time patient recovered from the comatose state he was very restless, deluded, over-talkative and sleepless when not under sedation. It was 2½ months before there was again mental improvement, and again it only lasted about 5 days. Concurrently with the succeeding relapse he had the first major epileptic fit. Two days prior to the fit when his B.P. was taken it registered 116/72, and blood examination, performed after the fit, gave negative Wassermann and Kahn reactions.

The mental symptoms, maniacal in character, grew rapidly more severe until patient was filthy in habits, incontinent of urine and faeces, confused, hallucinated, resistive and impulsive, and after 3 weeks he collapsed again. His pulse counts over the next 24 hours were 108, 104, 114, 106. This time he regained consciousness after 4 hours. His heart sounds also improved rapidly. Some few days before he collapsed his big right toe sloughed off. Then followed a fortnight's calm and rationality terminated by a further relapse and eventual collapse—for the third time. On this occasion the pulse was no more than 90, and the patient improved physically more rapidly than previously. For the next 3 months, except for several brief intervals of comparative tranquillity he continued restless, confused and occasionally aggressive and impulsive. His maniacal condition did not, however, again reach the earlier intensity, and towards the end of this period a mild depressive phase was noted for the first time. This phase lasted about a week, and was succeeded by a recurrence of mania and eventual collapse (fourth time). There followed alternate depressive and manic phases for about a fortnight, and the patient then gradually slipped into a quiet, confused, perplexed state with rambling, occasional thought-blocking and auditory hallucinations, punctuated at times by impulsiveness (window-smashing), aggressiveness, brief attacks of acute excitement with hallucinations and less frequently by depressive

phases (attempted suicide in one). At this stage the condition began to have the look of a confusional state. It was now 12 months since his condition began. He had during the year lost all the toes of his right foot and three of the left foot. He had had altogether 6 epileptic fits, and on one occasion he was noted to complain of diplopia (it was attributed to the sedatives he was having). For about 3 months the mental condition continued as described. Improvement then set in. This proceeded uninterrupted for about a month—except that for a day he passed loose stools containing blood and mucus, but negative for the dysenteric and typhoid groups of organisms—when he was noted to have difficulty in articulating and expressing himself and to be slow of cerebration. At this stage his brother took him out of the civil mental hospital where he had been a patient for the past 4½ months, and no further particulars are available. Altogether the patient had been under continuous medical observation for 16½ months.

Commentary: It provides some indication how comparatively little known is the occurrence of cerebral manifestations in thrombo-angiitis obliterans that this case was, in the 16½ months that it was under observation, variously diagnosed as schizophrenia, mania, manic-depressive psychosis, epileptic psychosis, all as primary conditions, at the same time that the condition of the feet was correctly diagnosed as due to thrombo-angiitis obliterans. It may, of course, be that the mental condition was unconnected with the vascular one—other authors have warned against too readily assuming a connection between the two—but the occurrence of other cerebral manifestations such as fits, diplopia, dysarthria, the earlier paroxysmal symptoms typical of thrombo-angiitis obliterans affecting the cerebral vessels, points the probability that the mental symptoms were likewise due to the vascular condition. A difficulty in attributing the mental symptoms to the same vascular condition in the brain as the other cerebral symptoms mentioned above is that whereas the latter were paroxysmal and transient the former were long-sustained.

There are two distinct physio-pathological mechanisms at work in thrombo-angiitis obliterans: one a slow and progressive occlusion of the vessel or vessels affected, and the other a paroxysmal functional disturbance induced by the physical changes in the vessel wall. In time, as Scheinker and others believe, the recurrence or the prolongation of the functional disturbances leads to its irreversibility. It may, however, be that the progress of the organic change in the vessel wall produces a parallel and permanent alteration in the functional capacity of the vessel wall. For a greater or lesser period it is possible to distinguish the effects of the two mechanisms—the spasmodic physiological disturbance and the progressive pathological lesion. In the legs, for instance, intermittent claudication not infrequently occurs in association with advancing early gangrene. It can be assumed that the same thing happens in the brain, the temporary physiological disturbance producing transient symptoms, the permanent organic change enduring symptoms.

The paroxysmal character of some of the symptoms found in thrombo-angiitis obliterans may possibly be accounted for by partial occlusion of a vessel from temporary spasm, or by temporarily complete occlusion from organic change in the vessel wall plus passing spasm. As for the enduring symptoms present they result, of course, from the irreversible occlusion of a vessel, most probably from the combination of organic change in the vessel and permanent loss of functional capacity. Even the enduring symptoms,

it should be noted, do not necessarily advance consistently and continuously: the establishment of collateral circulation, for instance, may arrest or slow their progress.

How is the presence of mental symptoms in a case of thrombo-angiitis to be explained, presuming that the concurrence is connected and not accidental? Mental symptoms, as we know, may occur in the absence of any demonstrable pathological condition in the brain; and it is still possible that mental symptoms may occur in the presence of thrombo-angiitis obliterans of brain vessels without any parallelism between the two. The physical event may have set the condition alight, though not in the direct way that a spasm or occlusion of a vessel produces a symptom, and there their relationship ends. If the mental symptoms should indicate permanent intellectual loss such as occurs with organic brain change, there will be no difficulty in attributing them to destruction of brain tissue from occlusion of the supplying vessel. In addition to the guidance derivable from the nature of the symptoms present their duration gives some indication of their genesis. If the mental symptoms are as fleeting as, say, neurological symptoms occurring in the course of thrombo-angiitis of the cerebral vessels may be, then there need be little hesitation in attributing them to the temporary vascular disturbance that is characteristic of the earlier stages of thrombo-angiitis. The difficulty arises with the more protracted psychotic episodes. I think the explanation here is, working on the assumption that there has been a thrombo-angiitic attack upon one or more of the cerebral vessels, that this event has acted as a trigger stimulus provoking a psychosis. It was this mechanism that produced the psychosis in the case described in this paper. The patient was, moreover, already predisposed to the occurrence of such an event through the action of heredity and recent mental stress. It is just possible that prior to the removal from medical care the patient was beginning to evince evidence of intellectual dissolution—he did not continue long enough under observation for this impression to be confirmed—and if this should be so an organic change was then overtaking symptoms produced by the mechanism described above.

There can be little doubt that the toe condition for which the patient first came under observation was already the beginning of the thrombo-angiitis—though he attributed it to an injury—and the recurrent cardiovascular collapses, though they took place after periods of acute excitement, were probably occasioned by spasm of the coronary arteries associated with early thrombo-angiitis. It is possible that the physical effects of the prolonged excitement may have prepared the ground for such an event. There may also have been involvement of the mesenteric vessels, when the patient passed blood in the stools. If these views are correct the case described has presented the features of thrombo-angiitis occurring in the vessels of the legs, brain, heart and mesentery, which, judging by the literature, are the more common sites of election of the condition.

Summary.

A case is described in which mental symptoms, predominantly manic, epileptiform fits and several other cerebral symptoms—diplopia, dysarthria—

have occurred in association with gangrene of the feet due to thrombo-angiitis obliterans, and considered to be due to the same vascular condition. Allusion is made to some views of the pathology of the condition, and the manner in which it affects the functional capacity of the blood vessels.

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MEPACRINE PSYCHOSIS.

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FROM time to time in the Middle East, cases were admitted into hospital bearing the diagnosis of Mepacrine Psychosis. This was a label which one hesitated to accept because, for one thing, the cases presented no single clinical type, and for another, they showed, with few exceptions, little or no evidence of symptoms of an organic reaction type such as might be expected in a toxic psychosis. It was, moreover, important, in view of the widespread use of mepacrine both as prophylactic against malaria and in the treatment of it, that the occurrence of a psychosis during the exhibition of mepacrine should not be ascribed to it, except on the irrefutable evidence of a causal connection between the two. Though I have no figures to indicate the incidence of mepacrine psychosis relative to the number of cases of malaria treated with the drug in the M.E.F., I believe the ratio to be very small indeed. Kingsbury mentions 12 cases among several thousand cases of malaria treated with mepacrine ; Allen *et al.* quote Greene as having encountered 2 cases in a series of 750 so treated, in Malay. Hoops had 1 case of mental excitement among 1,207 cases ; Briercliffe 15 cases of delirium among some hundred persons taking mepacrine. Field estimated the incidence of mepacrine psychosis to be less than 0·1 per cent. of cases treated. Gaskill and Fitz-Hugh noted 35 cases of toxic psychosis in 7,064 cases of malaria treated with mepacrine in an army hospital during the recent war ; Mergener reports 1 case in 1,000, and quotes Udalagama, who recorded 7 such cases in a series of 644, and Bispham, who noted only 1 case in 7,915 cases that came under his personal supervision, and who up to 1941 found only 35 instances in the literature. Burnham quotes Dove as having noted no case of alarming reactions (presumably including psychotic reaction) in a series of 30,000 cases treated with mepacrine.

The present review is based on 33 cases, 25 of which I had myself had the opportunity of seeing during their stay in hospital. It was possible to determine in 10 of the cases that the psychotic symptoms had commenced prior to the exhibition of mepacrine, and had been precipitated either by the malaria or by circumstances antecedent to it. In 7 of these cases the symptoms were aggravated by the mepacrine, and in 3 it had no influence. It is possible, therefore, to divide the cases into 3 groups : those in which psychotic symptoms followed the exhibition of mepacrine and which can, therefore, be legitimately

regarded as having been precipitated by it, designated group A; those aggravated by mepacrine, designated group B; and those that appear to have been precipitated by the malaria, designated group C. Groups B and C have cases in common, which fall to be included in each of the groups. The number of cases in each of these groups is, 23 in group A, 7 in group B, and 8 in group C. This division permits of the rejection in the study of mepacrine psychosis of groups B and C, and of their utilization for the purpose of making comparisons between the groups in several particulars. All the observations that follow relate to group A, therefore, unless otherwise specified.

Cases Precipitated by Mepacrine: Aetiology.

All 23 cases are of the male sex, and all British except for 2 Palestine Jews. The average age is 28; the extremes of age are 20 and 44; and 87 per cent. of the cases fall into the 20 to 35 age-group. The proportion of officers and N.C.O.s to privates and equivalents (11 to 12) is high compared to their ratio in the services. The intelligence levels of the cases, though the records are incomplete in this respect, point, as far as they go, to a scatter not differing from that found in the Services generally. The types of psychological make-up found in the series show perhaps an unduly high proportion of the schizoid type, and evoke the suggestion that the schizoid personality may possibly be more susceptible to mepacrine than the other types. But the immunity shown by the many schizoid individuals who have taken mepacrine without ill-effect and the occurrence of mepacrine psychosis in other than the schizoid types indicate that susceptibility to mepacrine does not reside exclusively in the mental and emotional constitutions of the individuals affected. The distribution of the various types was as follows: Schizoid type 27 per cent.; obsessive, anxious and immature types, each 13 per cent.; an assortment of cyclothymic, psychopathic and hysteroid types 21 per cent., and unclassified 13 per cent.

As with most psychiatric breakdowns, the aetiology of the mepacrine-precipitated cases reveals a multi-factorial origin. In addition to the toxic effect of the malaria, which can be presumed to have been an active contributory factor in all the cases, the following other factors are recorded in more than half the cases (13):

Emotional stress (other than that of battle)	7 cases.
Recent battle stress	3 ,,
Alcoholism	2 ,,
Infective hepatitis	1 case.
Sundry factors (P.U.O., septic process, ? cholecystitis)	3 cases.

A noteworthy feature of the cases in the series is that 11 of them (47·8 per cent.) give a history of one or more attacks of malaria in the 18 months prior to the psychiatric episode, and 2, malarial attacks prior to that. Gaskill and Fitz-Hugh have recorded that most of the 35 cases reviewed by them had had one or more attacks of malaria in the past. A constitutional pre-disposition to psychotic breakdown is evident in only 3 of the present series, these having

had previous psychotic breakdowns, whilst the third had a further attack of mania 14 months after the mepacrine-precipitated attack. Three cases give a family history of psychopathy or insanity. Kingsbury noted that one mild and one severe case, in his series of 17, gave histories of previous mental breakdowns. Four of the 9 cases reviewed by Allen *et al.* had had previous " nervous or mental symptoms," and 6 had associated physical conditions which could have been predisposing factors.

Gaskill and Fitz-Hugh found infection with *P. falciparum* to be twice as frequent as infection with *P. vivax*, but this applied equally to the 7,064 cases of malaria as to the 35 cases that developed toxic psychosis. They found no evidence of mental instability in their cases, and suggested vitamin deficiency as a possible contributory cause.

Idiosyncrasy.

No evidence of idiosyncrasy to mepacrine is forthcoming in the author's series. It is inconstant in its toxic effect. Fourteen cases had had mepacrine with impunity in the 18 months prior to their breakdown, and 3 subsequent to it. In only one case did psychotic symptoms reappear with the treatment of malaria, and in that case mepacrine was not exhibited: quinine and plasmoquine were employed. Gaskill and Fitz-Hugh noted that 16 of their recovered cases were at a later date retreated with mepacrine, 15 without any manifestation of untoward symptoms. Shiers reports a case which does, however, suggest that idiosyncrasy for mepacrine may exist. During a period of 10 months his patient had taken mepacrine on 3 occasions in different daily and total dosages, and developed mental symptoms on each occasion.

Dosage and Toxicity.

The dosage of mepacrine used undoubtedly has some influence. In only one instance in the present series did the prophylactic dose (1–2 tablets daily, equal to 0·1–0·2 g.) produce psychotic reaction. The patient was employed in a highly malarious area and had been taking 2 tablets daily for 9 months when symptoms appeared. The breaking-off of the engagement by his fiancée probably played a contributory part. He recovered following convulsive treatment (6 convulsions), but no sooner had that happened than he had a malarial relapse, was given mepacrine and promptly reacted with psychotic symptoms again. With cessation of the mepacrine and two convulsions he was once more restored to normality. Kingsbury records the occurrence of mepacrine psychosis after a dosage as low as 0·6 g. The medical consultants of the United States Army, without adducing supporting figures, give their opinion that psychological disturbances in association with mepacrine are mostly due to " unduly large doses," and note that they have also occurred in connection with suppressive medication. Burnham, on the other hand, records a case of attempted suicide with mepacrine, in which 90 gr. were probably ingested, though an undetermined amount was rejected in the vomit, and though the patient became unconscious and stuporose within 6–7 hours, he regained full consciousness within 48 hours with no development of psychotic

symptoms. Greene's 2 cases developed psychotic symptoms at the end of 6 and 7 days respectively after taking 3 daily tablets (0·3 g.). The case described by Shiers first developed mental symptoms following suppressive mepacrine, 0·1 g. daily, and subsequently during the treatment of malaria, with a daily dose of 0·6 g.

The relation of mepacrine dosage to body weight has been offered as explanation for its toxic effect. In the present series 4 cases are recorded as underweight and of poor physique.

Kingsbury ascribes the toxic effect of mepacrine to two factors, one, to the liberation of toxins by the action of the drug on the malarial parasite, and the other, to the toxic effect of mepacrine on the C.N.S. Turner considered the effect to be due to drug idiosyncrasy, pointing out that the amount of mepacrine taken was not sufficient to produce the symptoms usually associated with the toxic effects of the drug. The study made by two interns, quoted by Allen *et al.*, who gave 1½ gr. mepacrine 3 times daily for 5 days to 2 normal male subjects, who showed no signs of malaria, suggests, however, that mepacrine is toxic in therapeutic doses. Both cases felt exhilaration on the fifth day, one also noted insomnia, and one, at the end of the course, showed flight of ideas, distractibility and a constant stream of irrelevant talk. The factor of suggestibility could not be ruled out in either case. They incline to think that the delayed excretion of mepacrine, for one reason or another, may account for its toxic effect.

The factors that probably act adjuvantly to mepacrine and render it toxic in medicinal doses are: the total amount taken relative to body weight; bodily conditions delaying its excretion, such as constipation, hepatic and renal diseases, disturbed water balance; idiosyncrasy to the drug in rare instances; predisposition to mental breakdown, inherited and acquired; intercurrent stress, physical (infection, especially), emotional and mental. It is necessary in addition to postulate the existence of an individual factor of transient nature to explain the inconstant effect of mepacrine where such factors as have been mentioned above have remained constant, as far as can be judged, but where the mepacrine has induced a psychotic reaction on one occasion and not the next. Investigation of the mepacrine blood level in relation to the onset of mental symptoms may yield useful information, but so far none is available in the literature.

Time of Onset of Symptoms.

About the middle of 1944 the dosage of mepacrine used in the treatment of malaria in the Middle East for cases arriving from Italy and Sicily was standardized at 3·4 g., given over 6 days, followed by maintenance doses of 0·1 g. daily for at least a month. This became the standard treatment for British and other European troops in 1945. Prior to 1944 the standard Q.A.P. treatment of malaria was used, entailing a dosage of mepacrine of 1·5 g. given over 5 days. Where psychotic symptoms developed they occurred during the course of the intensive mepacrine treatment, usually on the third or fourth day (33 per cent.), or at various times following it, mostly within a

week of termination of intensive treatment (67 per cent.). In only one case did symptoms appear before the third day. Twenty-one days following intensive mepacrine dosage was the latest at which it seemed reasonable to connect the symptoms with the mepacrine. One case was, however, admitted to hospital considerably later (3 months), the symptoms having developed relatively slowly to the point where behaviour was affected;* Kingsbury noted the minimum interval between the commencement of treatment and the onset of symptoms to be 1½ days, and the maximum 12 days (5 days after the completion of the course), with an average of 5½ days; the 9 cases reviewed by Allen *et al.* averaged 6·5 days, the dosage used was 1·5 g. given over 5 days. The dosage given in the series of 35 cases reviewed by Gaskill and Fitz-Hugh was 2·1 g., and the onset of psychotic symptoms ranged from the third day of treatment after 0·9 g. of mepacrine had been taken, to 12 days after the completion of treatment. The most frequent was 6 days after completion of treatment. They note in addition, that the onset was often insidious. Field observes that mental symptoms commence just before or just after the end of treatment. Mergener's case developed mental symptoms on the fifth day, after having taken 2·8 g. mepacrine.

It would appear that the later symptoms become manifest the less favourable is the early progress of the case. As Table I indicates, the cases in which symptoms commenced during the period of intensive mepacrine intake (group A) give a ratio of 1 to 1·5 between those recovering within 2 months and those not recovering within this period, whilst in group B, in which symptoms appeared after the completion of the intensive mepacrine course, the ratio is 1 to 3. The difference, however, is not significant, χ^2 being 1·8 and p 0·15 approximately.

TABLE I.

	Recovered within 2 months.	Not recovered within 2 months.
(*a*) Symptoms commencing during period of intensive mepacrine dosage	4	6
(*b*) Symptoms commencing after completion of intensive mepacrine dosage	5	15

SYMPTOMS.

The types of reactive condition induced by mepacrine may be gathered from Table II.

The two most frequent are the schizophrenic and manic reactive ones. In several cases it was impracticable to designate the reaction as either simply manic or schizophrenic, for they showed features of both types of reaction, an exaltation of psychomotor activity and mood coupled with schizophrenic type of ideation; and the reactions were accordingly designated as manic-schizophrenic in type. One observation stands out clearly, namely, that mepacrine tends to produce a manic rather than a depressive setting. Thus in Table II, though the figures are too small for valid statistical deductions,

* and is included among the mepacrine-precipitated cases.

TABLE II.—*To Show Reaction Types and Main Features of Cases.*

	Group A. (Precipitated by mepacrine.)		Group C. (Precipitated by malaria.)		Group B. (Aggravated by mepacrine.)	
	No.	%.	No.	%.	No.	%.
Schizophrenic reaction	8	34·8	3	37·5	4	57·1
Manic reection	4	17·4	1	12·5	..	
Manic-schizophrenic reaction	4	17·4	..		..	
Depressive reaction	3	13	2	25·0	2	28·6
Confusional reaction	1	4·35	..		..	
Alternating manic and depressive phases	1	4·35	1	12·5	..	
Personality change, ? schizophrenic	1	4·35	..		..	
Behaviour disturbance	1	4·35	..		..	
Paranoid reaction	..		1	12·5	1	14·3
Totals	23	100·00	8	100·0	7	100·0
		% of 23.		% of 8.		% of 7.
Showing schizophrenic features	12	52·2	3	37·5	4	57·1
,, manic ,,	9	39·1	2	25·0	..	
,, depressive ,,	4	17·4	3	37·5	2	28·6
,, confusion ,,	3	13	..		..	
,, personality change	1	4·35	..		..	
,, behaviour disturbance	1	4·35	..		..	
,, paranoid reaction	..		1	12·5	1	14·3

it is seen that mepacrine produces manic and depressive features in the ratio 9 to 4, whilst malaria yields a ratio of 2 to 3. Carrol C. Turner refers to Forrester's experience with the British Salonica Force, 1918–19, that, after mental confusion, depression was the earliest and most prominent symptom found in association with malaria. With mepacrine, as the present series indicates, and as is confirmed by the literature on the subject, the mood change produced is one of elation and euphoria frequently leading to acute mania. A simple confusional picture was present in only one case, though transient and mild confusional symptoms were noted in 2 cases of mania. If there is any one type of reaction that is characteristic of mepacrine psychosis it is the manic-schizophrenic syndrome mentioned above. Though it occurs in distinctive degree in comparatively few of the cases (4 or 17·4 per cent.), it does not appear in group C (precipitated by malaria). Some of the cases diagnosed as schizophrenic exhibited manic features in the early phases, but because they were neither prominent nor persistent they were not labelled manic-schizophrenic. Similarly, several of the cases diagnosed as manic, when fully developed, showed schizophrenic features. These cases reinforce the impression of the peculiar effect of mepacrine in inducing an exaltation of mood coupled with a schizophrenic type of thought disturbance. If the 3

types of reaction manifesting manic and schizophrenic features at one or other time in their course, namely, the manic, schizophrenic and manic-schizophrenic reactions, are grouped together, the incidence of the syndrome comprising the features mentioned is about 70 per cent. It is higher still, 78 per cent., if the 2 cases noted further, which commenced as a manic reaction and personality change respectively and developed later into schizophrenic states, are added.

The onset of psychotic symptoms is signalized by insomnia almost invariably, and in the non-depressive cases by a sudden change of behaviour, with usually an outburst of noisy talkative excitement. The psychotic picture develops rapidly thereafter. There is a brief phase lasting a day or two, characterized by features such as puzzlement, fleeting ideas of influence, a loss of personality and reality sense, a degree of emotionality and, in some cases, transient confusion and disorientation. The mood then changes to the more characteristic and enduring one of elation and euphoria. With this the thought content becomes delusional and the behaviour disordered, sometimes grossly. The delusions are of an exalted character relating mostly to the patient's social position and work. The patient soon begins to interpret his experiences—the loss of inhibition and the elation—in a spiritual, religious light, and this is followed by failure of co-ordination of thought and the expression of bizarre ideas such as are commonly present in typical cases of schizophrenia. The delusional trend of thought is not maintained long enough for the delusions to acquire any degree of systematization. Insight is totally lost only for the brief period of the climax which the development of symptoms quickly reaches; it is present both before and afterwards, if often only fleetingly. When within a few weeks or months improvement commences, it proceeds rapidly to full recovery. In the cases that do not progress to recovery, evidence of dementia quickly supervenes on the acute stage of florid symptoms; there is deterioration of the personality, the manner becomes facile, and affect and interest are dulled.

Turner remarks on the maniacal nature of the reaction to mepacrine; he observes that the condition merges into a "somnolent delirium" or even "deep coma", but this was noted in only 2 cases in the present series, and in both there was a complicating factor that may have accounted for the unusual type of reaction. One case had had infective hepatitis coincidentally with the malaria. Fourteen days after discharge to convalescence the patient became sleepless, restless, noisy, loquacious and aggressive, and was admitted to the psychiatric hospital (78th) in this condition. E.C.T. (twice) and sedation had little effect, and 10 days after admission the patient lapsed into a comatose state, with acetone in the breath and urine and raised temperature (up to 101°). The other case had been treated with mepacrine, though malarial parasites had not been found in the blood. It had, in fact, been labelled as P.U.O., and whatever the nature of the infective agent may have been it appears to have invaded the central nervous system, for the C.S.F. was found to be slightly turbid and the cells increased to 12 per c.mm. No organisms were found. Urine culture was negative, and blood agglutination for typhus, typhoid and *Brucella* not abnormal. The blood showed a leucocytosis with

a count of 12,300 (P. 51%, L. 47%, M. 2%). On the third day of mepacrine treatment the patient developed maniacal symptoms, his physical condition deteriorated with the excitement, and he slipped into a muttering delirium 6 days later.

The two cases seen by Greene, as quoted by Allen *et al.*, are described as cases of "cerebral excitation"—they were hilarious and excited, danced and sang. The 9 cases they review give the following distribution of reactions: excitement, closely resembling mania, 5; mild excitement with confusion, 2; almost no excitement but severe confusion, 2. Gaskill and Fitz-Hugh also note the two types of condition; the one showing increased motor and psychomotor activity, euphoria and expansiveness, auditory and visual hallucinations and delusions, and occasionally disorientation; the other, with insidious onset, showing gradual clouding of the sensorium, disorientation and loss of recent memory and diminished motor and intellectual activity. "The latter patients were withdrawn and seclusive, the affect being one of bewilderment and fearfulness." Udalagma, quoted by Mergener, notes that amnesia follows the acute symptoms of excitement, confusion and disorientation. Mergener's case manifested an initial manic phase followed by a depressive one on the third day in a confusional setting. With improvement, an extensive amnesia was noted. The patient described by Shiers developed exaltation of faculties on each of the three occasions that he took mepacrine.

When psychotic symptoms have preceded the exhibition of mepacrine, their aggravation by it is less dramatic in onset, but is none the less clearly recognizable. The change produced is one of degree and not of kind.

Clinical Pictures.

The clinical pictures presented by the various types of reaction may be better appreciated from the description of a few representative cases:

F. H. B—; aged 36; Flying Officer; bank clerk in civil life; maternal uncle insane, aunt alcoholic; schizophrenic reaction type.

Admitted to hospital for B.T. malaria and placed on mepacrine. Following day suddenly began declaiming to the ward: "The world does not exist, never has and never will. Ladies and Gentlemen, this is the end of the world. I am going to die. For Jesus Christ's sake, kill me," etc. Next day, in more tranquil and clearer state of mind, clearly recalled what he had been saying, explaining that he felt as if the words were being put into his mouth, thought he was going to be killed and felt muzzy. After a fortnight, presumably having shown no further outward symptoms of mental disturbance, he was discharged, but his behaviour became rapidly abnormal again, so that he presented himself at a R.A.F. station completely naked, having walked there in this state some 500 yards from his hotel, and was readmitted to hospital. He reported that he was under the compulsion to find out what was wrong with the world, so as to put it right, that he did not know how he was going to do this, but that as a preliminary he thought he should have his head and legs cut off. His talk was rambling and showed flight of ideas. A week later there was less psychomotor excitement: his manner was, however, facile, and he frequently affected an inane smile. He displayed neither insight nor concern about his circumstances or his future. Occasional thought-blocking was observed. Still referred, but without any display of emotion, to being responsible for the evil in the world. Two months later he was recorded as recovered.

J. J. G—; aged 30; Sergeant, Regular; married; manic reaction type.
Had two attacks of malaria and two complete courses of mepacrine therapy, over a period of 3 months. At the end of the last course became sleepless and restless and his manner changed: was argumentative and paranoidal in outlook. On admission he was talkative, overactive, euphoric and exalted; declared there was nothing wrong with him, and smiled inanely and was generally facile; claimed to have a scheme for repaying the National Debt and asked to see the O.C. hospital regarding it. He recovered rapidly within 3 weeks of admission.

W. H—; aged 31; Regular Officer; manic-schizophrenic reaction type.
Seen when he had more or less recovered from the acute symptoms a fortnight after their commencement, he gave the following account of their development. On completion of mepacrine course and on the eve of his discharge from hospital, he began to experience acceleration and press of thought and a feeling of excitement. Next morning, returning to unit, felt he was talking brilliantly and more than was his wont. Then quickly followed a feeling of light-headedness and puzzlement and disordered thought and behaviour. His talk became rambling and disjointed. Had idea that he was being watched and that he was being influenced in his actions, and resisted this. In recall, says of this period, he felt as if in a trance, only hazily appreciating his surroundings and his actions, and that on admission to hospital he felt worried by changes he noted since he was previously there (2 days ago). Thought he had been dead for a year, and that he had resuscitated himself through will-power. "If I wished I could be God, but preferred to remain on earth. I could live for ever. I felt I was a saint and dead, turned to dust, a speck on top of the pyramid. I could get right within myself outside space. My body was indestructible. I had split the atom and feared I might blow up the whole earth. Black and white had met, I had won a colossal sweepstake and was the Supreme Being. I thought I was the genius who was running the war, and that Churchill, Roosevelt and Stalin had met to consult me." Conceived the idea that he was Prince John (who was born same year as himself), and that he was being used as a "whispering gallery for deception." "I have had ups and downs whilst here. In my ups I think I am God, marvellous at everything; in my downs worry whether I am a degenerate, whether I have infantile palsy and worry about my recent experiences." On admission to hospital, he looked vacant and bewildered, addressed the M.O. casually, asking, "Who am I, what am I?" He was not, however, disorientated, and his memory was unimpaired. His manner was grandiose: mood, one of elation. He was talkative, wrote many disjointed letters, and drew up scribbled plans for finishing the war, for demobilization, etc. Expressed numerous delusions of exaltation—that he belonged to Royalty, was to receive the V.C., get high promotion, etc., and showed such poor sense of reality that he was frequently bidding the staff farewell as he was about to set off in execution of his ideas. At one time or another he mistook identities and manifested depersonalization and feelings of passivity. He frequently passed irrelevant remarks, was hallucinated, especially at nights. At times noisy and overactive. He was, however, possessed of a degree of insight, and was not altogether detached from reality; though he behaved at times as if he were unable to distinguish between fantasy and reality.
He had only one testicle; the other had atrophied he said, following a kick at 17. He was unmarried and was a latent homosexual with strong though repressed homosexual urges. Had guilt feelings regarding masturbation. Had never had intercourse. Was a hard-working and very conscientious officer, and had gained the M.C. at Dunkirk.

R. C. E—; aged 31; Private; manic-schizophrenic reaction type.
In the night following completion of course of mepacrine for M.T. malaria became restless and rowdy, talked irrationally. On admission to hospital was disorientated as to place and person, showed psychomotor over-activity and mild flight of ideas. Slightly elated, and later euphoric, expressed a number of bizarre delusions—his thoughts were being read, he was a Brigadier, had put an end to the war—but he had fleeting insight. The psychiatrist in charge expressed the view that the case had never appeared as a true toxic confusional picture, and considered it a schizophrenic episode. Five months later he was declared recovered.

B. N—; aged 24; Private; single; manic-schizophrenic reaction type.
Whilst having mepacrine treatment for malaria became elated and excited; declared he had received the gift of the Holy Spirit, felt raised above worldly things and believed he would never be able to procreate. He wrote to the Under Secretary of State for War outlining a scheme for establishing a training college for social and religious workers. "I have the greatest message for the world in 2,000 years," he wrote, "I shall never sleep again in this life for the simple reason that it would be totally unnecessary. I am Christ reborn." At times grinning and mumbling to himself. Despite his delusions, his behaviour was correct. Recovered within fortnight of onset of symptoms. Though S.G. 1, had failed twice in his matriculation examination prior to the war; had fallen in love with his crammer's wife. Had recently started studying for it again in off-duty hours.

G. B—; aged 37; Lieutenant; married; depressive reaction type.
Father committed suicide at 44; mother had mental illness prior to death at 55. Trained as solicitor, but not feeling fit to practice took up teaching. History of mood swings. Whilst undergoing mepacrine treatment for M.T. malaria developed mental symptoms, depression without retardation, marked ideas of unworthiness, ideas of reference. Demanded to be sent back to unit to stand trial for desertion, believing his army career to have been a succession of failures. "My name must be mud all over the Arakan. They are talking of throwing me into the water as a fifth columnist." His *rapport* was good and there was no disharmony of mood and thought. Had a slight stammer, tachycardia, exaggerated reflexes.

H. C—; aged 31; Sergeant, Regular; single; confusional reaction.
Had 5 attacks of malaria in the past 2 years. A month ago broke off his engagement. With present malarial relapse was placed on mepacrine and on third day his speech became slow and incoherent, his mood oscillated between elation and depression, vomited after food and was incontinent. Twelve days later his answers were monosyllabic and absurd; he was slow in carrying out physical movements to order and was still incontinent. Physical examination and investigation of blood and C.S.F. were negative. By the time of his admission to hospital, 3 weeks after commencement of symptoms, the mental state had cleared and he rapidly regained normality.

J. W. W—; aged 31; C.S.M., Regular; single; instance of aggravation of pre-existing symptoms by mepacrine.
Returned home after 8 years' service abroad. Had difficulty in accommodating himself to the changed circumstances of life. In his absence overseas, mother and brother had died, and on returning felt alone in the world. Also felt he could not measure up to the job of instructor which he was given. Developed a mild reactive depression, and was recommended for admission to a neurosis centre. Whilst waiting to enter the centre he had a malarial relapse, was admitted to hospital and placed on mepacrine. Insomnia and depression increased, feared he was going insane, and in a state of utter misery, 3 days after commencing mepacrine treatment, made suicidal attempt by cutting wrist. The acute depressive symptoms cleared quickly, but anxiety symptoms persisted for more than 6 months.

Prognosis.

Fourteen of the 23 cases (68 per cent.) recovered within 6 months of onset of symptoms; 1 in 14 days, 4 in 22 to 25 days, 4 in 2 months, 2 in 3 months, 2 in 7 months, 1 in 5 months. The average was 62 days. In Table III the development reached at the end of 2 months is shown. The cases are divided between the manic and schizophrenic sub-group and the remainder. The figures point to an earlier recovery for the manic and schizophrenic sub-group than for the other cases in the group: the ratio of recovered to non-recovered is 7 : 9 for the former and 2 : 5 for the latter. The difference, though suggestive,

is not significant. What the recovery rate would be had it been possible to follow up all the cases to, say, 6 months, it is difficult to say, but of the 15 cases followed up for that period, 14 recovered.

TABLE III.

	Manic and schizophrenic sub-group.		Remaining cases.		Total.	
	No.	%.	No.	%.	No.	%.
Recovered* within 2 months	7	43·8	2	28·6	9	39·1
Not recovered† at end of 2 months	9	56·2	5	71·4	14	60·9
Totals	16	100·0	7	100·0	23	100·0

* Included improved.
† Including improved followed by relapse.

No appreciable difference in the tendency to early recovery between the various clinical types included in the manic and schizophrenic sub-group is detectable (see Table IV).

TABLE IV.

	Schizophrenic type. No.	Manic type. No.	Manic-schizophrenic type. No.
Recovered within 2 months	3	2	2
Not recovered at end of 2 months	3	1	..
Total	6	3	2

Greene's cases, quoted by Allen *et al.*, recovered within 24 to 48 hours. The 9 cases reviewed by them give an average duration of symptoms of 15·1 days. The symptoms in Field's case lasted approximately 1 week. Thirty-three of the 35 in the Gaskill and Fitz-Hugh series recovered within a range of 8 to 85 days, with an average of 23 days. In the 2 patients who failed to recover, they considered a schizophrenic reaction had been precipitated. Five of Udalagama's 7 cases recovered in from 17 hours to 41 days, one died of exhaustion and other complications, and one developed chronic mental symptoms. Bispham's case recovered in 22 days, Mergener's in 14 days.

The stages reached at the end of 2 months by the non-recovered cases in the author's series were as follows:

(*a*) Schizophrenic reaction type:
  (i) Showing further deterioration 1
  (ii) Showing relief of acute symptoms but with residual dilapidation 2
(*b*) Manic reaction type:
  Showing schizophrenic development . . . 1
(*c*) Manic-schizophrenic reaction type:
  Showing dilapidation and instability . . . 1

(*d*) Depressive reaction type:
(i) Showing schizophrenic development . . 1
(ii) Unchanged 2
(*e*) Personality change—? schizophrenic development . 1

It will be observed that in addition to the immediate manic and schizophrenic reactions to mepacrine, 2 cases, commencing in other guises, developed schizophrenic symptoms.

Age-Incidence.

A comparison between cases precipitated by mepacrine and those precipitated by malaria suggests that mepacrine psychosis is more likely to occur in the older than the younger soldier. This may be connected with the observation previously made, that there is a relative preponderance of officers and N.C.O.s amongst the cases of mepacrine psychosis reviewed. In the 20–25 age-group the ratio of officers and N.C.O.s to private and equivalent ranks is 2 : 7, whilst above 25 the ratio is 4 : 3. Table V indicates a ratio of approximately 2 : 3 for the incidence of mepacrine psychosis in the age-groups below and above 25, whilst with psychosis precipitated by malaria it is the reverse—5 : 3. The difference is not, however, statistically significant.

Table V.

Age-period.	Group A. (Pptd. by mepacrine.)				Group C. (Pptd. by malaria.)			
	No.	%.	No.	%.	No.	%.	No.	%.
20–25	9	39·1			5	62·5		
26–35	11	47·8	14	60·9	1	12·5	3	37·5
36–44	3	13·1			2	25·0		

The reaction is more likely to be schizophrenic in type in the younger age-group, 20–25; the other reactions mostly occurring in the older age-groups, 26 and above. This may be gathered from Table VI.

Table VI.

Age-period.	Schizophrenic reaction.		Other reactions.	
	No.	%.	No.	%.
20–25	6	75·0	3	20·0
26 and over	2	25·0	12	80·0
Totals	8	100·0	15	100·0

There does not appear to be any notable connection between personality make-up and the type of psychotic symptoms precipitated by mepacrine. Two of the 3 depressed cases gave a positive family history of psychopathy or insanity, whilst in the manic and schizophrenic sub-group a positive history occurred in 2 of the 16 cases. Emotional stress, other than that of battle, figures as a contributory factor in 4 of the 8 cases of schizophrenic reaction type, as against its occurrence in 3 of the 15 other cases. It is, perhaps, noteworthy that the schizophrenic reaction type is not associated with any history

of earlier breakdowns. There are no significant differences in the previous incidence of malaria amongst the different types of reaction.

Mepacrine staining was noted in 7 cases of group A (30·4 per cent.) and in 3 cases in group B (42·9 per cent.). It was more or less proportionally distributed among the various reaction types. Eight of the 9 cases of Allen *et al.* developed pigmentation. Mepacrine pigmentation is said (Manson) not to occur before the third day, and probably it is not without significance that mental symptoms likewise appear from the third day on, as a rule. The intensity and duration of the staining are affected by intercurrent infections and factors interfering with the elimination of mepacrine, as, e.g., constipation. It may persist as long as 3 months (Manson). The elimination of mepacrine from the body is slow, and may not be completed for as long as a month. The rate of elimination probably influences the duration of symptoms resulting from the mepacrine.

Effect of Convulsive Treatment.

Four cases in group A and 2 in group C received electrical convulsive treatment. Cessation of mepacrine will, no doubt, have played a part in determining such favourable results as were obtained, but the symptoms did not promptly disappear with the stoppage of mepacrine, and the beneficial influence of the convulsive treatment cannot be denied. Four (2 cases of schizophrenia and 2 of depression) of the 6 cases showed improvement and remission against 2 unchanged. Two (one case of schizophrenia and one of depression), however, relapsed shortly after treatment. The number of convulsions given ranged from 2 to 6, averaging 4·6.

Combining such figures cited in the literature, as are relevant, with those of the writer's series provides the following data: The incidence of mepacrine psychosis amongst the cases of malaria treated with mepacrine is 0·25 per cent. (47 in 18,580); the minimum dose of mepacrine which has induced psychotic symptoms has been 0·45 g., and the symptoms have appeared as soon as 1½ days after the exhibition of mepacrine and as late as 21 days. The recovery-rate has been 81·4 per cent. (57 cases out of 70). The duration of symptoms has ranged from half-a-day to 5 months; with an average, for the 51 cases having the averages recorded, of 32 days. 10 per cent. approximately of the cases give a history of previous mental breakdown (8 in 81 cases), and 11·6 per cent. a positive family history (5 in 43).

Differential Diagnosis.

The differential diagnosis of mepacrine psychosis presents two problems: one, the differentiation from cerebral malaria and, two, from an endogenous or biogenic psychosis. The mental symptoms of cerebral malaria, as usually manifested, come on more precipitately and are more acute in nature. In association with hyperpyrexia the patient develops delirious mania or muttering delirium, rapidly becomes unconscious and comatose; or without hyperpyrexia, coma or epileptiform convulsions suddenly develop, preceded perhaps in some cases by such premonitory symptoms as severe headache, drowsiness,

irritability, muscular twitchings. Difficulty of differential diagnosis is only likely to arise in those uncommon instances where mepacrine induces delirium or coma. Similarly, difficulty will be experienced in the presence of the less common and less dramatic forms of cerebral malaria, which may simulate almost any type of mental disorder. The course and severity of the malarial attack and the patient's physical condition may point to the presence of cerebral malaria, whilst the time-relationship of onset of symptoms with the exhibition of mepacrine, and possibly also the improvement of symptoms on ceasing mepacrine, will indicate the presence of mepacrine psychosis. In the cerebral forms, malarial parasites are usually scanty in the peripheral blood. The differentiation from a biogenic psychosis is a more difficult problem, because mepacrine does sometimes precipitate a condition indistinguishable from a biogenic psychosis. If recovery within 2 to 6 months may be taken as presumptive evidence in favour of regarding such cases as those of an acute reaction to mepacrine, there remain 9 of the 23 cases precipitated by mepacrine, which not having recovered at the end of 2 months, become suspect cases of biogenic psychosis. It is likely, of course, as has already been pointed out, that some of these cases, had it been possible to follow them up for, say, 6 months, might have shown recovery. However, reckoning with the possibility that these 9 cases may be instances of biogenic psychosis, we find, on analysing the stages of development reached by them at the end of 2 months, that 2 had developed into schizophrenia, 1 looked very much like a schizophrenia, 3 showed mental deterioration and 3 improvement of the florid symptoms, but with residual dilapidation of the personality. It will be seen, therefore, that at least 5 of the cases, namely, those showing either schizophrenic development or mental deterioration, suggest the presence of a biogenic psychosis. The series of 23 cases divides itself, therefore, into 18 of acute reaction (78·3 per cent.) and 5 of possible biogenic psychosis (21·7 per cent.). It may, of course, be that the biogenic psychosis is to be regarded as a sequel of an acute organic reaction. The evidence is, however, lacking, that it is possible to distinguish in those cases that develop as a biogenic psychosis, an initial stage that can be more accurately described as an acute organic reaction than an acute stage such as commonly ushers in a biogenic psychosis. The fact remains that, whether *via* an acute organic reaction or not, mepacrine precipitates a chronic psychosis in about a fifth of the mental breakdowns attributable to it. The problem of differential diagnosis, therefore, comes to this: whether it is possible in the early stages to distinguish between the acute reaction to mepacrine and a chronic psychosis associated with it. The 5 cases suspected of being instances of biogenic psychosis precipitated by mepacrine comprise 3 cases of depressive state and one each of schizophrenia and mania. The former embrace the total number of cases of depressive state found in the series: at the end of 2 months one was showing schizophrenic development and the other 2 showed no improvement. They were older than the average for the series, their ages being 30, 37 and 43. The two going on to chronic depression gave a positive family history of insanity (father in the one case, sister in the other), and a personal history of life-long feeling of anxiety and inadequacy. The case of

mania developed into schizophrenia. In neither this case nor the one manifesting frank schizophrenia from the start was it possible to point to any features hinting that their prognosis was less favourable than that of the other cases of mania and schizophrenia in the series. The most that can be said, therefore, on the subject of differential diagnosis between a biogenic psychosis and an acute reaction precipitated by mepacrine, is that where the complex of symptoms is predominantly depressive in character the prognosis is less favourable and the condition is likely to become chronic, and that the condition was possibly a biogenic psychosis from the start.

There is not, when all is said and done, much to commend drawing a distinction between an acute reaction and a biogenic psychosis in the early stages of psychotic reaction to mepacrine. Even more unsatisfactory than regarding a case as one of biogenic psychosis, because the symptoms progress into chronicity, is that of calling it, in the final analysis, an organic reaction, when, in fact, the characteristic features of an organic reaction are absent. It is more rational to drop both terms, acute organic reaction and biogenic psychosis, and to diagnose a psychotic reaction to mepacrine simply as an acute reaction, which, because of its specific character in many instances, can, with truth, be termed a mepacrine psychosis.

Precautions in Use of Mepacrine.

Though there is ample statistical evidence that the risk of mepacrine psychosis is infinitesimal compared to the advantages that mepacrine yields both in the prophylaxis against, and treatment of, malaria, it nevertheless calls for alertness to the danger of mepacrine in the odd case. The circumstances which should put the medical attendant on his guard in exhibiting mepacrine are :

(*a*) Recent attacks of malaria (the more so when there has been more than one).

(*b*) Hepatic derangement.

(*c*) Injudicious over-dosage with prophylactic mepacrine.

(*d*) The presence of any factor that may delay the excretion of mepacrine, such as constipation, renal insufficiency, inadequate liquid intake or excessive fluid loss (Allen *et al.*).

The danger signals calling for the stoppage of mepacrine in the treatment of a malarial attack are :

(*a*) Staining of skin.

(*b*) Appearance of insomnia, alteration of conduct—restlessness, talkativeness—or confusion.

If the occurrence of the comparatively uncommon untoward effects of mepacrine are borne in mind, and the appearance of danger signs heeded, there is little risk in giving the dosage of the standard course. To exceed this dosage is, however, asking for trouble. Kingsbury appears to favour limiting the daily dose to 0·2 g. The U.S. Army medical consultants recommend that 0·7 g. as a suppressive dose, and 2·8 g. in 7 days, as a therapeutic dose, should not be exceeded.

SUMMARY.

Thirty-three cases of psychosis associated with mepacrine have been reviewed. In about 70 per cent. a reaction, characterized by schizophrenic or manic or both manic and schizophrenic features, occurs. Depressive reactions are possibly instances of biogenic psychosis precipitated by it. Aetiological factors contributing to the toxic effect of mepacrine are considered. Figures are given for the time of onset of symptoms, their duration and the rate of recovery. The differential diagnosis is considered.

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SCHIZOPHRENIA IN A BOY OF 11 YEARS.

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THIS child developed signs of a serious mental illness during an attack of jaundice three years ago, just before his 11th birthday, and the condition has continued to develop up to the present time, though not quite evenly. At one period the illness was thought to have remitted, but it is evident in retrospect that the remission was, in fact, characterized by regression in behaviour and considerable invalidism. The clinical picture showed sustained mutism and one postural oddity as the most prominent features; and in other respects the child showed an interest in his environment and participation in outside activities which in an adult with a similar diagnosis would be regarded as unusual. There was a morbid heredity in the case and a personality of distinctly pathological character which was clearly shown by his behaviour during his early years. The genesis of the reaction was complicated by an acute infective illness and by two head injuries, neither of which now appears to have been of importance, but which led to much clinical obscurity at the time. The anomalous clinical pattern and the inability of the child to communicate his experiences illustrate the difficulties of diagnosis at this age, and an attempt is made here to outline other possibilities which need consideration and the reasons in this case for rejecting them.

The literature dealing with schizophrenia in childhood is not abundant, and little agreement is evident as to the incidence or frequency of the condition. Lurie and others (1936) have drawn attention to this in a paper based on the survey of 1,000 behaviour problem children at the Child Guidance Clinic in Cincinnati which excluded all organic cases. These were sent to hospital primarily because of behaviour difficulties and not because of psychiatric abnormality in general, and they considered therefore that their own figures indicated that the incidence in general is probably higher than that indicated by the few reports available. Twenty cases (2 per cent.) were psychotic, and of these they considered 13 to be schizophrenic. Unfortunately only 2 case-histories are included in the report. Of equal uncertainty is the clinical pattern, and many writers have warned about the pitfalls in the diagnosis of this condition in childhood, and have attempted to formulate lists of symptoms which are thought to be characteristic of the disease. Bradley (1941) has laid down the following formulation: The child should be psychotic, should have become so after a period of normality, should show positive evidence of "withdrawal"—disturbed social contact; and may show various secondary symptoms—anxiety, speech disturbances, bizarre conduct, and evidence of regression in behaviour. Bradley and Bowen (1941), in a survey of 138 behaviour disorders in children under 13, found 4 schizophrenics and 10

schizoid personalities, and found the most consistent and fundamental symptoms to be seclusiveness (with irritability if disturbed), bizarre behaviour, regression of interest, and sensitivity to comment or criticism. Seclusiveness with irritability was present in all 14 cases and not in the other behaviour disorders. Kasanin and Kaufman (1929) stress the importance of withdrawal and odd behaviour, and Lutz (1937) in a discriminating survey of his own and other cases stresses the importance of withdrawal from every-day contact with the environment. On the other hand Clardy and others (1941) brought all the resources of electroencephalography, air encephalography, and intelligence and personality tests to bear on 7 cases of presumed schizophrenia in an attempt to uncover or exclude organic factors, and these authors commit themselves to the doubt as to whether schizophrenia ever occurs before 10 years, and not even then if puberty has not been reached. Langfeldt (1937) shows a similar scepticism.

More specifically with reference to the case here described are observations on the significance of particular symptoms in children. Lutz (1937) noted speech disturbance to be frequent enough to be of value in diagnosis, and Homburger (1926) noted that prolonged speech disorder in children suggested schizophrenia. Creak (1939) mentions fastidiousness, insistence on orderliness, and stereotyped abnormalities of posture; and she notes also the early and obvious difficulty of these patients in establishing normal relationships with other children. All these things were very clear in this case. Homburger (1926) stresses the pre-eminent importance of studying the development of the illness longitudinally in children if mistakes are to be avoided. He stresses the personality change in the child at the conclusion of each episode, the simplification and regression in speech and behaviour, and a tendency towards a more stereotyped type of thought and emotional response. As Potter (1933) points out, the thinking of a child is concrete rather than abstract, and the power of verbalizing is limited; and delusions if present tend to be simple, naïve and unorganized, and the principal manifestations must inevitably be in the field of behaviour.

The mother of this boy was of the kind described by Despert (1938). She was aggressive, over-anxious and solicitous, at least in the early stages of the illness; and the father was a subdued individual who hardly emerged at all in the family pattern. Evidence concerning the family is conflicting in the literature. Strecker (1922) thought the family situation and other environmental factors of little importance in schizophrenia, but Kasanin and Kaufman (1929), in a study of a series of cases which included 6 nuclear schizophrenics, found 2 foster children, 3 with shiftless, irresponsible fathers, and 1 with a brutal and alcoholic father.

Case history.—The patient is an only son with 3 sisters. His mother, as noted above, was of an anxious, solicitous type, though in the later stages of his illness she appeared to yield up hope of his recovery and reconciled herself very well to the situation. She had suffered from "hysteria" at the age of 20, and at this time she often used to wake suddenly from sleeping, fearing that the house was on fire. On several occasions she fell in the street and described herself as unable to move or speak, but aware of what was said to her. After a period of treatment in hospital these phenomena disappeared and she has not been affected since, except that she suffers from recurrent paroxysmal headaches. The maternal

grandmother is stated to have broken down mentally after a fall on her head, and would often have " blackouts," during which she rushed from the house. She died in a mental hospital in 1930. The patient's father formerly suffered from severe vertigo, which is now much better following an operation on the middle ear. He had in fact had several operations on this ear, and it is interesting to note at this point that the postural oddity shown by the patient was concerned with the protection of the ear on the same side as that on which his father had been troubled.

The birth was normal and the child walked at 13 months, talking if anything a little earlier than the average. After he went to school, at the age of 5, it was apparent that he was more timid and distrustful than others and that he was a solitary child. He preferred to play by himself, and expressed fear and dislike of " rough boys." He was terrified of dying, and required constant reassurance that the trivial cuts and scratches of childhood would not prove fatal; and he was terrified of water, and consistently refused either to paddle or to bathe. He was teased by his sisters and responded with tears, and his schoolfellows called him a " sissy." His parents were unable to induce him to make friends, and if excursions with other boys were arranged he would leave them and return home. During air raids he was not apparently afraid but talked continuously and excitedly. When evacuated with his sister, however, he is reported to have been white and shaken and " transfixed with fear " when the time came for him to leave home.

His Headmaster reports him as above average in intelligence, and he had reached standard 7 before leaving school at the time of his illness. A battery of intelligence tests given to him at an early stage in his illness at a time when he was not mute rated him as superior. During childhood he contracted successively measles, chicken-pox, and whooping cough, not severely, and without any unusual features that might suggest an encephalitis. In 1943 he is stated to have collided with another boy during a race and to have been unconscious for 4 minutes. For the remainder of the day he was " drowsy and stupid," but appeared quite well by the next morning.

The first indication of illness occurred during a mild attack of infective hepatitis in March, 1944, just before his 11th birthday. For no organic reason that could be discerned he complained of his eyes and insisted that the room be darkened. He almost stopped eating, lost a good deal of weight, and, being regarded as a case of anorexia nervosa, he was removed to hospital. After 3 weeks he was much better and went away to the seaside for convalescence, which was terminated abruptly by the fact that he refused to speak or to open his eyes, over which he held his hands. He improved, however, and a few weeks later returned to school, where he remained until November, 1945. During this time he showed no very marked positive abnormalities other than an accentuation of his personality traits—seclusiveness, suspicion and timidity. In November, 1945, however, he was struck on the head with a football (not apparently with great force), and thereafter he became dreamy and vague, put his hands over his eyes again and had to be taken from school. It appears that he did not see daylight for the next 11 weeks, refused to eat from time to time, screamed if he was touched, seldom spoke, and sat all day long in his chair, being dragged or carried about the house when it was necessary to move him. In February, 1946, his family could stand this no longer, and he was admitted to hospital. The notes covering that admission state that he lay in bed with his eyes tightly closed, resisting any attempt to move his limbs, and crying quietly when the attempt was made. One electro-shock was given without improvement, and it was noted at that time that his attitude was resumed an appreciable time before consciousness was regained. Late in July, 1946, he improved dramatically, and in September he was discharged. There was, however, a notable degree of regression in his conversation, which was of a standard well below that which he had previously attained. A representative sample was, " It will be nice at home in me little chair, drinking me little glass of milk, wiv me muvver to look after me."

In October, 1946, he complained of pain in his ear (on the same side as his father's lesion had been), and refused to attend occupational therapy which had been arranged for him or to see a doctor. He insisted on wearing a woollen helmet covering most of his face night and day. When seen by the writer as an out-patient in January, 1947, he had not spoken for 11 weeks, he had screamed and kicked if interfered with, and had made several unprovoked attacks on little girls in his neighbourhood.

He was admitted to hospital on 8 January, 1947. He was mute, and wept if pressed to speak—quietly, copiously, and without apparent distress. He took a hand held out to him and grasped it tightly, as though in need of sympathy, and was quite obedient to any direction except that he should speak. Narco-analysis with sodium amytal was undertaken, and during this a number of stereotyped movements were manifested—he beat his chest and made signing movements with his hands—but could not be induced to speak, nor was any rapport established at any point. There were no technical difficulties, and the failure was certainly a function of the illness and not of the technique. He was examined carefully as an aphasic might be tested, and no abnormality was apparent. He would, for example, select objects the names of which were shown to him on cards, and use them correctly, except that he showed great aversion to a pencil and would not write or make any mark on paper.

In the ward he was generally liked. He was mischievous, but pleasantly so, not averse to gentle horse-play, and able to play draughts and cards. His woollen helmet was taken from him and instead he kept one hand permanently over his ear, without apparent fatigue. This was never taken down for any purpose—he played whist, bathed, ate and slept with it in place. During sleep the hand was undermost, but it was never observed away from his ear. He befriended the ward cat and appeared very attached to it. He showed both interest and curiosity in ward activities, but showed no kind of emotional warmth, and was certainly less active physically than is normal at 13 years. An interesting feature was the meticulous care he bestowed on his clothes, particularly in the matter of the creasing of his trousers, which he placed carefully under the mattress every night. Unfortunately his response to the presence of other children could not be studied.

Late in February treatment by insulin shock was begun. After the first coma he talked for the first time, repeating " Oh dear, Oh dear " several times until the clouding disappeared. During coma his hand came away from his ear, but returned as his sensorium cleared. In the ensuing days, after termination with glucose, he expressed the feeling, " I want to wake up a proper lad; let me hear proper voices, not these voices all around me. I want to get out of this trance, they are playing jokes on me." He screamed loudly at about these times, like a soul in anguish, and it was indeed hideous to hear him. His mental content could not be studied satisfactorily except by his spontaneous utterances. Answers to questions were confused by his echolalia, stereotyped repetitions, and by his great suggestibility. Questions of the kind used with adult schizophrenics elicited quite misleading answers, as would be expected in a regressed child in whom the content was of a very unorganized and simple kind. It is interesting to note that in sopor, when approaching coma, so strongly was his hand held to his face that his weight could be lifted by it. With the onset of coma the hand came away easily and remained by his side. Late in April, in the face of failure to show any improvement, insulin treatment was abandoned, and his condition has remained unchanged since.

X-ray of his skull was repeated on 2 occasions, and was negative. Neither biochemical investigation (17 ketosteroids, etc.) nor electro-encephalography gave results outside the range of normal.

Differential diagnosis.—A neurotic reaction was a clear possibility, especially in view of the apparent friendly relationship the patient was able to establish with adults. Homburger (1926) noted that voluntary silence might occur for very long periods in neurotic children, and Hutter (1939) describes what he calls a psychotic reaction in a psychopathic type in a girl of 15 years, who required artificial feeding for months, and who was mute, negativistic, and showed stereotypies. This case made a good recovery and was discharged, and he differentiates the reaction as a " leichtere psychose," not very helpfully perhaps on the grounds of " nicht wollen," as opposed to " nicht können." This possibility was rejected in this case in view of the length of the history, the totality of the disability, and the positive symptoms which have been described.

Heller's disease requires some consideration. This group of diseases, as it

is likely to be, was described by Weygandt in 1908, and by Heller a little later with a definition of the syndrome by Zappert in 1921; and syndromes more or less similar were described by de Sanctis (1925) and Constantini. The whole question is reviewed by Bovet (1938), who describes a case and stresses the other diagnostic possibilities—post-encephalitis, epiloia, epileptic dementia, and infantile schizophrenia. Bovet does not believe the disease to be an entity, and notes that similar symptoms may occur in juvenile syphilis, post-pertussis encephalitis, trauma, and post-encephalitis. Bovet's own case, it may be noted, was associated with epilepsy. This case, however, falls into an older age-group than that described for Heller's disease, and has not deteriorated with the rapidity always noted in these cases.

Post-encephalitis is a possibility always to be considered, and the absence of neurological signs even at this stage would not of itself eliminate the possibility (Kasanin and Petersen, 1926). No history of acute encephalitis lethargica was forthcoming, but this, too, would not be sufficient. On the other hand, most descriptions have emphasized the hyperkinetic nature of the clinical picture—restless over-activity, emotional lability, impulsiveness and insomnia. Nevertheless, though unlikely in this case, it remains a possibility which only time will eliminate, and Kasanin and Petersen (1926) suggested that mild cases with barely noticeable onset might leave a residual psychosis apt to be diagnosed as schizophrenia, or depression. Encephalitis after the infectious diseases of childhood also usually shows a hyperkinetic pattern (Smith and Trapp, 1944), and here again the history gave no indication of such an event.

Three other possibilities were considered. Of these a severe cyclic depression was rejected. Kasanin and Kaufman (1929) thought it very rare, and when present clear cut and easily differentiated. The onset during jaundice raised the possibility of Kinnier Wilson's disease, but the picture is not at all characteristic, and examination showed no sign of Kayser-Fleischer rings or other abnormalities. The remaining possibility is epileptic dementia, and Kennedy and Hill (1942) draw attention to the possibility of a cortical dysrhythmia without actual fits yet leading to dementia. In their case the diagnosis by electro-encephalography (which showed paroxysmal spike and wave amongst other abnormal features) was confirmed a year later by the appearance of convulsions. The EEG in this case, however, gave no clear-cut information, and there was no evidence to suggest such a diagnosis.

Other possibilities eliminated, it remains to consider the positive evidence of schizophrenia. Adopting (after Campbell, 1925) withdrawal as a fundamental feature, if anything is, of schizophrenia, there were several interesting features about this boy. In a psychobiological study of withdrawal Angyal (1940) describes lack of interest, apathy and indifference as characteristic of the psychological element. It might be said this boy showed interest in the ward games, made friends with the cat, was well aware of what went on around him, and played cards. And yet, can anything be fundamentally more withdrawn than mutism not due to aphasia or anarthria, for his ability to speak from the neurological point of view was well shown during the insulin treatment? Not only was he mute, but no substitutive activity was shown.

He made no attempt to write or to sign or to make any active purposive contact with his fellows. Language or something to replace it is of the highest importance in social integration, and yet this patient had abandoned it. He adopted, and has maintained a stereotyped attitude with his left arm for months at a time, an attitude which to us is meaningless, and is possibly equally so to himself. Under sodium amytal a number of stereotyped movements, devoid of obvious meaning, were liberated, and in hypoglycaemia his speech was impoverished, repetitive, and gave evidence of hallucinosis and paranoid feelings, though the importance of these is hard to assess in that they were only evident in a state of clouded consciousness. Emotionally he appears bleached, and the occurrence of quiet circumscribed weeping not obviously associated with any feeling of grief and only precipitated by interference does nothing to alter the impression.

The prognosis of schizophrenia at any age is in general not very good, and in childhood it is gloomy indeed (Despert, 1938). In this case it could hardly appear less enlightened by any ray of hope in view of the steadily increasing social disability and the length of the history, which is now over 3 years.

Summary.

(1) A case of schizophrenia with mutism in a child of 11 years is described and the differential diagnosis is considered.

(2) A positive family history of mental abnormality and a morbid prepsychotic personality were outstanding features in the case.

(3) The symptomatology was anomalous, and illustrates the difficulty of diagnosis at this age, except in the light of the development of the illness over a long period.

(4) There was no response to any form of treatment.

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TREATMENT OF EPILEPTICS WITH EPANUTIN.

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Modern treatment of epilepsy is directed towards (1) the control of the fits, and (2) the diminution or abolition of the underlying cerebral dysrhythmia.

In this paper I shall give my personal observations on 196 patients treated with epanutin in the Maghull Colony over a period of 6 years.

DOSAGE AND TOLERANCE.

The average optimal adult dose consists of 1 capsule of gr. 1½ given 3 times daily after meals (to prevent gastric disturbances), and I have found that children from 10 years of age upwards can tolerate the adult dose; in the case of younger children caps. epanutin gr. ¾ *t.d.s.* is ample.

Sometimes the daily dose of 3 capsules brings little or no improvement. Yet the addition of a further capsule may abolish the fits altogether.

In one patient, after a period of freedom from fits, the daily dose was reduced from 4 to 3 capsules. The fits then began to recur. Restoration of the dose of 4 capsules abolished them once more.

In other cases, where epanutin alone has not succeeded in completely stopping the attacks, the addition of a nightly tablet of luminal—varying from ½ to 1½ gr., depending on the age of the individual and the nature of the fits—has given most satisfactory results.

Quite a few patients showed little response to 4 capsules daily, but did well on 5.

THE CHANGE-OVER.

In substituting epanutin for other anti-convulsants, viz. bromides, luminal, etc., we usually begin with one capsule the first day, 2 capsules the next, and 3 capsules the next.

The following day a gradual reduction is begun in the dosage of the previous drugs, e.g. one of the 3 doses of bromide mixture is omitted daily, and then the dose of luminal (if any) is reduced by ½ gr. at a time—until the patient is taking nothing but the 3 capsules of epanutin (Coope and Burrows, *Lancet*, March, 1940).

CLINICAL OBSERVATIONS.

Of 196 cases treated, 127 showed definite improvement.

59 showed reduction in total number of attacks.

48 responded to treatment in the first year.

6 ,, ,, 2 years.

5 ,, ,, 3 ,,

32 had immediate cessation of attacks after commencing epanutin, and remain free.
3 showed gradual reduction over 1–6 years.
4 had no attacks after increasing to 4 capsules daily.
1 showed improvement after reduction to alternate doses of 3 and 4 capsules daily.
12 showed improvement following the addition of luminal *nocte*. (One had no attacks following the addition of luminal, and has remained free.)
2 showed reduced minor attacks only.
15 ,, mental improvement without greatly reducing the number of attacks.

Epanutin Discontinued in 69 Cases.

4 showed increased number of attacks.
21 developed mental symptoms immediately on the establishment of the optimal dose (climbing up walls, walking on all fours).
2 developed mental symptoms at 1 year.
1 ,, ,, ,, 2 years.
1 ,, ,, ,, 3 ,,
5 ,, rashes (1 scarlatiniform, 3 morbilliform, 1 purpuric).
12 ,, vertigo, diplopia and blurred vision.
12 ,, tremors, staccato speech.
1 ,, depression and confusion.
3 ,, ataxia.
4 ,, vomiting.
1 ,, stupor.
2 became quarrelsome.

Twelve Selected Cases.

Case 1 (R. D—).—A young woman, 23 years of age, had " uncountable sensations " and one major attack in 1940.

She was put on epanutin 1 capsule *t.d.s.* in March, 1941.

The following year she had one major attack, and the " sensations " completely disappeared.

She had no further attacks (major or minor), and from being a lazy girl, she became bright and alert.

She is now earning her own living in London.

Case 2 (N. T—).—A young woman, 39 years of age, first consulted me 6 years ago. From the age of 14 she had been having an average of 6 major attacks per month. They were very severe in character, and she was constantly injuring herself (and her aged mother who looked after her).

She could not get off a chair unaided.

She was extremely dull and lethargic.

Treatment had consisted of bromide mixtures and luminal gr. 2 *nocte maneque*.

I decided to try her with 1 capsule epanutin gr. 1½ *t.d.s.*, with amazing results.

She has never had another fit. Her whole disposition has altered, and she has now become a happy, contented and useful member of society. She has taken complete control of all household duties, is a regular member of the local church choir, goes to the cinema, and is taking lessons in pianoforte playing. She has

had her hair permanently waved, and has been fitted with spectacles and artificial teeth.

In short—she has taken a new lease of life.

Apart from the fact that she shows some loss of weight, there have been no toxic symptoms.

CASE 3 (M. E—).—During the year 1943 a young woman (aged 28 years) averaged 6 major attacks per month.

In May, 1944, I put her on 1 capsule epanutin *t.d.s.*

Her attacks stopped immediately, and she has remained free. She is a bright, vivacious girl, always singing about the home, trying to make others happy.

She shows a slight degree of hyperplasia of the gums, and there is a slight loss in weight.

CASE 4 (J. T—).—This middle-aged man was admitted to the Colony in 1946, with a history of numerous severe major and minor attacks in 1945.

He was put on epanutin on admission.

The following month he had 1 major and 7 minor attacks, but none since.

He has become much brighter in every way, and is most efficient in his employment as a nurseryman.

CASE 5 (S. G—).—This young man was put on epanutin on his admission to the Colony in March, 1942. In the 9 remaining months of that year he had 6 major and 7 minor attacks.

He was increased to 4 capsules epanutin in 1943, with remarkable results.

	Major.		Minor.	
In 1944 he had	0	.	1	attack.
,, 1945 ,,	0	.	0	,,
,, 1946 ,,	0	.	0	,,

He is a bright, active man, and hopes very shortly to leave to earn his living.

CASE 6 (D. B—).—This patient—a young man of 18—was tried on 3 capsules of epanutin daily in 1940.

	Major.		Minor.	
In 1940 he had	0	.	6	attacks.
,, 1941 ,,	0	.	12	,,
,, 1942 ,,	0	.	24	,,
,, 1943 ,,	8	.	10	,,
,, 1944 ,,	11	.	0	,,
,, 1945 ,,	6	.	0	,,
,, 1946 ,,	0	.	0	,,

In March, 1945, epanutin increased to 4 capsules daily.
No further attacks.

(The next 6 cases show the response to epanutin by children, whose ages range from 9 to 15 years.)

CASE 7 (S. P—).—A girl (11 years).

	Major.		Minor.	
In 1944 (9 months) she had	7	.	24	attacks.
,, 1945 ,,	57	.	23	,,
,, 1946 ,,	2	.	9	,,

Put on epanutin gr. 1½ *b.d.s.* on 4 January, 1946.
No attacks since 9 January, 1946.

IQ/BE.		IQ/FE.		Wt.
95	.	98	.	+ 6 lb.

CASE 8 (J. M—).—A girl (15 years).

	Major.		Minor.	
In 1945 she had	30	.	14	attacks.
,, 1946 ,,	0	.	0	,,

Put on epanutin gr. 1½ *t.d.s.* in December, 1945.
Attacks stopped immediately.
None since.

IQ/BE.		IQ/FE.		Wt.
87	.	86	.	+ 11 lb.

CASE 9 (L. S—).—A girl (9 years).

	Major.		Minor.	
In 1946 (9 months) she had	84	.	174	attacks.
,, 1946 (3 ,,) ,,	0	.	8	,,

Put on epanutin gr. ¾ *t.d.s.* and luminal gr. 1 in September, 1946.

IQ/BE.		IQ/FE.		Wt.
85	.	92	.	+ 3 lb.

Large reduction in major and *minor* attacks.

CASE 10 (F. A—).—A boy (12 years). Admitted 12.xi.42.
Put on epanutin gr. ¾ *t.d.s.* in June, 1943.

	Major.		Minor.	
In 1943 he had	52	.	3	attacks.
,, 1944 ,,	39	.	4	,,
,, 1945 ,,	13	.	0	,,
,, 1946 ,,	0	.	0	,,

In 1945 he was put on the adult dose epanutin gr. 1½ *t.d.s.*
Since then he has greatly improved both physically and mentally (IQ unchanged).

IQ/BE.		IQ/FE.		Wt.
100	.	100	.	− 4½ lb.

No attacks in 1946.

CASE 11 (R. C—).—A boy (15 years) was admitted on 17.vi.43.
Previous to admission he was having a large number of major and minor attacks, although he was on epanutin gr. ¾ *t.d.s.*
In June, 1943, he was increased to gr. 1½ epanutin *t.d.s.* There was a marked general improvement.

	Major.		Minor.	
In 1944 he had	0	.	1	attacks.
,, 1945 ,,	1	.	1	,,
,, 1946 ,,	0	.	0	,,

IQ/OE/E.		IQ/FE.		Wt.
72	.	76	.	+ 8¼ lb.

No attacks in 1946.

CASE 12 (C. B—).—A boy (15 years) was admitted on 13.v.41.
Epanutin was tried soon after admission but discontinued because of dizziness. Tried again in 1943—no recurrence of dizziness but a slight gingivitis. Great improvement generally.

	Major.		Minor.	
In 1942 he had	0	.	504	attacks.
,, 1943 ,,	0	.	609	,,
,, 1945 ,,	0	.	0	,,
,, 1946 ,,	0	.	1	,,

A striking example of the very few instances where epanutin reduced the number of minor attacks.

IQ/BE.	IQ/FE.	Wt.
91	81	+ 9 lb.

(IQ = Intelligence quotient. BE = Before epanutin. FE = Following epanutin. OE = Already on epanutin.)

Weights.

It has been generally believed that patients put on epanutin show a loss in weight.

The following table may prove of interest.

	Numbers.	Gain in weight.	Loss in weight.	Stationary weight.
Men	56	26	22	8
Women	28	2	23	3
Boys	15	14	1	—
Girls	15	14	—	1
Total	114	56	46	12

It will be noticed that there is a greater tendency to lose weight by adult patients—females more so than males. In one of the women's homes 9 out of 9 patients on epanutin lost weight, and in another 8 out of 11 women lost weight.

In the children's homes on the other hand 14 out of 15 boys and 14 out of 15 girls gained weight.

Intelligence Quotients.

One would expect that an improvement in the physical and mental condition due to a reduction of fits under epanutin therapy would produce a rise in the IQ.

Of 30 children tested only 7 showed a higher IQ reading.

The explanation may lie in the fact that, though the convulsive explosions have been abolished, inhibited, or reduced by epanutin, the cerebral dysrhythmia referred to in the introduction may still exist, thus causing a blunting of the intelligence centres in the brain with a consequent lowering of the IQ.

Electroencephalographic recordings may throw some light on this perplexing matter.

Hyperplasia of the Gums.

This was present in 6·6 per cent. of the 196 cases treated, and occurred in spite of careful oral hygiene.

Prior to the administration of epanutin it had not been observed.

It was mostly of a mild type and, in itself, did not require a withdrawal of the drug.

Some cases responded quite well to vitamin C and calcium lactate tablets.

Urinary System.

Transient albuminuria was present in one patient who suffered from recurrent attacks of tonsillitis.

In about 20 per cent. of the urines tested the reaction was alkaline.

Effects on Mentality.

(a) *Beneficial.*—Many patients who, on prolonged bromide and barbiturate administration, showed signs of cerebral stagnation, and often mental deterioration, evinced a remarkable transformation when switched over to epanutin.

Patients who for years had been living in an atmosphere of apathy and introspection suddenly blossomed out into happy, carefree individuals.

Some who had been quarrelsome and difficult to manage took on a mantle of geniality, whilst others, once subject to periodic "brainstorms" became quite docile and pleasant.

(b) *Deleterious.*—In some cases epanutin has had an adverse effect, causing marked mental symptoms such as climbing up walls, walking on all fours, depressed and confused states, etc., as I have previously mentioned, and these usually take place in the very early stages of epanutin administration.

These distressing features disappear on the withdrawal of the drug.

Fatalities.

During the course of treatment 4 patients died, viz. 2 from diffuse broncho-pneumonia following status epilepticus, one from purpura haemorrhagica and one from hyperpyrexia.

Case 1.—A woman patient, 31 years of age, on being changed over to epanutin following a batch of major fits, became very exhausted and complained of dizziness.

Epanutin was then replaced by bromides and chloral, but without effect, for in the following 24 hours she had 15 attacks. Though she had no further fits, she developed a broncho-pneumonia from which she subsequently died.

Case 2.—A young man, 18 years of age, averaging 10 major and 3 minor attacks per month, had for a number of years been kept on bromide and luminal.

It was decided to try him with caps. epanutin gr. 1½ *t.d.s.* A fortnight later he had 2 major attacks, after which he was free for 2 weeks.

Then his attacks came 2 → 4 → 19.

Epanutin was increased to 4 capsules.

There were no further attacks, but the temperature rose to 102° F. → 105° F., and the patient died from diffuse broncho-pneumonia.

Case 3.—A male patient, 31 years of age, had been for 9 years on bromides and luminal, but because of his lethargic state we decided to change him to epanutin gr. 1½ *t.d.s.* in July, 1941.

He definitely improved until 24 August, 1943, when he developed external and internal haemorrhoids which bled rather freely. There were no other clinical signs.

The urine was normal, s.g. 1012, reaction acid, no albumen.

Four days later he developed a purpuric eruption on different parts of the body, fingers, back of neck, right axilla, accompanied by a sudden profound degree of anaemia.

He was transferred to the Liverpool Royal Infirmary, where he died on 31 August, 1943.

CASE 4.—A girl of 16 was admitted on 8.iii.44 suffering from major and minor attacks of epilepsy.

Being rather hysterical she was first tried on a bromide, borax and valerian mixture with luminal gr. 1 at night, but her attacks increased, and she had a large number of minors which appeared to take a lot out of her.

On 27.v.44 I decided to try her with epanutin.

The latter appeared to modify her attacks, but with the onset of her first menstrual period on 13.ix.44 she had a batch of 28 very severe major attacks, and her temperature suddenly flared up, and within an hour showed an axillary reading of 107·4° F. (8 p.m.).

By tepid sponging the temperature was reduced to 106° F. (9.30 p.m.), but the patient died at 12.15 a.m.

The temperature rose again after death.

Unfortunately in all these cases it was impossible to obtain a post-mortem examination.

SUMMARY.

The results of treatment of 196 patients in the Maghull Colony with epanutin have been described, and I shall briefly tabulate my findings and observations.

	Per cent.
Definite improvement	65
Total cessation of attacks	16
Gradual reduction of attacks (over 6 years)	1·5
Reduction in total number of attacks	30
Reduction in number of minor attacks	2
Mental improvement (without greatly reducing attacks)	7·6
Toxic symptoms developed in	30
Mental (13 per cent.) { Immediate	10
Mental (13 per cent.) { Remote	3
Rashes	2·5
Vertigo, diplopia and blurred vision	6
Tremors and staccato speech	6
Hyperplasia of gums	6·6
Depression and confusion	0·5
Stupor	0·5
Ataxia	1·5
Vomiting	2

I wish to acknowledge the invaluable help I have received from Dr. Robert Coope, Consulting Physician to the Maghull Homes for Epileptics (Inc.), from Miss Dutton (Lady Superintendent), Miss Ingham (Head-mistress of our Special School), and from the matrons of the individual houses in the Colony.

Part II.—Bibliography and Epitome.*

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Audiogenic Fits Produced by Magnesium Deficiency in Tame Domestic Norway Rats and in Wild Norway and Alexandrine Rats.

1. Domestic and wild Norway rats and wild Alexandrine rats on a magnesium-deficient and control diet were tested on alternate days with an air blast for susceptibility to audiogenic seizures. All the rats on the magnesium-deficient diet had fits, while not one of the control animals had a fit.

2. Domestic Norway rats fed the magnesium-deficient diet began to have running fits in an average of 8 days (range 3 to 16); wild Norways in an average of 15 days (range 5 to 30); and wild Alexandrines also in an average of 15 days (range 9 to 24).

3. Magnesium-deficient domestic Norways died usually during their first fit, and none survived more than four fits. Wild Norways and Alexandrines had between 6 and 19 fits, but none of them died during the entire test period of 50 to 55 days. (Author's abstr.)

The Effect of Experimental Insomnia on the Rate of Potential Changes in the Brain.

The changes in the potential pattern of the brain have been quantitatively studied during prolonged wakefulness and during mental activity. It was found that:

1. The EEG, quantitatively analyzed on the basis of per cent. time frequency distribution, affords an accurate objective method of studying the effect of mental activity and of the fatiuge of prolonged wakefulness.

2. Changes in the state of attention or alertness as produced by a mental multiplication problem cause an increase in the rate of the electrical activity of the brain. The changes are regular and the extent of the increase parallels the intensity of the mental effort.

3. Increasing periods of experimental insomnia also result in a progressive increase in the rate of the potential changes in the brain.

4. Superimposing an additional mental effort during experimental insomnia results in irregular changes indicating that the capacity of the fatigued brain to further increase its rate of electrical activity in response to such stimulus is reduced.

5. The changes produced by mental activity and by sleeplessness are in the same direction, although under the conditions of these experiments, not of the same magnitude. This is interpreted to indicate that mental effort required either for working a problem or in staying awake during experimental insomnia produces an increase in the rate of the electrical activity of the brain.

(Authors' abstr.)

Effect of Frontal Lobectomy on Blood Sugars of Normal Cats and Monkeys and Adrenal Denervated Cats.

A. In cats in which sham rage can be produced by bilateral frontal lobectomy:

1. The blood-sugar level under dial or nembutal anesthesia is increased within one half-hour following frontal lobectomy, and may continue raised for at least 4 to 5 hours thereafter.

2. No such rise in blood sugar occurs in cats which are anesthetized with barbiturates without frontal lobectomy.

3. Bilateral removal of an amount of occipital lobe approximately equal to that of bilateral frontal lobectomy causes no such rise in blood sugar.

4. There is an accompanying rise of pulse and respiratory rate when blood sugar rises.

5. Previous adrenal denervation causes the blood sugar rise which appears after frontal lobectomy to fall within 3 to 4 hours.

6. No rise in blood pressure occurs after frontal lobectomy although blood sugar, pulse and respiration increase.

B. In monkeys, which do not develop sham rage after cortical ablations, there is no significant change in blood sugar, pulse, respiration or blood pressure after bilateral frontal or occipital lobe ablation. (Authors' abstr.)

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The Use of Electric Shock Therapy in Psychoneurosis.

Fifty patients suffering from psychoneurosis had treatment supplemented by electric shock in the 3-year period between 1942 and 1944. Those patients whose symptoms were largely anxiety, tension and depression were most benefited. Thus among those with reactive depressions 9 of 11 recovered. Of those with anxiety conditions 10 of 12 were recovered or much improved. Seventeen of 18 suffering from a mixed psychoneurosis were similarly benefited. Of the compulsive obsessive group, 4 were markedly benefited while 4 were improved and 1 unimproved.

These results have been compared with those obtained in the earlier mentioned group of 200 psychoneurotic patients whose treatment was not supplemented by electric shock. There was a distinct difference between the two groups in the average length of hospitalization. In the shock-treated group it was 5½ months while in the non-shock-treated group it was 8¾ months. Thus the period of hospitalization of those who received electric shock was less than two-thirds that of the group treated in the pre-shock era.

Thirty-nine per cent. of the 200 non-shock-treated patients and 46 per cent. of the 50 shock-treated patients recovered. This is not an impressive difference considering the discrepancy in the numbers involved. However, 80 per cent. of the shock-treated group were home recovered or much improved, that is distinctly benefited, while but 59 per cent. of the non-shock-treated group were so benefited. Of the 200 patients, 151 received some benefit from treatment while 48 of the 50 shock-treated patients were so considered. (Author's abstr.)

An Evaluation of Shock Therapy.

In view of these findings, it becomes imperative that shock studies concentrate on investigating the readmission and deteriorating aspects of shock therapy. The findings tend to indicate that shock therapy increases the frequency of readmission and thus raises the question of whether the time saved in the hospital at the first admission is not lost by the early readmission following shock treatment. This is particularly significant since it seems likely that shock therapy does produce

deterioration and personality changes which may explain this increased readmission frequency. It is hoped that this paper may stimulate some research in this direction and that more extensive studies will be made. (Author's abstr.)

Brain Metabolism in Man : Unanesthetized and in Pentothal Narcosis.

1. The effect of pentothal anesthesia was examined in 9 subjects on whom 19 observations were made. Blood was drawn simultaneously from the right and left internal jugular veins and the femoral artery in order to determine the right and left cerebral arteriovenous oxygen differences and the right and left cerebral blood flows, which were measured according to the method of Kety and Schmidt to calculate cerebral metabolic rate. When results from both right and left sides are averaged, the oxygen consumption of the brain in the unanesthetized man is 3·3 c.c. oxygen/100 gm. of tissue/minute. This value, however, represents two groups : a higher one with 3·9 c.c. oxygen/100 gm. of tissue/minute and a lower with 2·7. Because of the asymmetric venous return, the cortical component usually appears preponderantly in one of the two internal jugular veins and it is concluded that the portion of the brain with the higher metabolic rate is the cortex.

2. In every instance pentothal anesthesia induced a depression in metabolic rate. The average during the second and third stages of anesthesia is 2·1 c.c. oxygen/100 gm. of tissue/minute, a reduction of 36 per cent. from the control value. The pattern of pentothal anesthesia shows that cortical oxidations are depressed earlier and more profoundly than those of the rest of the brain, which in turn may also be subjected to metabolic inhibition.

3. Because of some effects of pentothal, which cannot be attributed to metabolic inhibition, it is concluded that pentothal narcosis is on a bipartite basis, including metabolic depression as one factor and inhibition of nerve function as another. The clinical signs of pentothal narcosis can be best explained on this bipartite basis.

4. In the resting individual, the high metabolism of the cortex is correlated with its rapid blood flow. It is probable that the parts of the brain with the higher metabolic rates possess a greater vascular complement and that this is a structural adaptation to metabolic requirements. On the other hand, the retarded cerebral blood flow observed with pentothal anesthesia is functional and in part is a response to a decreased metabolic rate. The depression of metabolism induced by pentothal alters both the cerebral arteriovenous oxygen difference and cerebral blood flow. In most instances, both are decreased and, therefore, each of these factors is modified to account for the fall in cerebral metabolic rate. (Authors' abstr.)

Psychological Factors in Men with Peptic Ulcers.

Twenty men with peptic ulcers were studied from the psychosomatic point of view. None were psychologically mature. All of them had strong dependent desires which were secondary to either rejection or spoiling in early childhood. One group utilized the mechanism of over-compensation to deny these desires, resulting in the overt character picture of the driving, hard-working, ambitious business man. However, the authors found that the majority of their patients in a charity hospital were either outwardly passive and effeminate or openly acted out their deep oral desires. Ulcer symptoms developed in all of their patients as responses to frustration of these cravings, when the various defense mechanisms they used to handle such conflicts proved inadequate. (Authors' abstr.)

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VOL. LVII. MARCH, 1947.

APRIL.

NEW YORK NEUROLOGICAL SOCIETY AND NEW YORK ACADEMY OF MEDICINE, SECTION OF NEUROLOGY AND PSYCHIATRY.

PHILADELPHIA PSYCHIATRIC SOCIETY.

Cerebral Anoxia from High Altitude Asphyxiation: A Clinicopathologic Study of Two Fatal Cases with Unusually Long Survival and a Clinical Report of a Non-fatal Case.

Three cases of anoxic anoxia occurring in aviators while engaged in combat are presented in detail. In 2 cases the anoxia proved fatal in 40 hours and 3 weeks respectively, and in the third instance the patient was observed for a period of 3 weeks and was then transferred to the United States. The degree and duration of anoxia in each case are not completely known. In the first, the accident occurred at an elevation of " more than 20,000 feet," the patient being found unconscious 5 minutes after completion of a bomb run, at which time resuscitation was commenced. In the second, the patient was exposed to an atmosphere at 24,000 feet for approximately 10 minutes. In the third, it was at 27,000 feet that the oxygen tank of the plane was shot away, necessitating a rapid descent to 7,000 feet, during which time no effort could be made to revive the patient.

In the case of approximately 40 hours' duration (Case 1) a conspicuous necrosis of ganglion cells was observed in laminas III to VI of the cerebral cortex, the striatum, the cerebellum, Sommer's sector of the hippocampus and the anterior horns of the spinal cord, mostly focal in character, and degeneration of myelin in the internal capsule. Also observed were early proliferation of the fixed tissue cells of the leptomeninges and vascular adventitia and mild exudation of lymphocytes and neutrophils into the meshes of the arachnoid, the perivascular spaces, and, to a limited extent, the parenchyma of the brain. In the case of 3 weeks' duration (Case 2) the changes were of virtually the same location except that the cerebral white matter, brain stem and spinal cord were relatively spared. The profound damage in these cases of sudden and severe anoxic anoxia is strikingly similar to that observed in some of the other forms of anoxia. (Authors' abstr.)

Incidence of Anisocoria and Difference in Size of Palpebral Fissures in Five Hundred Normal Subjects.

Five hundred neurologically normal persons were studied with reference to the incidence of anisocoria and of differences in the width of the palpebral fissures. Nearly 17 per cent. of the patients showed a slight but perceptible anisocoria. In 4 per cent. the difference in pupillary size was pronounced. Inequality of the palpebral fissures of a slight degree was noted in nearly 36 per cent. of the patients. Pronounced differences were noted in nearly 6 per cent. When both the pupils and the fissures were unequal, the smaller pupil and the narrower fissure were on the same side in 77 per cent. of the patients. However, in nearly one-half the patients with anisocoria the fissures were equal, and inequality of the fissures was accompanied with equality of the pupils in 73 per cent. of the patients, revealing unequal fissures. Consequently, inequality or imbalance of sympathetic innervation could be held responsible for at least some instances of the observed anisocoria, but in general, no gross factor could be identified as responsible for any asymmetry of sympathetic stimulation. In other instances differences in errors of refraction may play a role in causing unequal pupils. The incidence of inequality of the palpebral fissures is relatively high, and mild degrees may be considered without significance. Anisocoria should never be dismissed as an anomaly until a thorough search reveals no etiologic basis for it. (Author's abstr.)

Relation of Mental Imagery to Hallucinations.

The mental imagery of 40 patients with schizophrenia, 10 patients who had recovered from an alcoholic hallucinosis, and 114 normal subjects was tested.

Schizophrenic patients with auditory hallucinations were found to have a significantly lower mean percentage of auditory imagery than either normal subjects or schizophrenic patients without auditory hallucinations. The normal subjects and the schizophrenic patients without auditory hallucinations did not differ significantly in this respect.

Patients who had recovered from auditory hallucinosis were found to have a significantly lower mean percentage of auditory imagery than normal subjects. The mean percentages of auditory imagery for patients who had recovered from an alcoholic hallucinosis and for schizophrenic patients with auditory hallucinations did not differ significantly.

Not only do these findings disprove the old theory that auditory hallucinations are exaggerations of predominating auditory imagery, but they suggest the new concept that one of the factors responsible for auditory hallucinations is relatively deficient auditory imagery. (Authors' abstr.)

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ARQ. DE NEURO-PSIQUIAT., BRASIL.

VOL. V. MARCH, 1947.

BRAIN.

VOL. LXX. MARCH, 1947.

Prefrontal Leucotomy : A Neuro-anatomical Report.

An anatomical study of 7 leucotomized and 1 lobectomized human hemispheres has led to the following results :

(1) The anteromedial nucleus of the thalamus projects to at least the pre-callosal part of the cingulate gyrus ; the anteroventral nucleus to more posterior parts of the cingulate gyrus ; and the axial orientation of this projection in at least anteromedialis is the same as in animals.

(2) There is some evidence that pars magnocellularis of the dorso-medial nucleus of the thalamus projects to only the medial half of the orbital region of the prefrontal cortex (areas 12 and medial 11), while the portion of pars parvicellularis of the dorsomedial nucleus which lies adjacent to pars magnocellularis projects to the lateral half of the orbital region (areas lateral 11 and probably 47). The dorsolateral portion of pars parvicellularis is found degenerated after lesions of areas 45 and 46 in the inferior frontal gyrus, the ventrolateral portion after lesions affecting the vicinity of area 8 in the superior frontal gyrus. Degeneration of the central portion of pars parvicellularis seems to correlate with a lesion involving areas 46 and 9 (or 10) in the middle frontal gyrus. An anteroposterior axis in the dorsomedial nucleus tends to project to an anteroposterior axis in the frontal lobe.

These observations are not necessarily incompatible with Walker's concept of an axial correlation between the dorsomedial nucleus and the prefrontal cortex in monkeys ; but there are some disagreements in detail which necessitate further comparative studies.

(3) Degeneration in nucleus submedius of the thalamus is found to take place after leucotomy. It occurs after involvement of approximately the same areas as

those whose damage leads to degeneration in the adjacent ventrolateral portion of pars parvicellularis of the dorsomedial nucleus, i.e. the vicinity of area 8 in the superior frontal gyrus.

(4) The most anteromedial portion of the ventral nuclear complex of the thalamus projects to area 6, and not more rostrally. The anterior part of the reticular nucleus of the thalamus appears to share in this projection to area 6.

(5) The anterior thalamic radiation courses through the tip of the ventral nuclear complex. Thereafter the projection fibres from the medial parts of the dorsomedial nucleus run in the ventral half of the anterior limb of the internal capsule, while the fibres from the central and lateral parts of the dorsomedial nucleus, together with projection fibres from the anterior nuclear complex, run upwards into the dorsomedial half of the anterior limb of the internal capsule.

(6) The existence of a prefronto-pontile tract (Arnold's Bundle) in the human brain is confirmed. It is tentatively suggested that it arises in area 10. It passes down the medial aspect of the anterior limb of the internal capsule and terminates in dorsomedially situated cells of the anterior pons. The question of termination of elements of the tract in the subthalamic nucleus and substantia nigra is discussed.

(7) Preliminary investigation of long association tracts related to the prefrontal cortex reveals definite degeneration only in fibres which may represent the uncinate fasciculus and fasciculus cinguli. No degeneration is discernible in the subcallosal, superior longitudinal, arcuate or inferior occipito-frontal fasciculi. A sclerosed tract which runs for some distance adjacent to the lateral border of the subcallosal fasciculus is considered to represent part of the course of the projection fibres of the anteromedial nucleus of the thalamus to the cingular cortex, and perhaps also fronto-occipital long association fibres. (Authors' abstr.)

Disease of the Nervous System Occurring Among Research Workers on Swayback in Lambs.

(1) Four of the 7 individuals who worked intensively in their respective roles, on the demyelinating disease known as swayback in lambs, developed a disease of the central nervous system, which is clinically indistinguishable from disseminated sclerosis.

(2) This might be due to an hitherto unidentifiable occupational hazard of chemical research workers.

(3) This might also indicate that there is some causal connection between swayback and disseminated sclerosis, and some consideration has been given to speculation along these lines, viz. to some common infective agent acting only in the presence of a trace element deficiency.

(4) As swayback is a demyelinating disease and can be prevented by copper therapy, it is apparent that trace element deficiencies should be considered in connection with analogous diseases of man. (Authors' abstr.)

Some Physical Aspects of Encephalography.

Gas does not rise beyond the first constriction which it encounters when it is injected into a glass model of the ventricles.

Gas passes readily through the cavities when an element of elasticity is introduced into the closure of the model.

The flow of gas within glass models is analyzed and the findings correlated with encephalograph *in vivo*. It is believed that the lateral ventricles undergo expansion during encephalography. The expansion (and the entry of gas) depends upon the rise of the pressure at the distal end of the gas bubble caused by replacement of fluid in the lower midline cavities. The increment can be measured by the vertical extent of the column replaced. The expansion of the ventricles leads to expansion of the cerebral hemispheres, and downward displacement of cerebrospinal fluid from the subarachnoid space. The pressure differential expansion is greater when the head is erect. Hence the degree of expansion is greater when the head is erect than when it is flexed. This is the only means of entry of gas when the head is flexed sufficiently to bring the foramen of Monro below the termination of the aqueduct. When the head is erect, however, the elastic recoil of the cerebral hemispheres produces a downflow of fluid after each inflow of gas. This also contributes to the better filling in this posture.

The manipulations found necessary to transfer gas from one cavity of the model to another are described and the application of these findings to the radiography of the ventricles is considered. (Author's abstr.)

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The Effect of Oral Administration of Lactic Acid upon the Clinical Course of Depressive States.

The authors are well aware that the data offered in this paper are far from being complete and are by no means conclusive. Nevertheless, the results seem to indicate that the oral administration of lactic acid and sodium lactate influences the mood of patients in depressive states. In some instances the influence is no more than an improvement in sleep. In others, improvement in mood has occurred without any change in content of thought. In the patients who recovered from the depressive state under L.A., improvement in sleep, in mood and ultimately in content of thought became apparent. The authors do not wish to present this

method as a new or well-defined form of therapy of depressive states, but they feel that the evidence from this work seems to indicate that the oral administration of lactic acid and sodium lactate can exert some influence on the mood, suggesting that the role of carbohydrate metabolism associated with depressive states bears further investigation.

It is well known that almost all patients with depression ultimately recover. Might it not be, therefore, that what we have interpreted as improvement and recovery with L.A. is no more than what would be observed in the spontaneous course of the disease ? Their data seem to suggest, however, that when so many patients show improvement with the administration of this metabolite that this might not be mere coincidence. If the L.A. is withdrawn two or three days after the sleep has shown initial improvement, the patient usually returns to the disturbed sleep pattern, but sleep can frequently be restored again by renewed administration. This is the more striking as many of the authors' patients even with considerable doses of barbiturates or paraldehyde still had sleep disturbances. Another question might be raised as to the role of the diarrhoea associated with the ingestion of L.A. in effecting the improvement, but usually the patient experiences diarrhoea only during the first two or three administrations when his condition is still subjectively and objectively unchanged. In addition, diarrhea produced by purgatives has no effect on depressions. Changes of the acid-base balance or the effect of the intravenous administration of lactic acid were not studied. With regard to the role of suggestion, it must be reiterated that every attempt was made to preclude the use of psychotherapy, even in its subtle forms, and if suggestion were helpful in cases of depression, the introduction of convulsive therapy would have been unnecessary. Another objection might be that the authors' cases were only so slightly depressed that a short period of rest or the protection of a hospital environment might have served as reason for the improvement. This could be true in certain instances, although practically all of their patients were so deeply depressed that electic shock therapy had been recommended.

Work, physical exercise, " total push " and physiotherapy have long been regarded as adjuvants, if not sole remedies, in the cure of depressive states. Convulsive therapy might conceivably be looked upon as severe and concentrated muscular activity in which the stimulus to the central nervous system would be incidental only. If we now see that lactic acid given by mouth can produce effects similar to various physical therapies, we might well consider lactic acid as the common denominator in all these methods of treatment.

(Authors' abstr.)

Conditioned PGR (Psychogalvanic Response) in States of Pathological Anxiety.

The authors have endeavoured to investigate the effect of pathological anxiety on the rate of conditioning, in order to determine whether the rate of conditioning might be eventually a valuable objective indicator of the degree of anxiety. The conditioned stimulus was a nonsense-syllable of low association value, the unconditioned stimulus was the sound of a buzzer and the conditioned response was the PGR (psychogalvanic response).

Two groups were used in this experiment. One was a group of 82 Hunter College students and the other a group of 51 patients from the In-patient Department of the Payne Whitney Psychiatric Clinic, some of whom had anxiety and some of whom did not, according to psychiatric observation.

The criterion of conditioning for the test was three successive marked responses to the conditioned stimulus when unaccompanied by the sound of the buzzer. The score was determined by counting the number of times the buzzer was sounded before this criterion was fulfilled.

All but 4 of the normal group had a score of from 14 to 58, while with but one exception all of the patients who were diagnosed by the psychiatric staff as having anxiety had a score of 14 or less.

The repeat correlation on 36 of the normal subjects was ·88. On repeat tests given to the patients the score in most instances increased or decreased as their anxiety increased or decreased, according to psychiatric diagnosis.

Differences in age, sex and general intelligence did not appear to affect the rate of conditioning. (Authors' abstr.)

MAY,

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Neurotic Predisposition and the Disorganization Observed in Experiments with the Cambridge Cockpit.

It is contended that the disorganization of activity observed in the Cockpit test is essentially similar to that occurring in the neurotic reactions of aircrew to stress. In tests, the " overactivity " reaction resembled the acute anxiety reactions of aircrew, and the " withdrawal " reaction resembled various neurotic reactions, of which some have been labelled " hysteria." It has been shown that in some cases the effects observed in the tests were part of a more general reaction comprising frankly neurotic features. In some cases the test reaction recapitulated a previous neurotic illness. It has also been shown that the degree and type of the disorganization observed in the test depended upon the grade and type of the neurotic predisposition as assessed at an independent psychiatric interview. The test behaviour of experimental subjects, whether fit pilots, or pilots suffering from overt neurotic symptoms, tended to be of the kind expected. Thus the test behaviour was abnormal in two-thirds of the patients, but only in one-quarter of the fit pilots. The " overactivity " reaction was shown especially by those assessed as obsessional at interview, whereas the " withdrawal " reaction tended to be shown by those of hysterical disposition. (Authors' abstr.)

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VOL. VI. APRIL, 1947.

Parenchymatous Cortical Cerebellar Atrophy Associated with Pick's Disease.

1. In a case of parenchymatous cortical cerebellar atrophy the loss of Purkinjë cells was combined with practically complete disappearance of nerve cells in the rostral three-fourths of the inferior olivary nucleus.

2. The atrophic changes in the cerebellum were associated with similar alterations in certain parts of the cerebrum where they were interpreted as those of Pick's disease.

3. Some features of the clinical history suggests that the condition was familial.

(Authors' abstr.)

On the Mechanism and Localization of the Symptoms of Electroshock and Electronarcosis.

The symptoms of electroshock and electronarcosis in decerebrate, uni- and bilateral decorticate preparations, and in animals with one deafferented hind leg were compared with the syndrome of shock and narcosis in normal animals.

In the decerebrate preparations shock and narcosis produced an enhancement of the decerebrate rigidity and an increase of the respiratory rate. It was postulated that in the normal animal these symptoms of medullar stimulation are masked by inhibition, produced by the stimulation of structures situated rostrally of the decerebration section in the midbrain.

The respiratory arrest observed in the course of electroshock and electronarcosis in the intact animal is considerably shortened in the decerebrate preparation. This indicates that the arrest in the normal animal is not caused by a paralyzing action of the current directly on the respiratory centre, but again by inhibition of that centre.

Uni- and bilateral decortication did not produce major changes in the symptoms of electroshock and electronarcosis. This may indicate the relative unimportance of the cortex for the production of these syndromes.

The observations on animals with one deafferented limb made it clear that in general no spinal reflex mechanism is involved in the production of the extensor contractions which are part of the shock and narcosis symptoms.

(Authors' abstr.)

Temporal Lobotomy.

A theoretical discussion is presented of the psycho-physiological mechanism of the prefrontal lobotomy and of the possible importance of the temporal lobes for emotional integration.

A new psychosurgical operation or temporal lobotomy is described by which a bilateral and deep section of the temporal lobe is produced in front of the tip of the temporal horn of the ventricle. The physiological aim of this operation is to cut the uncus, the beginning of the hippocampus, the uncinate fasciculus and other associational intercortical pathways.

The operation has been tried on two patients. One of them with predominant auditory hallucinations and strong associated emotional reactions, was not relieved by the temporal lobotomy. A secondary prefrontal lobotomy was more successful, although there were also more profound changes in the mental reactions after the frontal operation. In another case of a long-time deteriorated schizophrenic the temporal lobotomy was performed after an unsuccessful prefrontal operation. Some lessening of agitation was obtained. No gross neurological disturbances appeared after the temporal lobe sections and only in the first case was there some temporary difficulty in understanding speech and some loss of hearing. Further experience is necessary to evaluate fairly this operation, despite the fact that its first results have not been very striking. Larger sections of the temporal lobes may be necessary. (Author's abstr.)

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VOL. X. JANUARY, 1947.

Synaptic Conduction to Giant Fibers of the Cockroach and the Action of Anticholinesterases.

1. A large number of sensory fibers from the cercus of the cockroach enter the 6th abdominal ganglion and form synaptic connections with 12 to 16 giant fibers which ascend the cord.

2. These synapses conduct synchronously up to 400 stimuli per second with a delay of 0·6 to 1·5 milliseconds. Spatial summation occurs.

3. Treatment with DFP causes marked synaptic facilitation alternating with periods of synaptic block, a condition which persists after washing in saline. The conduction process in the giant fibers appears to be unaffected by DFP in the concentrations used. It is concluded that trans-synaptic conduction is dependent on cholinesterase.

4. In the presence of DFP acetylcholine blocks trans-synaptic conduction, though alone it has no action.

5. Physostigmine, prostigmine and strychnine block trans-synaptic conduction with no sign of the facilitation and after-discharges characteristic of DFP. These drugs fail to sensitize the ganglion to the blocking action of acetylcholine.

(Authors' abstr.)

Generality of the Role of Acetylcholine in Nerve and Muscle Conduction.

Evidence suggesting the generality of an essential role of ACh in the conduction of nerve and muscle has been offered in two different types of experimental approach.

One method is based on the effect of cholinesterase inhibitors on the action potential of different kinds of nerves and of muscle.

1. As samples of sensory nerves, the optic and superficial ophthalmic nerves of *Raja erinacea* were selected. DFP abolishes reversibly the action potentials of sensory as well as of motor and mixed nerves.

2. The effect of cholinesterase inhibitors on adrenergic nerves was tested in experiments on the splanchnic nerve of *Rana catesbeiana*. Eserine abolishes the action potential of this nerve. The effect is easily reversible.

3. The action potential of the curarized frog's sartorius muscle (*Rana pipiens*) is completely and reversibly abolished by DFP. Eserine has the same effect.

Another type of approach, by which the assumption of an essential role of ACh may be supported, is evidence for the presence of the specific cholinesterase which is known to occur only in nerve and muscle.

4. In both sensory nerves in which the effect of DFP has been demonstrated, the optic and superficial ophthalmic nerve of *Raja*, specific cholinesterase is present in a concentration within the range that had previously been found in other nervous tissue and in muscle.

5. Cholinesterase is also found in high concentration in adrenergic nerves, i.e. the splanchnic nerve of the bullfrog and the postganglionic fiber of the superior cervical ganglion of cat. In the former the rate of ACh hydrolysis is 10 mg./g./hr. and in the latter it is 25 mg./g./hr.

6. In *Tubularia*, one of the hydrozoan coelenterates, which is the lowest group of animals to possess a nervous system comparable to that of higher animals, and in *Planaria*, the specificity of cholinesterase was found to be as high as that of any other cholinesterase tested. (Authors' abstr.)

Giant Nerve Fiber System of the Crayfish. A Contribution to Comparative Physiology of Synapse.

The giant fibers in the central nervous system of the crayfish, *Cambarus clarkii*, were isolated in the oesophageal commissures and stimulated. It was found that the same peripheral mechanisms are brought into action by stimulation of any of the four giants.

The two medial giants are independent of each other. They conduct at a speed of 15–20 meters per second. They differ in no respect from peripheral nerve fibers.

The segmented lateral giants are interconnected in all ganglia posterior of the 4th thoracic. Stimulation of one invariably leads to excitation in the other. Their conduction speed is 10 to 15 meters per second. Transmission from one segment to the next of the same fiber is accomplished within 0·1 millisecond. The crossing time from one fiber to the other causes a similar delay in different ganglia, and takes about 0·5 millisecond. By cutting the lateral giants between different ganglia it is possible to delay the arrival of the impulse by forcing it to cross repeatedly.

In fresh preparations motor fibers of the roots of the abdominal ganglia are excited by stimulation of each of the four giants. The place of transfer between the lateral giant and the root at the same side is more peripheral than that with the medial giants.

The relation between impulses in the giants and the roots was studied. The first and third routes of the abdominal ganglia were found, in fresh preparations, to be excited by each giant impulse, no matter how closely they followed each other. With high frequencies of stimulation blocking of the root fiber occurs, preventing the passage of impulses. This blocking is not due to a refractory period, when the giant is stimulated with double shocks, the second impulse is effective under these conditions.

Aged preparations especially show a lengthening of the refractory period, in which a second giant fiber impulse does not cause a root potential.

Whereas the connections of the different elements in the lateral giants conduct with equal facility in either direction, the transmission from the giants to the roots is one-way. (Author's abstr.)

Topographical Representation of Muscles in Motor Cortex of Monkeys.

The topographical representation in the motor cortex of individual muscles acting over the ankle-joint has been investigated in nine macaque monkeys under Dial anesthesia. Simultaneous responses of eight muscles were recorded by isometric myographs during stimulation of the motor cortex.

The leg area was systematically explored millimeter by millimeter with a Goodwin thyratron stimulator and a unipolar electrode. The records were analyzed for evidence of muscle representation in terms of "solitary responses," tension-ratio and latency. Not only individual muscles, but also slips of a muscle have a focal point in the cortex from which a solitary response of that muscle is elicitable or the response is stronger and more prompt relative to other muscles. Among the muscles investigated, the anatomical flexors were found less responsive than the extensors. The inhibition of flexor responses by simultaneous excitation of the cortical extensor points is one factor in the unresponsiveness of the flexor muscles. Of the extensor group the muscles acting on the toes are more responsive than a muscle acting on the ankle. A hypothetical organization of Betz cells into a field composed of a focus and a fringe, the latter exhibiting overlap, is suggested to account for the type of muscle representation observed. (Authors' abstr.)

The Effect of Sedatives upon Delayed Response in Monkeys Following Removal of the Prefrontal Lobes.

Two monkeys which before operation gave a satisfactory performance in the delayed response experiment were unable to do so after removal of the prefrontal lobes.

Following intraperitoneal injections of nembutal or dial they were able to make scores reliably above chance up to delays of 25 seconds.

After withdrawal of drugs one animal retained this ability.

The significance of these results is discussed from the point of view that inattention due to increased activity and distractibility has been the cause of previously reported failure rather than the loss of immediate memory or retroactive inhibition. (Author's abstr.)

Effect of Di-isopropyl Fluorphosphate (DFP) on Action Potential and Cholinesterase of Nerve. II.

1. Studies on the correlation of the effects of DFP on the action potential and cholinesterase activity have been extended to the giant fibers of the stellar nerve of squid and to the fin nerve.

2. The effects of a range of concentration of DFP have been studied in these nerves and in the lobster cord.

3. The technique of the experiments has been modified to permit continuous recording of the action potential of the nerves during exposure to and recovery from the compound.

4. On exposure of the nerves to 1 mgm. of DFP at room temperature (22–25° C.) the action potential is abolished slowly. The action potential of the stellar nerve disappears in 10–12 minutes; that of the fin nerve in 30–40 minutes.

5. Higher concentrations of DFP result in quicker action. Three to four mgm. of DFP abolish the potential of the stellar nerve in 2–4 minutes. Five mgm. of DFP act on the giant fibers of the lobster cord in the same time.

6. The reappearance of the spike during recovery from exposure to the higher concentration is more rapid than when lower concentrations of DFP have been used. The spikes reappear within a few seconds and recovery is complete within a few minutes.

7. Tested under the same conditions, the action of eserine on the stellar nerve is slower. The molar concentration of eserine must be about twice as high as that of DFP to obtain the same rate of action. This indicates a lower rate of penetration of eserine.

8. After the electrical activity of the nerves of the three preparations had returned to normal, the cholinesterase activity was determined. In all cases the enzyme activity was about 20 per cent. of untreated control nerves.

9. In similar experiments performed on the abdominal cord of the lobster, but at 5–7° C., the remaining enzyme activity was close to 50 per cent. as was to be expected from the lower rate of the irreversible inhibitory process at low temperatures.

10. The correlation established between the presence of cholinesterase and the electrical activity of the nerves of the squid and lobster has been extended to the case of the bullfrog and frog sciatic nerves. Two hours after injection of massive doses of DFP into the animals, cholinesterase was still present in the nerves.

11. The presence of the cholinesterase was demonstrated by the method of bio-assay. It is shown that the manometric technique is not adequate in this particular case, due to a combination of adverse factors. (Authors' abstr.)

Effects of Potassium on the Endplate Potential and Neuromuscular Transmission in the Curarized Semitendinosus of the Frog.

1. A technique for intra-arterial injection in the isolated muscle is described.

2. Small increases of K first facilitate and then depress neuromuscular transmission. It is suggested that both of these effects of K may involve alteration of the excitability of the muscle fibers and alteration of the size of the e.p.p.

3. During the period of depression a response is followed by prolonged reduction of responsiveness. It is pointed out that K diminishes restoration in some manner not revealed by the electrical signs of repolarization. (Authors' abstr.)

MARCH.

Decerebrate Rigidity.

It is known that intravenous injection of appropriate doses of sodium cyanide results in a transient state of true decerebrate rigidity. The present experiments show that during the period of functional decerebration the electrical activity of all structures above the midbrain is absent. The activity of the suppressor region in the bulbar reticular formation is slightly depressed, while that of the facilitatory region in the lateral pontile tegmentum is unchanged or increased.

The hypothesis is advanced that both NaCN and appropriate lesions in the midbrain produce decerebrate rigidity by interrupting all afferent impulses to the bulbar suppressor region, thereby causing a deprivation-paralysis of that structure. The facilitatory region in the lateral pontile tegmentum, however, continues to receive afferent impulses from the cranial nerve nuclei as well as from the cord, and thus its facilitatory influence on the internuncial pools of the ventral horns of the cord continues unchecked. The balance between inhibitory and facilitatory impulses arriving in the cord is thereby upset. In the absence of impulses from the suppressor region in the bulb, this internuncial activity is greatly increased and is manifested peripherally as extensor rigidity.

It has been shown that the decerebrate state induced by NaCN may be modified by small lesions in the reticular formation of the brain stem and, furthermore, that it may be entirely prevented by lesions which selectively destroy the facilitatory region in the pontile tegmentum. Lesions restricted to the midline suppressor region, on the other hand, yield decerebrate rigidity. Although this hypothesis cannot be proven by the facts available at present, it seems to explain all the known observations regarding decerebrate rigidity. (Author's abstr.)

Convulsive Activity Induced by Fluoroacetate.

(1) Intravenous injection of sodium fluoroacetate causes local, rhythmic, seizure discharges in subcortical structures. These occur at the time when the animal is exhibiting repeated tonic seizures.

(2) There is no clear correlation between the electrical activity of the cortex and the paroxysmal activity occurring in the thalamus, hypothalamus or reticular formation of the pons.

(3) Dome and spike activity has been recorded from the cortex synchronously with rapid seizure discharges in subcortical structures. (Author's abstr.)

Injury Potentials Along Peripheral Nerves in Relation to Histological Structure.

The injury potentials at different levels of peripheral nerves in the cat's lumbosacral region have been measured. They were found to diminish continuously from the spinal nerve roots towards the periphery. The proportion between the injury potentials of the ventral roots and the tibial nerve was 4 : 1. Ventral roots had, on an average, 4·7 mV higher injury potentials than dorsal roots.

This drop of the injury potential along the nerve was found to be related to the calibre of the nerve fibres at the different levels. A general correlation was observed between cross-sectional fibre area per total nerve cross-sectional area on the one hand and injury potential on the other, so that a greater relative fibre cross-sectional area corresponded to a higher injury potential.

Calibre spectra are presented for a number of nerves at different levels as well as for motor and sensory roots (cat). (Author's abstr.)

Injury Potentials at Different Levels of Cross-section of Spinal Cord.

The injury potentials of different points of the cross-section of the spinal cord have been investigated with wick electrodes or glass capillaries and compared with the histological picture.

The grey substance always has a lower injury potential than the white substance.

The white substance of the dorsal funiculus has a higher injury potential than that of both lateral and ventral funiculi.

The value of the injury potential of the dorsal funiculus was found to be 28·5 mV ± 2·1 (17 exp.), measured against the surface of the cord.

(Author's abstr.)

Effect of Afferent Impulses on Cortical Suppressor Areas.

Afferent nociceptive impulses initiated by electrical or mechanical stimulation of the sciatic nerve, injection of hypertonic NaCl solution into a muscle, or stretching of a contractured muscle led to an excitation of the suppressor as well as the sensorimotor and projection areas of the cortex. Quantitative experiments show similar reactions to threshold and supra-threshold stimuli. The excitatory process seems to be based on a diminished synchronization and on recruitment of additional cortical neurons. It is suggested that the suppressor areas are involved in a homeostatic mechanism. (Author's abstr.)

Influence of Suppressor Areas on Afferent Impulses.

Electrical stimulation of the frontal, parietal, or occipital suppressor areas of the cat results not only in a diminution or suppression of cortical activity, but also in a diminution or suppression of the cortical effects induced by afferent somatic and visceral impulses. (Author's abstr.)

Prolonged Facilitation of Synaptic Excitation in Sympathetic Ganglia.

Following the conduction of one or more volleys of impulses along the presynaptic and postsynaptic neurones of a sympathetic ganglion, there are long-lasting changes which facilitate subsequent excitation of the ganglion cells by impulses in the presynaptic fibers. Such facilitation may persist for many minutes.

A single ganglion cell which does not respond to slowly recurring volleys of preganglionic impulses may be brought into action by the arrival of more frequently repeated volleys. Presumably this is due to the persistance of some effect induced by each presynaptic impulse. The frequency of discharge from a cell is increased by an increase in the frequency of excitation.

When studying the response of a group of ganglion cells, the magnitude of the postganglionic action potential provides a measure of the number of ganglion cells responding to a volley of preganglionic impulses. The magnitude of this postganglionic response to a given preganglionic volley may be increased by as much as 10-fold, following a brief period of repetitive excitation through the preganglionic fibers. This indicates that many more ganglion cells respond to a given number of presynaptic impulses, following previous activity.

By increasing the frequency and duration of the conditioning train of impulses, the number of ganglion cells responding to a given preganglionic volley and the duration of this facilitation are increased. Following a single conditioning volley, a small degree of facilitation is detectable for a few seconds. After many volleys, the effect may last for more than five minutes.

Antidromic stimulation does not facilitate the response of a ganglion cell to synaptic excitation; on the contrary, it lowers the irritability of the cell. Also, the excitation of a ganglion cell by one set of presynaptic endings does not increase the irritability of the cell for subsequent excitation by other presynaptic endings. Furthermore, the response of a cell to acetylcholine is reduced by previous synaptic or antidromic excitation. These facts argue against the possibility that prolonged facilitation is due to previous activity of the ganglion cell itself.

The duration and magnitude of the prolonged facilitation is unaffected by modifying the circulation through a ganglion. This and other evidence indicate that the effect is not due to the persistence of some chemical agent in the synaptic region.

There remains the possibility that prolonged facilitation is due to a long-continued alteration in the presynaptic endings, which causes the nerve impulses arriving at the synapse to have a more effective excitatory action.

The relation of these phenomena to our recent observation of prolonged afterdischarge of rhythmically recurring impulses is discussed. (Authors' abstr.)

Effect of Di-isopropylfluorophosphate (DFP) on Action Potential and Cholinesterase of Nerve. III.

The study of the correlation between conduction and cholinesterase activity in nerves exposed to DFP has been continued and additional proof is offered for the close association of the two processes. The following results have been obtained with the superior cervical sympathetic nerve of the cat at 37° C.

1. When the nerve is exposed to 4 mgm. of DFP per c.c. (0·02 M), the action potential is abolished within 2–5 minutes, but recovers when the nerve is returned to Ringer's solution.

2. A, B, and C fibers are equally affected.

3. After recovery the cholinesterase activity is about 20 per cent. of the normal. This is the same percentage as found previously in other nerves treated with DFP in the same way.

4. On additional exposure of the nerve to DFP for 20 minutes, the action potential is abolished irreversibly. This rate of irreversible abolition of the action potential is in good agreement with the rate of irreversible inactivation of cholinesterase exposed *in vitro* to DFP at 37° C.

5. Eserine at an equimolar concentration abolishes the action potential in the same way, although at a lower rate.

6. In contrast to the effect of DFP, the action of eserine is reversible even if the nerve is exposed for an additional 20 minutes after abolition of the action potential. This is in agreement with the reversibility of the cholinesterase inhibition by eserine demonstrated on the same nerves.

With the bullfrog sciatic nerve at room temperatures (20–24° C.), the following results have been obtained:

7. The action potential is reversibly abolished by exposure of the nerve to eserine (6·5 mgm. per c.c. or 0·02 M).

8. Even when the nerve is exposed to eserine repeatedly and for long periods of time, the action potential reappears when the nerve is washed in Ringer's solution.

9. On exposure of the nerve to 4 mgm. of DFP per c.c. for 27–85 minutes, the action potential was abolished but recovered when the nerve was returned to Ringer's solution. Exposure for 120 minutes, however, abolished the action potential irreversibly. The time required to abolish conduction irreversibly is about the same as that found with the lobster cord at the same temperatures.

10. The parallelism between cholinesterase activity and action potential found previously in nerves exposed to DFP as a function of time has now also been established as a function of temperature. (Authors' abstr.)

J. NEUROSURG.

VOL. IV. MARCH, 1947.

J. PERSONAL.

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J. PSYCHOL.

VOL. XXIII. APRIL, 1947.

The Efficiency of the Group Rorschach Test in the Psychiatric Screening of Marine Corps Recruits.

The use of the Group Rorschach Test, in conjunction with a mental test and a pencil and paper personality inventory, in the psychiatric screening of Marine Corps recruits has been described. It has been shown that in the author's experiment the Group Rorschach Test differentiates between recruits who adjust and those who fail to adjust to recruit training in the Marine Corps. The group method had been shown to identify neuropsychiatric misfits missed by a typical pencil and paper personality inventory and that a simple and economical inspection evaluation of each group protocol is adequate to the needs of psychiatric screening of recruits. The Mean-Square contingency coefficient between inspection evaluations of 99 group records by two clinical psychologists is ·80, and the Mean-Square contingency coefficient between inspection evaluations of 141 group protocols and a check list evaluation of the same group records after they had been scored is ·91.

The experiment has shown that there is a high positive relationship between inspection evaluated group records and Drill Instructor performance ratings of the same subjects. There is also a high positive relationship between inspection evaluated group protocols and the personal and social history factors of the same subjects. It has also been suggested that the Group Rorschach Test is practicable for use in the psychiatric screening of Marine Corps recruits and leads to the identification of over 86 per cent. of those neuropsychiatrically unfit, when combined in a test battery with a psychometric test and a pencil and paper personality inventory.

(Author's abstr.)

J. SOC. PSYCHOL.

VOL. XXV. FEBRUARY, 1947.

Correlates of Criminal Behavior.

The study here reported has attempted to demonstrate the applicability of the bisected variable tetrachoric method as an instrument for research in a part of the confusing domain of criminology. The results that have been obtained have convinced the writer, at least, that such an approach has great potential value.

It seemed at the outset that simply to establish an intercorrelation table between the various traits might shed light on the problem of linkage among the forces

producing psycho-social conflict and resulting in arrests for criminal behaviour. In a sense this belief has been supported by the findings. But in another sense we have succeeded in raising more new questions than we have been able to answer old ones. Further development of the present data should provide results of even more interest than those already suggested. Such development might advantageously consist of reorganization or grouping of the variables so that those showing congruent profiles are juxtaposed. This will not only effect a more logical arrangement in that related items will be brought together, but it will also facilitate interpretation by rendering smoother and more easily read correlation profiles.

It is not unreasonable to surmise that a factor analysis of all or part of the set of variables might help greatly to reduce some of the complexities that are now present in the statistical raw data, i.e. the correlation table. It is evident from the fashion in which the profiles tend to form clusters that many of them are operationally very similar to each other. Discovery of what Tyron calls " operational unities "—general components which act as if they were unitary determiners of nominally different characteristics—should tend greatly to simplify the problems connected with our large table by reducing the number of " factors " with which we have to deal. There is, for instance, clearly some unitary determiner which causes the correlations for the four mental tests, school achievement, and diagnosis of intelligence defect all to act in a similar fashion in relation to all of the other variables in the table. " Estimated poor risk " and " prison sentences " and possibly other traits also can be combined into a single operational unity for purposes of further simplification.

Our method of inquiry has plainly indicated one profound generalization. This is that criminality is not an isolated phenomenon, but that it is inextricably a part of the total social organism. Symptom treatment of the type now prevalent—punitive imprisonment, legislative verbiage, increased police forces, etc., can of themselves accomplish no fundamental cures for " Crime." This can arise only from far-reaching adjustments of our entire social structure. If the present attempt serves only to demonstrate in some small measure a few of the many influences that contribute to the uniqueness and individuality of every criminal, and if it thereby serves to modify some of the stereotypes which obscure our thinking in regard to criminal behaviour, it will not have been without justification.

(Author's abstr.)

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The Significance of F. A. Carus and G. H. v. Schubert for the Psychology of the Dream.

The usual claim that we owe the first decisive step towards an analysis of dreams to Freud is unjustified. It undervaluates the contributions of the philosophers Carus and Schubert, who lived about 100 or 75 years respectively before Freud. These men recognized, among other things, the symbolism of dreams and their relations to mythology and poetry. K. F. MUENZINGER (Psychol. Abstr.).

Self-observations During Mescaline Intoxication.

The effects of 0·6 gm. of mescaline are described. Color hallucinations were observed similar to those described by other authors. The state of euphoria, which lasted a few hours, gave way to a psychosis of 6–7 hours' duration, characterized by intensified suggestibility and fears of death.

K. F. MUENZINGER (Psychol. Abstr.).

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VOL. XI. 1944.

1. Psychiatry.

Rehabilitation of British Industry's Neurosis Cases. [*J. Rehabilit.*, **12**, *No.* 4, 33–5, 35, (1946).]

The first Industrial Rehabilitation Center established in England in 1943 in one year treated satisfactorily 580 men and 460 women, many of whom were medically and psychiatrically difficult, usually because of occupational and social maladjustment. Each patient received psychiatric interviews with intelligence and aptitude tests. Workshops and daily physical training were provided, with communal activities every evening. A 2-week training course for 30 trainees is to be established for industrial medical and lay workers, sponsored by 150 industrial firms. A research department is being planned to investigate the causes of breakdowns in industry. F. A. COOKSLEY (Psychol. Abstr.).

Schizophrenia in Children. [*Ohio St. med. J.*, **42**, 1248–54 (1946).]

The author presents 7 cases of schizophrenia in children. The symptoms by which schizophrenia in children may be diagnosed when other disorders are ruled out are: Seclusiveness associated with irritability if seclusive activities are interfered with; excessive day-dreaming; bizarre behavior; diminution of interests and preoccupation with interests common to younger children; sensitivity to criticism, often associated with violent outbursts; and a reduction in physical activity. Prognosis in the 7 cases cited does not appear too favorable. Recent reports, however, indicate that up to 50 per cent. of schizophrenic children may show improvement. Treatment is primarily aimed at helping these children to improve their personal and social relationships. The treatment can best be carried out in a hospital-school-institutional setting. F. C. SUMNER (Psychol. Abstr.).

Psychogenic or Hypothalamic Amenorrhea. [*Med. Clin. N. Amer.*, **30**, 1103–14 (1946).]

Because of psychologic disturbances the hypothalamus may through loss of normal nerve impulses fail to release luteinizing hormones from the anterior pituitary gland which are necessary for the production of estradiol. A non-estrogenic hormone may then inhibit the follicle stimulating hormone required for menstruation. Diagnosis is made by ruling out physical causes and by discovery of an earlier psychic shock. As emotional stress is eliminated, the condition may disappear. Other cases may require psychoanalysis, with reassurance that there is no organic disease. The woman who is maladjusted, perhaps unconsciously, is more difficult to treat. The theory that release of luteinizing hormones from the anterior pituitary system is affected by nervous stimuli from the hypothalamic-pituitary nervous system has been experimentally proved.
F. A. COOKSLEY (Psychol. Abstr.).

2. Biochemistry, Physiology, Pathology.

Retromammillary Inhibition of Cortically Induced Movement. [*Proc. Soc. exp. Biol., N.Y.*, **63**, 76–8 (1946).]

The authors discovered a rostral midbrain area in the cat which, when stimulated while cortically-induced movement was in progress, inhibited these movements. Although the same areas in monkeys were similarly studied, no inhibitory responses were observed. C. P. STONE (Psychol. Abstr.).

Identification of the Substances which Produce a Positive Wassermann Test in the Cerebrospinal Fluid. Lipides with Antigen Properties. Prunell, Alfredo (Hospital Vilardebo, Montevideo). [*Arch. soc. biol. Montevideo*, **13**, 33–65 (1946) (*English and French summaries*).]

The luetic antibody is obtained from the cerebrospinal fluid (I) of luetic patients by the following modification of the Takata reaction: Incubate at 37° for 15–20 minutes the mixture of 3 c.c. (I) with 0·30 c.c. of a mixture (II) of 5·6 c.c. M/15 KH_2PO_4 and 94·4 c.c. of M/15 Na_2HPO_4, and with 0·30 c.c. 0·5 per cent. $HgCl_2$. Cool, centrifuge, and decant. Treat the precipitate thrice with 10 c.c. water and

5 minutes' centrifuging. Add 3 c.c. 0·85 per cent. physiological salt solution to the precipitate, bring to pH 6 with 0·01 N HCl and warm to 40° until completely dissolved. Add (II), diluted to one third, until pH 6·7. The antibody is precipitated at pH 7·4. By fractional precipitation with $(NH_4)_2SO_4$ it is shown to consist of a euglobulin and a pseudoglobulin. The isoelectric point of the reagin is 5·8. The results of the Wassermann, Lange, and Kahn reactions are the same with these globulins as with the original luetic (I). Only 0·0004 gm. of the incompletely purified globulin-antibody (III) give a positive Wassermann test. (III) shows colloidal properties in dialysis. No substance with a bearing on the method of complement fixation appears in the dialyzate. The lipides extracted from luetic (I) have antigenic properties like those extracted from heart muscle. Procedure for preparation: Evaporate 12 c.c. centrifuged luetic (I) at 37°, add 6 c.c. absolute EtOH, stir for 30 minutes, incubate at 37° for 24 hours, centrifuge and evaporate by an air current. To the residue add a few drops of water and 3 c.c. 0·85 per cent. physiological salt solution. This emulsion effects a positive Wassermann test of the same intensity as a solution of 1 per cent. Bordet antigen.

F. FROMM (Chem. Abstr.).

Magnesium in Normal and Pathologic Cerebrospinal Fluid. Castells, C., and Gherardi, J. [*Arch. soc. biol. Montevideo*, **13**, 23–5 (1946).]

In the cerebrospinal fluid of 6 normal persons 1·40–3·6 mgm. per cent. Mg were found by Youngberg's modification of Denis's method (*C. A.*, **25**, 1857). In 9 cases of epilepsy, tabes, dementia precox, hydrocephalus, and manic-depressive psychosis the same Mg level was found. F. FROMM (Chem. Abstr.).

Lysozymic Activity of Human Cerebrospinal Fluid. Caselli, Patrio, and Tolone, Salvatore (*Univ. Naples, Italy*). [*Boll. soc. ital. biol. sper.*, **22**, 539–40 (1946).]

Normal human cerebrospinal fluid was dialyzed to destroy the inhibiting activity and was then shown to exert lytic activity against *Micrococcus lysodeikticus*. Some pathological fluids manifested this activity without dialysis.

HELEN LEE GRUEHL (Chem. Abstr.).

Antilysozymic Activity of Human Cerebrospinal Fluid. Caselli, Patrio, and Tolone, Salvatore (*Univ. Naples, Italy*). [*Boll. soc. ital. biol. sper.*, **22**, 537–9 (1946).]

The antilysozymic activity of the fluid was tested against normal ovalbumin and normal blood serum. Normal cerebrospinal fluids exerted a marked inhibitory effect on the lysozymic activity of these substances. Pathological fluids with a moderate protein content exerted a definite but less marked inhibiting effect. This activity was thermostable and was reduced by lowering the pH to the acid range. It disappeared on dialysis. HELEN LEE GRUEHL (Chem. Abstr.).

Relation Between the Chemical Composition of Spinal Fluid and the Course of Birth. Makar'ev, F. A. [*Akusherstvo i Ginekol., No.* 3, 54–5 (1946).]

Rapidly progressing course of birth is characterized by a high K-ion level in the spinal fluid and a lower level of Ca and Mg. which characterizes a higher tone of the sympathetic centers. The process of slow birth is accompanied by low K level, and higher levels of Ca and Mg. G. M. KOSOLAPOFF (Chem. Abstr.).

Convulsions Produced by Fetal Anoxia: Experimental Study. Fender, Frederick A., Neff, William B., and Binger, Grace (*Standford Univ. School of Med., San Francisco*). [*Anesthesiology*, **7**, 10–13 (1946).]

Nervous tissue is more sensitive to O deprivation than any other type of body tissue. This tends to be most marked at the highest neurologic levels. Cases are reported of 2 pups born of mothers which had been deprived of normal O supply shortly before delivery. Both pups developed a convulsive state, one five and one six weeks after birth. It is felt that anoxia played a role in the development of this state. It is further believed that fetal and neonatal anoxia in human beings may play a major part in the development of epilepsy.

RUTH BERGGREN (Chem. Abstr.).

The Production of Electricity by Nerve. [*Science*, **104**, 569–70 (1946).]

Results from experiments on the effect of biological substances on the " oil-cell " model of the nerve impulse are discussed as evidence supporting the theory that the electrical nerve impusle is a phase-boundary potential produced by acetylcholine in contact with nerve lipoid. F. A. MOTE (Psychol. Abstr.).

Effect of Hyperventilation on Carotid Sinus Reflexes and Tone of the Vasomotor Center. Heymans, C., Pannier, R., and van Ostende, A. (*Univ. Gand, Belgium*). [*Arch. intern. pharmacodynamie*, **72**, 430–9 (1946).]

Hyperventilation, alkalosis and acapnia in dogs cause no fall in blood pressure, nor do they depress the reflexes from the carotid sinus or the central vasoconstrictor tone. M. L. C. BERNHEIM (Chem. Abstr.).

Indophenol Oxidase of the Central Nervous System. III. Indophenol Oxidase of Various Portions of the Nerves of the Human Fetus. Pesce, Vito Stefano (*Univ. Bari, Italy*). [*Boll. soc. ital. biol. sper.*, **22**, 646–7 (1946); *cf. C. A.*, **41**, 491f.]

The indophenol oxidase activity was lacking in the human fetal nervous system up to the 5th month of development. After that period it was present in varying degrees in the different portions of the nervous system. It was present in greater amounts in the gray than in the white matter.

HELEN LEE GRUEHL (Chem. Abstr.).

Indophenoloxidase of the Central Nervous System. IV. Action of Biogenic Amines on the Indophenoloxidase Activity of the Nervous System. Mitolo, Michele. [*Biol. ital. biol. sper.*, **22**, 651–4 (1946); *cf. C. A.*, **41**, 1302i.]

Experiments on chickens, guinea-pigs, rabbits, rats and dogs showed that the injection of biogenic amines in intoxicating but sublethal doses caused a diminution in the indophenol oxidase activity of the nervous system. This diminution was very marked with adrenaline and less marked but definite with histamine, triethanolamine and the other amines studied.

V. Action of Barbiturates on the Indophenoloxidase Activity of the Nervous System. Ruccia, Domenico. [*Ibid.*, 654–6.]

Barbiturates, administered in high doses to rats and rabbits, induced a definite diminution in the indophenoloxidase power of the nervous system.

HELEN LEE GRUEHL (Chem. Abstr.).

Diphasic Action of Chemical Mediators of Nervous Impulse. Peruzzi, Pietro (*Univ. Pisa, Italy*). [*Boll. soc. ital. biol. sper.*, **22**, 426–7 (1946).]

In perfusion experiments on isolated guinea-pig heart, adrenaline in a concentration of 10^{-11} sometimes exerts a stimulating action, sometimes has no effect, and sometimes exerts an inhibiting effect. Acetylcholine exerts a stimulating action in a concentration of 10^{-7} and an inhibiting effect in a concentration of 10^{-6}.

HELEN LEE GRUEHL (Chem. Abstr.).

Chemical Mediators in the Sympathetic Nervous System. West, G. B. [*Pharm. J.*, **158**, 6–7 (1947).]

A discussion of sympathin I and sympathin E and their relationship to adrenaline and noradrenaline. H. M. BURLAGE (Chem. Abstr.).

New Problems of Muscle and Nerve Physiology. von Muralt, Alexander (*Hallerianum, Bern, Switz.*). [*Arztl. Monatsh.* (*Schwarzenberg, Switz.*), **2**, 923–34 (1946).]

A review in which the relationships between chain reactions and muscular activity are discussed, as well as the electric and chemical viewpoints in nerve physiology. J. M. LITTLE (Chem. Abstr.).

Disturbances of Neuromuscular Excitability During Alimentary Imbalance and Avitaminoses. XII. Application of Chronaximetric Methods to the Study of Members of the Vitamin B Complex in the Rat. Lecoq, Raoul, Chauchard, Paul, and Mazoue, Henriette (*Sorbonne, Paris*). [*Bull. soc. chim. biol.*, **28**, 305–14 (1946); *cf. C. A.*, **40**, 6129[8].]

XIII. Correction of the Disturbances of Chronaxia in B Complex Avitaminosis in the Pigeon and Its Relation to Dietary Balance. [*Ibid.*, 314–22; *cf. C. A.*, **40**, 3804[4], 5116[5].]

XIV. Role of the Principal Vitamins in the Maintenance of the Acid-base Balance of the Body. [*Ibid.*, 595–600.]

Discussion based on 8 previous papers. Vitamins C and D have an anti-alkalosic action; A, E and the B complex are antiacidosic. Carotene has no action in either direction (in rats).

XV. Avitaminoses A, C, D and E in the Pigeon. [*Ibid.*, 601–7.]

By chronaximetric methods it was shown that avitaminoses A and E result in chronic acidosis with some polyneuritic symptoms and that avitaminoses C and D cause symptoms of alkalosis. L. E. GILSON (Chem. Abstr.).

The Production of Experimental Pellagra by Adenine. Raska, Sigwin B. (*Cornell Univ. Med. School, New York, N.Y.*). [*Science*, **105**, 126–7 (1947).]

The physiological effects followed by death of one series of dogs which had included in their diet 400–500 mgm. adenine or free base mixed with $NaH_2PO_4.H_2O$ and of another group which were fed 300 mgm. adenine daily are described. These experiments show a direct relationship between purine metabolism and avitaminosis of which pellagra is the most frequent variety. Adenine probably combines with the constituents of vitamins or their precursors preventing their utilization, for many symptoms observed are those found in cases of extreme vitamin deficiency.
H. B. KLEVENS (Chem. Abstr.).

Observations on Pellagra in American Prisoners of War in the Philippines. Lewis, Charles F., and Musselman, Merle M. (*Univ. Hospital, Ann Arbor, Mich.*). [*J. Nutrition*, **32**, 549–58 (1946).]

Pellagra was observed in American troops living for 3 years on a deficient diet in Japanese prison camps in the Philippine Islands. Men developed pellagra while on a diet low in calories, high in carbohydrates, and lacking in animal proteins, fresh fruits and vegetables. It appeared in epidemic proportions after 6 months on a deficient diet. The signs and symptoms that were observed are described. The clear separation of certain dermal and neurological lesions according to specific vitamin lack was difficult. Processed foods, a crude yeast culture, and pure vitamin preparations were effective in controlling pellagra. Pure vitamin preparations were more effective when the diet was more adequate.
W. B. ESSELEN, jun. (Chem. Abstr.).

Histamine Contents of Various Nerves During Excitation. Ryvkina, D. E., and Bulatova, N. N. (*Inst. Evolut. Morphol., Acad. Sci., Moscow*). [*Byull. Eksptl. Biol. Med.*, **22**, *No.* 9, 32–5 (1946).]

In the animal species studied the histamine contents of the nerves decreased in the order: Phrenic, vagus and sciatic. In rodents (rats and rabbits) the nerve histamine concentration is greater than in cats and dogs. The irritation of nerves by an electric current of threshold strength leads to an increase in histamine concentration. Stronger currents lead to a histamine depletion. The histamine concentration remains unchanged during morphine narcosis whether threshold or stronger currents are used. H. A. WEGNER (Chem. Abstr.).

Reciprocal Action Between Thiamine, Acetylcholine and Cholinesterase. Knipst, I. N. (*M. V. Lomonosov Univ., Moscow*). [*Byull. Eksptl. Biol. Med.*, **21**, *No.* 3, 19–20 (1946).]

The experiments were carried out in two series. In the first series the response of the rectus muscle of a frog's abdomen to acetylcholine alone and with thiamine

was studied. The muscle was divided into two parts. On one part progressive concentrations of acetylcholine were used, on the other the same concentrations of acetylcholine with the addition of several concentrations of thiamine. The highest concentrations of thiamine depressed the response of the muscle to acetylcholine, the lowest concentrations stimulated it, and the middle concentrations depressed it in some cases and stimulated it in others. In the second series the response of the same muscle to cholinesterase was studied. The addition of thiamine to this esterase always inhibited its hydrolyzing action on acetylcholine, the degree of inhibition depending on the concentration of thiamine and on the fact whether true or pseudocholinesterase was used. J. DAVIDSON (Chem. Abstr.).

Titrimetric Determination of the Cholinesterase Activity of Blood. Scoz, G., and Michele, G. De (Univ. Naples). [*Boll. soc. ital. biol. sper.*, **19**, 7–8 (1944).]

Add 0·1 c.c. of whole blood to 3 c.c. of dilute Na barbital buffer of pH 8. Place in a thermostat at 40° for 10 minutes, then add 1 c.c. of a solution containing approximately 33 mgm. of acetylcholine chloride. Incubate 3 hours at 40° and titrate to pH 8 with 0·02 N NaOH. A blank determination without blood must be made to determine how much acetylcholine is hydrolyzed by the buffer solution during incubation. L. E. GILSON (Chem. Abstr.).

Nerve Conduction after Inactivation of Cholinesterase. Boyarsky, L. L., Tobias, Julian M., and Gerard, R. W. (Univ. of Chicago). [*Proc. Soc. Exptl. Biol. Med.*, **64**, 106–8 (1947).]

Frog sciatic nerve, exposed to diisopropyl fluorophosphate in a suitable concentration in peanut oil and for a time sufficient to inactivate its cholinesterase, can still conduct impulses with entirely normal action potentials. Cholinesterase is not essential for nerve conduction. L. E. GILSON (Chem. Abstr.).

Acetylcholine Formation in B_1 Avitaminosis in Man. Anosov, N. N. [*Byull. Eksptl. Biol. Med.*, **21**, *No.* 3, 16–19 (1946).]

Acetylcholine formation was tested by the action of the blood from avitaminosis B_1 patients on isolated organs. Arterial blood taken 30 minutes after administration of 2 mgm. of eserine was placed in a test tube containing enough eserine to make a concentration of 1 : 100,000, and was tested on the eserinized abdominal muscle of a frog and small intestines of a mouse and cat. Observations were made on 4 patients with mild, and 18 patients with acute, avitaminosis. In no case did the blood of the patients show any acetylcholine action. The parenteral administration of eserine caused an accumulation of acetylcholine in the blood and also caused the restoration of the functions and mechanisms, especially the sensitivity and functions of the vegetative nervous system, which were disturbed by the depressed formation of acetylcholine in the blood. J. DAVIDSON (Chem. Abstr.).

Effect of Organ Extracts and Their Fractions on Acetylcholine Synthesis. Torda, Clara, and Wolff, Harold G. (Cornell Univ. Med. Coll., New York, N.Y.). [*Am. J. Physiol.*, **148**, 417–23 (1947).]

The results indicate that blood serum and animal tissues contain substances that increase acetylcholine synthesis and also decrease it. Human blood serum and water extracts of various animal tissues contain substances that increase acetylcholine synthesis. These substances are in part nondialyzable (proteins, lipoproteins) and in part dialyzable, many of them heat-stable and organic. Ether extracts of serum and various tissues contain factors that decrease acetylcholine synthesis. For some of the depressor effects fatty acids are responsible.
E. D. WALTER (Chem. Abstr.).

Anaerobic Synthesis of Acetylcholine. Lipton, M. A., and Guzman Barron, E. S. (Univ. of Chicago). [*J. Biol. Chem.*, **166**, 367–80 (1946).]

The brain enzyme which synthesizes acetylcholine anaerobically is soluble and can be extracted from acetone-dried preparations. Citrate, *cis*-aconitate, or acetoacetate must be present, and probably yield an " active " acetate, which acetylates choline. Adenosine triphosphate, K, and a coenzyme from boiled yeast or animal tissues are also necessary for the synthesis. M. L. C. BERNHEIM (Chem. Abstr.).

Action of Histamine, Acetylcholine and Peptone on the Sympathectomized Dog. Bennati, D., and Bacq, Z. M. (Inst. Physiology, Montevideo, Uruguay). [*Arch. intern. pharmacodynamie*, **72**, 397–404 (1946).]

Sympathectomized and vagatomized dogs are more sensitive to small doses of acetylcholine and histamine than vagotomized dogs with enervated carotid sinus. Sympathectomized dogs do not recover completely from peptone shock.

M. L. C. BERNHEIM (Chem. Abstr.).

Presence of Choline Acetylase in Striated and Cardiac Muscle. Nachmansohn, David, Berman, M., and Weiss, Michael S. (Columbia Univ.). [*J. Biol. Chem.*, **167**, 295–6 (1947).]

Choline acetylase was demonstrated in breast, skeletal and cardiac muscle. The amounts were smaller than in brain tissue.

JULIA O. HOLMES (Chem. Abstr.).

3. Pharmacology and Treatment.

Effect of Dimethylaminoethyl Benzhydryl Ether Hydrochloride (Benadryl) on Permeability of Meningeal Capillaries. Gelvin, E. Philip, Elias, Herbert, and McGavack, Thomas Hodge (N.Y. Med. Coll., New York, N.Y.). [*J. Pharmacol.*, **89**, 101–5 (1947); *cf. C. A.*, **40**, 6665[8].]

Repeated administration of benadryl to hospital patients with various disorders caused no change in the permeability of the meningeal capillaries to fluorescein and no significant change in the chemistry, cytology, pressure, or dynamics of the spinal fluid.

L. E. GILSON (Chem. Abstr.).

Mechanism of the Action of Calcium by Suboccipital and Intravenous Administration. Amiragova, M. G. (Shtern Inst. of Physiol., Moscow). [*Byull. Eksptl. Biol. Med.*, **21**, *No.* 4, 53–6 (1946).]

On intracranial and on intravenous administration of Ca in dogs there is a liberation in the cerebrospinal fluid and in the blood of a substance of sympathomimetic character. In the study of the metabolism of the vegetative centers it is necessary to use the blood obtained from the sinus through the torcular Herophili.

H. A. WEGNER (Chem. Abstr.).

Pharmacological Action of Dibenzylmethylamine (566 *Labaz*). *Heymans, C., Dallemagne, M. J., and Bacq, Z. M. (Univ. Gand, Belgium).* [*Arch. intern. pharmacodynamie*, **72**, 233–48 (1946).]

Dibenzylmethylamine is not sympathomimetic, but sensitizes the animal to adrenaline and to hypertensive reflexes of sinocarotid origin. It is a diuretic, and stimulates respiration centrally. It is a very active stimulant for the psychic and motor cerebral centers. It is a powerful local anesthetic, but causes much local edema, and so is unsuitable for surgical use.

M. L. C. BERNHEIM (Chem. Abstr.).

Action of Prostigmine, Eserine, Diisopropyl Fluorophosphate and Atropine on the Central and Peripheral Transmission of Nerve Impulses. Heymans, C., Pannier, R., and Verbeke, R. (Univ. Gand, Belgium). [*Arch. intern. pharmacodynamie*, **72**, 405–29 (1946).]

Prostigmine, eserine, diisopropyl fluorophosphate and atropine injected into a dog head by means of the crossed-circulation technique do not modify the reflex or direct excitability of the respiratory or cardiovascular centers. Diisopropyl fluorophosphate sensitizes these centers to the action of eserine and prostigmine.

M. L. C. BERNHEIM (Chem. Abstr.).

A New Pharmacological Action of Cocaine. Anticonvulsant Action. Gutierrez-Noriega, C., and Zapata Ortiz, V. (Inst. nacl. higiene salud publica, Lima). [*Rev. med. exptl. (Peru)*, **4**, 59–100 (1945).]

Subconvulsive doses of cocaine were antagonistic to metrazole in dogs, mice and guinea-pigs. A similar antagonism to strychnine was observed with mice

and in certain chloralosed dogs, but not with unanesthetized dogs. In curarized dogs there was no synergism or antagonism in hypertensive reactions, but in many cases cocaine abolished the hypertensive reactions associated with metrazole convulsions. H. L. WILLIAMS (Chem. Abstr.).

Role of the Sympathetic Nervous System in Changes of Subordinate Conditions in the Central Nervous System Under the Action of Morphine. Zukusov, V. V. [*Farmakol. i Toksikol.*, **9**, *No.* 1, 8–12 (1946).]

The influence of morphine (I) on summation of impulses was tested in rabbits after extirpation of the superior cervical ganglia. Electric impulses were employed at 0·5, 1 and 2 v. They were intensified by injecting adrenaline (II), pervitin (III), benzedrine (IV), ephedrine (V), or sympathol (VI) into an ear vein. Extirpation of the ganglia increased the capacity of the central nervous system to summate impulses, and decreased the constancy of the effect of (I) on summation. Sympathomimetic amines tend to restore the lost summation capacity. This effect is parallel to the relative activity of the drug as a stimulant to the central nervous system. The effect of (I) is indirect, not through the sympathetic nervous system. Urethan has a similar effect. The intensification activity of the tested amines is indicated by the dose, per kgm. of body weight, for impulses of 1 v., as follows: (II), 5; (III), 0·0001; (IV), 0·0003; (V), 0·0025; (VI), 0·006 (unit not stated). JULIAN F. SMITH (Chem. Abstr.).

The Effect of Benzedrine on Mental or Physical Fatigue in Soldiers. Somerville, Walter (*Exptl. Sta., Suffield, Alberta*). [*Can. Med. Assoc. J.*, **55**, 470–6 (1946).]

Benzedrine in 15 mgm. doses over a period of 17 hours did not significantly enable 50 soldiers to return better performances over an obstacle course than did placebo pills; nor did 35 mgm. show any appreciable effect in the last 24 hours of a 56-hour physically fatiguing exercise on 50 subjects. When given to 73 officers in 40 mgm. doses in the last 34 hours of a 72-hour test on staff problems, no significant effect was shown over inert control substances. There was no evidence that benzedrine tended to prevent sleep. No side effects of any significance were noted. G. H. W. LUCAS (Chem. Abstr.).

A Comparison of Amphetamine Sulfate with Other Stimulants of the Central Nervous System in Morphine Respiratory Depression. Handley, Carroll A., and Ensberg, Dorrence L. (*Baylor Univ. Coll. Med., Houston, Texas*). [*Anesthesiology*, **6**, 561–4 (1945).]

The results of this study on 14 human subjects indicate that amphetamine sulfate is the most effective drug of the 5 stimulants studied in antagonizing morphine respiratory depression. Amphetamine is also more prompt in acting than the other 4 agents. Average percentage increases in minute volume above the depressed levels were as follows: Amphetamine 102, nikethamide 37, ephedrine 30, metrazole 21, and caffeine 17 per cent. RUTH BERGGREN (Chem. Abstr.).

A New Lethal Dose of Curare, with Some Observations on the Pathology Produced by Large Doses. Cole, Frank (*Univ. of Minnesota, Minneapolis*). [*Anesthesiology*, **7**, 190–7 (1946).]

The anoxic lethal dose of intocostrin in the dog is 0·065 c.c. per lb. body weight. The anoxic lethal dose is unaffected by cyclopropane-O anesthesia. The death of one dog after administration of a sublethal dose indicates the possibility of a cumulative effect of curare. The use of curare on succeeding days may be associated with a heightened effect of the drug. An unidentified anti-curare effect was encountered with a technique including tracheal intubation, cyclopropane-O anesthesia, pentothal induction, and the administration of the curare with saline solution through rubber tubing. The deaths of 2 dogs show that the animal is in a dangerous condition on emergence from deep curarization. There is a nonanoxic lethal dose of curare. Dogs can make complete recoveries, with artificial respiration, after receiving 0·33 c.c. intocostrin per lb. body weight. The lethal dose of intocostrin in dogs, in the presence of continuous artificial respiration is about

20 times the anoxic lethal dose. Large doses of curare appear to affect the cardiovascular system. No clinical evidence of brain damage could be found (other than that due to anoxia) attributable to large doses of curare. Bloody diarrhoea was a constant finding in the later experiments. Prostigmine does not appear to be a perfect neutralizing agent for large doses of curare. The safest and proper method of terminating the effects of a very large dose of curare is continuous artificial respiration until the animal has recovered completely.

RUTH BERGGREN (Chem. Abstr.).

Antagonism Between Sulfanilamide and Certain Vitamins with Respect to the Nervous System of the Rat. Lecoq, Raoul, Chauchard, Paul, and Mazoue, Henriette (Sorbonne, Paris). [*Compt. rend. soc. biol.*, **140**, 279–80 (1946).]

Daily injection of sulfanilamide prolonged nerve chronaxia and shortened muscle chronaxia. These changes are similar to those seen in chronic alkalosis and they were prevented by administration of *p*-aminobenzoic acid, nicotinic acid, riboflavin, or ascorbic acid. They were not modified by thiamine, adenine, pantothenic acid, or pyridoxine. L. E. GILSON (Chem. Abstr.).

Potassium versus Biotin in the Treatment of Progressive Paralysis in Dogs. Smith, Susan Gower (Duke Univ., Durham, N.C.). [*Proc. Soc. Exptl. Biol. Med.*, **63**, 339–41 (1946).]

In the paralysis previously described (*C. A.*, **39**, 5300[8]) restoration of K to the diet causes a return to a nearly normal state. Biotin is less effective; it appears to work indirectly, possibly by mobilizing K temporarily or having a synergistic effect when the K reserves are too low to operate alone.

L. E. GILSON (Chem. Abstr.).

The Mode of Action of Anticonvulsant Drugs on Electrically Induced Convulsions in the Rabbit. Barany, E. H., and Stein-Jensen, D. [*Arch. intern. pharmacodynamie*, **73**, 1–47 (1946).]

The convulsive threshold, seizure-pattern and post-convulsive stupor were studied in rabbits stimulated by short periods of 50-cycle a.c. With stimulus duration of 0·21, 1·0, and 4·0 second, the thresholds are 58, 28 and 23 milliamp. Variations of 10 per cent. in the threshold may occur. After a convulsion, the threshold returns to normal in about 1 hour, and it rises slightly after repeated convulsions. Phenobarbital, phenytoin, barbital, and bromide influence the threshold much more with 0·21 second than with 1·0 second, Na phenobarbital (10 mgm./kgm.) raises the threshold 96 per cent. at 0·21 second, but only 25 per cent at 1·0-second stimulation. All the drugs shorten the tonic phase of threshold convulsions, and usually shorten the total duration of the fit, and often atypical fits occur. The seizure-pattern, in normal rabbits, is independent of the stimulus duration and intensity. The tonic phase lasts about 15 seconds and the clonic about 4 seconds. After the drugs, the pattern is dependent on the stimulus. The duration of the post-convulsive stupor is reduced by phenytoin but not by the other drugs.

The Influence of the Electrode Arrangement in the Determination of Drug Action by Means of Electrical Convulsive Thresholds. Barany, E. H. [*Ibid.*, 189–92.]

Na phenobarbital (10 mgm./kgm.) causes a greater rise in the convulsive threshold if the test current is applied through electrodes in the conjunctival sacs rather than in the external auditory duets. M. L. C. BERNHEIM (Chem. Abstr.).

Action of Diallylbarbituric Acid (Dial) on the Electrically Induced Epileptic Fit. Barany, Ernst H., and Stein-Jensen, Erna (Univ. Upsala, Sweden). [*Acta Pharmacol. Toxicol.*, **2**, 264–7 (1946) (*in English*).

In rabbits, dial had a significant threshold-raising action when a 0·21 second electric stimulus was used, but not when the stimulus was prolonged to 1 second. The total duration of the convulsive seizure was shortened by dial.

L. E. GILSON (Chem. Abstr.).

Action of Narcotics of the Barbituric Acid Group on the Course of Insulin Hypoglycemia. Andreeva, M. P. [*Byull. Eksptl. Biol. Med.*, **14**, *No.* 9, 45–7 (1942).]

Dial and medinal definitely alter the course of insulin-caused hypoglycemia. The symptoms of hypoglycemia are delayed and by the use of fractional introduction of medinal it is possible to reach a complete absence of convulsions, although the blood sugar drops sharply in the meantime. Finally, under such conditions, one dog failed to die, although its blood sugar was kept as low as 16 mgm. per cent. for 6 hours. G. M. KOSOLAPOFF (Chem. Abstr.).

Effect of Some Barbiturates on Tissue Cultures in vitro. *Pomerat, C. M., Drager, G. A., and Painter, J. T.* (*Univ. of Texas, Galveston*). [*Proc. Soc. Exptl. Biol. Med.*, **63**, 322–5 (1946).]

The technique of using hanging-drop tissue cultures of spinal cord taken from chick embryos on the 9th day of incubation for testing the inhibitory action of barbiturates on the outgrowth of nerve fibers is described. Total inhibition was obtained at 1 : 6400 concentration for seconal-Na and at 1 : 3200 for pentobarbital-Na and amytal-Na. For 14 other barbiturates the inhibiting concentrations ranged from 1 : 12,800 to 1 : 800. Fibroblast outgrowth from chick heart fragments *in vitro* was more resistant to barbiturates than fiber outgrowths from cord explants.
L. E. GILSON (Chem. Abstr.).

Distribution of Barbiturates in the Human Body. Andrew, R. L., and Neubauer, L. G. (*Dominion Lab., Wellington, New Zealand*). [*Analyst*, **72**, 21–2 (1947).]

Analyses during over 20 years show that barbital, and phenobarbital are distributed quite uniformly in the liver, brain, kidney, lungs, intestine and thigh muscles, but may be considerably higher in the contents of the stomach and in the urine. W. T. HALL (Chem. Abstr.).

Chloroethylidene-methylene Narcosis. Rossiiskii, D. M. [*Byull. Eksptl. Biol. Med.*, **14**, *No.* 9, 36–45 (1942).]

Experimental narcosis with methylene chloride and ethylidene chloride were performed, on a qualitative basis, in comparison with $CHCl_3$ on dogs. Both substances are tolerated better than $CHCl_3$ and have a lesser period of excitation blood pressure and respiration during narcosis are not noticeably decreased. Numerous human cases are cited in which these substances and mixtures were used in a variety of operations with successful results.
G. M. KOSOLAPOFF (Chem. Abstr.).

Blood Sugar and Pulse Reaction in Therapeutic Shock and in Experimental Increase of Affect. Wohlfahrt, Snorre (*Beckomberga Hosp., Stockholm, Sweden*). [*Monatsschr. Psychiat. Neurol.*, **108**, 121–56 (1943).]

Blood-sugar concentration (I) and pulse rate (II) were determined 30, 15, and 5 to 1 minute before, and 2, 5, 10, 20 to 25, 30, 40, 50, 60 and 70 minutes after, shock induced by metrazole (III), anoxia (N breathing) (IV), or electric stimulation (V). After maximum (III) shock (4 cases) (I) rose by about 75 mgm. per cent. and after usual (III) shock (3 cases) by about 25 mgm. per cent. The time at which the maximum (I) was reached varied from 5 to 60 minutes. When no shock (3 cases) followed (III), (I) did not change significantly, although (II) increased as much as when shock occurred. After (IV) shock (12 cases) (I) rose 9–52 mgm. per cent. The maximum was reached 5–20 minutes after the shock. There was no relation between amount of rise in (I) and intensity of shock or change in (II). After (V) shock (11 cases) (I) rose 21 to 44 mgm. per cent.; the maximum was reached at 5 to 50 minutes. There was no evident relationship between increases in (I) and (II). Nine patients accustomed to and expecting (III) shock were given 0·9 per cent. NaCl solution instead. (I) rose 9 to 34 mgm. per cent. with the largest increases in the patients showing the strongest affect. (II) also rose sharply in most instances. As controls 20 patients received a NaCl solution injection without any suggestion that it would cause shock. The average increase in (I) was 5 mgm. per cent. and the average (II) decreased.
WARREN M. SPERRY (Chem. Abstr.).

The Brain Changes Associated with Electrical Shock Treatment: A Critical Review. [*J. Lancet*, **66**, 363–9 (1946).]

That brain changes follow electrical shock treatment seems evident from a review of the literature, but it has not been proved whether they are transitory or permanent. Other complications make estimation difficult, but scattered cell loss and cell changes have been observed in experimental animals and to a less degree in man. The author believes this therapy should be used judiciously and sparingly and only in cases which can definitely profit from its application.

F. A. COOKSLEY (Psychol. Abstr.).

The Effect of Electric Shock on the Cerebrospinal Fluid. Finkelstein, B. A., and Loewenthal, M. (*County Health Inst., Königsfeld, Switz.*). [*Monatsschr. Psychiat. Neurol.*, **107**, 315–24 (1943).]

Sugar, chloride, total protein, and the gold-sol and several other reactions were determined in the spinal fluids of 9 patients 3 to 5 minutes after electric shock, and in one patient 20 minutes after an epileptic seizure. No significant deviations from normal were observed. WARREN M. SPERRY (Chem. Abstr.).

The Action of Carbon Dioxide in Experimental Convulsions. Ozorio de Almeida, Miguel. [*Bull. acad. med.*, **130**, 365–7 (1946).]

The addition of CO_2 to the respiratory air causes disappearance of attacks of various forms of experimental epilepsy produced by the local application of strychnine to the motor cortex. The effect is directly on the motor centers and does not depend on changes in the pH. A. E. MEYER (Chem. Abstr.).

Humoral Changes During Electro-shock Epilepsy in the Curarized Animal. Soulairac, Andre (*Univ. Paris*). [*Compt. rend. soc. biol.*, **140**, 263–4 (1946).]

The hyperglucemia and decrease in alkali reserve produced by electric shock treatment cannot be due entirely to the intense muscular activity commonly provoked, since they are also produced by electric shock in rabbits paralyzed with curare or narcotized with $MgSO_4$. L. E. GILSON (Chem. Abstr.).

Duration of Action of Metrazole. Carlsson, Arvid, and Theander, Georg (*Univ. of Lund, Sweden*). [*Acta Pharmacol. Toxicol.*, **2**, 227–34 (1946) (*in English*).]

The duration of action of a single dose of metrazole (I) was determined in guinea-pigs with the aid of N_2O. After administration of Na diethylbarbiturate plus (I) a higher partial pressure of N_2O is required to obtain a certain degree of narcosis than after the barbiturate alone. This analeptic action against the barbiturate of a single subcutaneous dose of 150 mgm./kgm. of (I) persisted for more than 10 hours after the injection. (I) does not exert an analeptic action against N_2O.

A Depressant Component in the Action of Metrazole. [*Ibid.*, 268–74.]

In tadpoles and frogs the stimulant action of metrazole (I) is followed by depression. (I) appears to act as a depressant in guinea-pigs narcotized with N_2O. Repeated subcutaneous injections of (I) in doses of 35 mgm./kgm. produce convulsions at first, but if continued, have less and less effect (in both rabbits and guinea-pigs). This development of tolerance may indicate a secondary depressant action. L. E. GILSON (Chem. Abstr.).

Analeptics. Jacques, Andre (*Hotel-Dieu de Quebec, Quebec, Can.*). [*Laval Med.*, **11**, 760–82 (1946).]

A review, including caffeine, strychnine, lobeline, coramine, metrazole, picrotoxin, ephedrine, adrenaline, neosynephrine, paredrine, benzedrine, cobefrin, methedrine. H. L. WILLIAMS (Chem. Abstr.).

Stimulant and Depressant Effects of Metrazole in Sodium Diethylbarbiturate Depression. Carlsson, Arvid, and Theander, Georg (*Univ. Lund, Sweden*). [*Acta Pharmacol. Toxicol.*, **2**, 379–82 (1946) (*in English*).]

In guinea-pigs depressed with Na diethylbarbiturate the analeptic action of graded doses of metrazole appears to increase only up to a certain limit. Further increase in dosage sometimes results in a reduction of the analeptic effect.

L. E. GILSON (Chem Abstr.).

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The following names are printed in SMALL CAPITALS: authors of original articles and of books reviewed. Names of authorities referred to in the text are in ordinary type.

(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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PART I.—GENERAL INDEX.

PART II.—AUTHORS REFERRED TO IN THE EPITOME.

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