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Original Communication.

STREPTOCOCCAL PUERPERAL FEVER IN THE ANGLO-EGYPTIAN SUDAN.

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Introductory.—The present paper, which is the second of a series of short notes upon the streptococci met with in the Anglo-Egyptian Sudan, owes its inception to the fact that during the last few months we have met with several cases of puerperal fever in Khartoum and Omdurman which were associated with the presence of a streptococcus in the discharge from the uterus.

The peculiar local sociological conditions have permitted us only to make cultures on six occasions, separated by long intervals, but, as we have been unable to find any bacteriological literature dealing with this disease in the Tropics, we think that perhaps a few remarks upon our strains may possibly be of interest to some tropical practitioners.

Before detailing the results of our investigations we desire to record a few facts with regard to tropical puerperal fever and to review the work which has been performed with regard to the etiology of this fever in order to compare the organisms found here with those discovered by other workers, and for this purpose we offer such historical remarks as we are able to make with the limited literature available in Khartoum.

Tropical Puerperal Fever.—It is probable that puerperal fever, or puerperal septicæmia, as it is often wrongly called, as the causal organisms may not occur in the blood, has been prevalent throughout the world in all ages wherever man has roamed, but as it is conveyed from infective sources, living or dead, autogenetic or heterogenetic, by instruments or by the hands of the attendants, to the uterus of the parturient woman, it is obvious that, in those primitive tribes in which little or no aid is given to the woman in childbirth, there will be little puerperal fever, notwithstanding that her immediate surroundings may be insanitary.

Usually in non-civilized races there is less difficulty with child labour, and hence less damage to the organs of generation, and consequently a less number of portals of septic infection.

The reasons for this easier childbirth are not well known, but may possibly depend upon two factors, *i.e.*, the mother and the child. With regard to *the mother*, the fact that pregnancy takes place at an earlier age in the uncivilized than in the civilized and the fact that the woman of non-civilization, from spare and hard living, is often thinner than the woman of civilization may help, even if her pelvic measurements are relatively smaller; while it is often alleged that the head of *the uncivilized child* is smaller than that of a civilized race, and it has ever been asserted by Brooke that on an average the child weighs 1 lb. lighter in uncivilized races. If these statements are correct they will help to explain the easy child labours and the less amount of puerperal fever in those races.

When we consider *old native civilizations* and *the Caucasian races*, we find that child labour is difficult, and that assistance has had often to be rendered to the parturient woman from time immemorable and that puerperal fever in isolated cases and in epidemics has been known for ages.

Turning to one of the old civilizations of the Tropics, viz., that seen in Ceylon, these facts are well borne out by the researches of one of us in 1907 into the vital statistics of the various peoples inhabiting that island.

These inquiries showed that the deaths of women in childbirth were higher than those in Europe and that the principal cause was puerperal fever.

When the racial incidence was investigated it was found that the sociological and hygienic factors influencing this incidence were marked, as the percentage of the total annual racial deaths attributable to childbirth and principally caused by puerperal fever was only 0·1 per cent. for Europeans, while it was 1·2 per cent. for Sinhalese, who form the bulk of the population, 0·8 per cent. for Tamils, the next largest native community, 1·1 per cent. for a mixed native and European race known as burghers, under which heading also come those inhabitants of pure Dutch descent from the settlers of two hundred years ago. Many of these burghers are very poor and nearly all inhabit towns and mostly live under more insanitary conditions than the average European. The Mahommedan communities of Arabs and Malays have a mortality of 1·2 per cent. and 1·1 per cent. respectively.

The disease is known to have been not uncommon in Bengal since Twining wrote in 1833, while its death-rate in Calcutta for 1906-07 was 1·2 per cent. of the total deaths.

With regard to Egypt the first medical accounts of the fever are contained in Pruner's writings published in 1847, where it is stated that it was not so common as in Europe, but an epidemic, extending from Alexandria to Luxor, is mentioned as taking place in 1844.

The peoples of the Anglo-Egyptian Sudan are peculiarly interesting from the point of view of our present study, because they contain very primitive tribes, semi-civilized natives, and civilized peoples.

As examples of the *Primitive Tribes*, we may consider the Nyam-Nyam who live in the southern part of the Bahr-El-Ghazal Province, and the Jur or Gour tribe, which occupies a limited area of that province between the River Gell and the Rumbek-M'volo road. In these tribes, according

to Anderson, childbirth is usually a simple physiological process taking place for the first time when the woman is in her teens, and managed by a midwife who is simply any other woman who has given birth to a child and who sees that everything connected with the parturient woman is strictly clean and placing her on a bed of freshly cut leaves allows Nature to do the rest, with the sole exception of such rare cases as require assistance, when, according to the same authority, she calls in the aid of some small boys. Under these primitive conditions puerperal fever must be rare. The same easy childbirth can be observed among the Bedouins of Syria.

Among the *semi-civilized* Arabs and Sudanese of Kordofan and other parts of the Sudan every young girl when aged 5 or 6 years undergoes one of two forms of so-called circumcision. The milder operation, called "Sunna Tahuret," *i.e.*, circumcision according to religious law, consists of the removal of the clitoris and labia minora, while the more severe "Pharaoh's Tahuret," *i.e.*, the old Egyptian circumcision, entails in addition the removal of the upper two-thirds of the labia majora. The result of these operations is the formation of scar tissue, and hence it is almost always necessary to enlarge the vulvar orifice by means of a razor, not merely at the time of marriage, but again at the birth of a child, when otherwise it would be difficult for the head to emerge. The enlarged orifice is again partially closed some little time after the birth of the child, and therefore the incision requires repetition at every succeeding birth.

If this second cutting is performed carelessly and the resulting wound becomes septic, then fever ensues, and in a case of this nature we have found streptococci and other organisms, but we have not included this case among our six puerperal strains presently to be described, as it was more of the nature of an ordinary septic traumatism. These people are well acquainted with puerperal fever, which they call "El Jarat," or sometimes "Humma Nafas," or when slight they term it milk fever, or "Humma Laban," and which they consider to be transmitted from one case to another.

The *civilized* peoples of Khartoum and Omdurman, more especially the Greeks, Syrians, and better-class natives, suffer from *Febris puerperalis* and *Febris in puerperio*, but no statistics are available to show the incidence of the disease.

As regards Zanzibar, the deaths from puerperal fever are given as eight out of a total mortality of 1,022, of which 572 are female deaths at all ages.

In none of the above statistics was it possible to compare the puerperal deaths with the number of births, as these were not accurately known.

In the West Indies and in Central and South America the fever is not uncommon, and Brooke, writing in 1908, with his experience of the West Indies and Singapore, says:—

> "the mortality and morbidity from puerperal sepsis and the infantile death-rate among native communities are enormous."

He blames the village midwife or handywoman, who, he says, is a prejudicial, ignorant and dirty person, and summarizes his remarks by stating:—

> "we see that, for the native woman under her native skies, want and poverty may play havoc with the child that is to be, but there is often a physical environment of ignorance and sepsis during labour which *demands the attention* of public opinion."

Our experience in various tropical and subtropical regions supports these statements made by Brooke.

Apart from stray references to a certain number of cases occurring in various tropical hospitals and referred to in the medical reports of the particular government, we have been unable to find any further references to the disease in the Tropics in the literature at our disposal here, and therefore for etiological information we must turn to investigations made in temperate climates.

Etiological History.—For our purpose the first period of the history of the fever, viz., the *Grecian*, may be excluded, and we may commence with the second or *Willisian Period*, in which Willis named the disease *Febris puerperarum* in his work "De Febribus," published in 1660, and devoted a chapter of his "London Practice of Physick" to the "Fevers of Women in Childbed." He divided these fevers into three classes: *the lacteal, the putrid*, and the *symptomatick*. The last named are fevers due to infections, such as small-pox, quinsy, &c., occurring during the puerperium, while the two preceding forms agree with Schottmüller's *Febris in puerperio* and *Febris puerperalis*, as set forth by him in 1911. Willis states that the mild *lacteal* can pass into the severe *putrid* fever.

With regard to the method of infection he did not recognize transmission from without, for on page 635 of the second edition of his "London Practice of Physick" he says:—

> "Tho' this Fever, however malignant it be, is not accused of Contagion and *there be no fear in those that lye in, of a venemous Miasm being received from without;* nevertheless all Women in Child-bed have an innate Minera of Virulency and ought to have a care of the mischief of this, as a Fomes of a mighty Malignity."

This passage may be looked upon as a precursor of the autogenetic theory of puerperal infection.

He also noted as predisposing causes the varying sociological conditions of the women, for on page 631 he says:—

> "Women in Child-bed, *through the taint of their ill affected* Body, as tho' they were struck with the Contagion of a pestilential Air, are found to be extremely obnoxious to a putrid or rather malignant Fever, tho' they all do not equally receive the taint of this Disease; for *poor Women*, Hirelings, Rusticks, and others us'd to hard Labours, also Viragoes, and Whores, who are clandestinely delivered, *bring forth without great difficulty*, and in a short time after, rising from their Bed, return to their wonted Labours; but *Women that are rich*, tender and beautiful, and many living a sedentary life, as tho' they partak'd of the Divine Curse after a more severe manner, *bring forth in Pain*, and presently after their delivery *lye in an uneasie and dangerous condition.*"

This state of affairs has been altered in England and to-day the poor are more affected than the

rich because the improvement in hygiene and in antiseptics has inverted the sociological influence, for the poor have now more aid in their confinements and hence run more risk of puerperal fevers, while, in his time, there was much less obstetrical aid, judging by the midwifery books of his period, and hence less chance of infection. We have already seen that much the same features appear in the differing incidence of puerperal fevers, as shown in primitive tribes and in the more highly civilized native races of the Tropics.

Apparently he believed in an autogenous infection in some way connected with the injuries associated with childbirth, and that this infection was brought into play by agents which in modern language lower the resistance of the body.

Willis failed to appreciate the importance of the heterogenetic production of the fever, but Kircher, in 1671, stated that he believed that the disease was due to a putrefaction caused by animalcules.

Thus as early as the seventeenth century there appeared the idea of a double origin for the fever, viz., the autogenetic and the heterogenetic, and also that the disease was microbic in origin, and with this may be said to end the *second or Willisian Period.*

The Third or Transmission Period of the history is devoted to the study of the transmission of the heterogenetic type of the fever and begins in 1788 by Denman's observation that the disease was carried from cases of puerperal fever to healthy lying-in women by doctors and midwives, which view was strongly supported by the work of Alexander Gordon in Aberdeen in 1795, and by Oliver Wendell Holmes in America in 1843. The last-named observer asserting that not merely could it be conveyed in this manner, but that it could come in a similar way from a case of erysipelas or from a *post-mortem*, and that it was necessary for the physician to disinfect his hands and to change his clothes after leaving a case of puerperal fever. This work was ably supported and put upon a sound basis by Semmelweiss, whose brilliant researches are too well known to require recapitulation.

With these investigations the heterogenetic origin of the disease was firmly established and it now remained for the bacteriologists to show the nature of the infective material which, when carried from the sick to the healthy, produced the disease.

The Fourth or Bacteriological Period of the history opens in 1871, when von Recklinghausen found micrococci in the bodies of persons dying from puerperal fever. The next important step was the discovery by Pasteur in 1878-79 of his "microbe en chapelet" in the blood of puerperal fever patients.

As this organism belonged to the genus named *Streptococcus* by Billroth, in 1874, Arloing gave it the name *Streptococcus puerperalis*, in 1844, apparently believing that it was distinct from the organism named *S. erysipelatos* Fehleisen 1883, which is more popularly known as *S. pyogenes* Rosenbach 1884. Later in this paper we shall see that Furneaux-Jordan and Mackay have revived *S. puerperalis*, but Arloing's name has priority and stands for a synonym of *S. crysipelatos.*

A new phase of the bacteriological history was opened in 1893 by Veillon finding an obligatory anaerobic micrococcus in such diseases as Ludwig's angina, suppuration of Bartholin's glands, phlegmonous permephritis, &c. This organism, which he called *Micrococcus fœtidus* Veillon 1893, though usually a diplococcus, can exist in short chains and therefore may well be a streptococcus. Hallé, in 1898, found it in the secretions of the normal vagina as well as in pus from Bartholin's glands and in the exudate of retained placentæ. It was next observed by Jeannin in 1907 to be present in numerous cases of putrid puerperal infection and is thought by Veillon's pupils to be the same organism as the anaerobic streptococcus found in vaginal secretion in 1897 by Menge and Kroenig, whose work had been questioned by Koblank but supported by Natvig, Schottmüller and Hamm.

In 1907 Gioelli reported the presence of a coccus, thought to be a staphylococcus, which he found in a periuterine abscess and named *Coccus anaerobius* Gioelli 1907, while in 1908 he dealt with the question of the bacteriology of puerperal infections. As this coccus produces fœtid gas it may well be the same as Veillon's organism.

In 1910 Schottmüller increased our knowledge as to the streptococci in puerperal fever by finding a new obligatory anaerobe which he called *Streptococcus putridus*, and which he found not merely in puerperal fever, but also in otitis media, meningitis, cysto-pyelitis, abscess of the lung, gangrene of the lung, and empyema, and he followed this up in 1911 by two papers upon the etiology of *Febris puerperalis* and *Febris in puerperio.*

In fifty cases of *Febris puerperalis* he found the following organisms to be present thirty-three times, *i.e.*, in 66 per cent., and in all severe and fatal cases:—

S. erysipelatos, Febleisen, 1883, in fifteen cases in the uterine discharges and in two of these also in the peripheral blood.
S. putridus, Schottmüller, 1910, in fifteen cases in the uterus including five blood infections.
S. erysipelatos with S. putridus three times in the uterine discharge, with both together in the blood once and separately in the other two cases.

He also met with *Streptococcus mitior seu viridans*, an aerobic organism first described by himself in 1903, in the uterus and blood of one case.

He considers that there are two distinct methods of infection; the first is the *autogenous* caused by organisms, like *S. putridus*, which live in the normal vaginæ of pregnant and puerperal women and are capable of being carried from the vagina to the uterus by means of instruments or by the hand This form he considers to be non-contagious.

The second method of infection is the *heterogenous* caused by *S. erysipelatos* and brought from an external source of infection to the puerperal woman as just described.

Von Lingelsheim, in 1912, considered that the importance of *S. putridus* must, for the time being, remain undecided as it lacked confirmation, but it is obvious that the gas production alone differentiates this streptococcus from *S. erysipelatos* Fehleisen, and it appears to us that there is a

general agreement between Schottmüller's organism and that described by Veillon. They both produce fœtid gas, they both are obligatory anaerobes, and they are both found in the vagina and also in association with puerperal fever, and they have both been found in severe infections in other parts of the body. They are probably the same organism as the anaerobic vaginal streptococcus described by Menge and Kroenig, and also that found by Gioelli in 1907.

All these organisms, in our opinion, should be classified under the name of *S. fœtidus* Veillon 1893.

In 1901 Lewkowicz found an obligatory anaerobic streptococcus, which he named *S. anaerobius micros*, in the mouths of sucklings. In 1907 Jeannin reported that it was present fairly frequently in puerperal infections. It is described as being lanceolate and usually disposed in diplococcal forms and only occurring in short chains.

In 1912 Furneaux-Jordan published an important lecture upon "Puerperal Infection." He and Mackay examined the uterine discharges of twenty-one cases of puerperal fever and found streptococci in seventeen cases, *i.e.*, 80 per cent. This streptococcus was identical in all cases and was said to be *quite distinct from other streptococci*, and so the name *Streptococcus puerperalis* Furneaux-Jordan and Mackay 1912 was given to it, but we have noted that Arloing had already applied this name in 1884 to a streptococcus which he obtained from cases of puerperal fever and which he believed to be distinct from *S. erysipelatos* and *S. pyogenes*, the only named forms at that time, but at present all three are considered to be one and the same organism.

The known puerperal streptococci are therefore :—

(1) *S. erysipelatos* Fehleisen 1883.
(2) *S. fœtidus* Veillon 1892.
(3) *S. anaerobius* Lewkowicz 1901.
(4) *S. mitior* Schottmüller 1903.
(5) *S. puerperalis* Furneaux-Jordan and Mackay 1912.

Other organisms.—Streptococci are however by no means the only organisms found in Puerperal Fever as the following have also been recorded : *Aurococcus aureus* (Rosenbach, 1884) ; *Albococcus tetragenus* (Gaffky, 1884) ; *Diplococcus pneumoniæ* (Weichselbaum, 1887) ; *Diplococcus gonorrhœæ* (Bumm, 1885); *Bacillus coli* (Escherich, 1886) ; but *Bacillus typhosus* (Zopf, 1885), (Eberth's bacillus) only rests under suspicion, while *B. pseudodiphtheriticus* has also been reported.

Among the anaerobic organisms other than streptococci the following have been met with in puerperal infections : *Bacillus emphysematosæ* (Fränkel, 1893) ; *Bacillus tetani* (Flügge, 1886) ; and a *Vibrio* described by Curtis in 1913, and probably by Kroenig in 1895, which though deserving of a definite appellation is still unnamed.

Abortion.—A very interesting point is the question whether the same organisms are found *post abortum* as *post partum*. This was investigated by Schottmüller in 1911, more particularly in criminal abortions, with the result that he found the following organisms arranged in order of frequency to be present : *S. putridus*, a *Staphylococcus*, *B. coli* and *B. emphysematosæ*, while *S. erysipelatos* was relatively rarely met with.

Febris in Puerperio.—Another point of interest is the organisms causing *Febris in Puerperio*, *i.e.*, the slight fever known by Willis' name of Lacteal or Milk Fever, which is frequently met with *post partum*. This has also been investigated by Schottmüller and Heymann who found the following germs to be present : *S. putridus*, a *Staphylococcus*, *B. coli*, *B. erysipelatos*, *B. vaginæ* and *B. emphysematosæ*, arranged in order of frequency.

Thus it would appear that the same organisms occur in the mild and in the severe infections, a fact which places on a sound basis Willis' observation that the mild Lacteal may become the severe Putrid Fever.

Methods of Infection.—Adverting to the methods of infection of the parturient woman we note that Geddes in his "Statistics of Puerperal Fevers," published in 1912, says that he believes 99 per cent. of the cases are due to those conducting the labour. A statement of this nature makes it imperative to possess some knowledge as to the presence or absence of bacteria in the normal vulva, vagina, and uterus.

This has been investigated by many workers whose researches make apparent that the vulva at birth is germ free, but after seven to eight hours it contains microörganisms which have probably been acquired from the secretion of the mother's vagina, the air, and the water of the first bath. As a rule the following organisms are described as being present in the normal vulvar secretion : *Obligatory aerobes : Albococcus tetragenus*, *B. coli*, and *B. pseudodiphtheriticus*. *Aerobes and facultative anaerobes : Albococcus albus* and *B. vaginæ*. *Obligatory anaerobe :* a *Streptococcus*, probably *S. fœtidus*.

With regard to the vagina this appears to be free from microörganisms at birth, at which time its secretion is acid, which is said to be due to carbonic acid, and is also bactericidal, an action which cannot be due to leucocytes which are normally absent.

Some twelve hours after birth the first bacteria can be found therein. The secretion remains acid during life, but is now due to lactic acid, which is said to be present in a strength of 0·4 per cent., and appears to be associated with an organism *Bacillus vaginæ*, Döderlein, 1893.

The normal adult secretion has a bactericidal action when tested against staphylococci, streptococci and bacteria, but saprophytic organisms can grow therein and may be obligatory or facultative anaerobes, but are generally characterized by having acidophile tendencies. Anaerobic organisms are common, but obligatory aerobes are not frequently met with. Pathogenic organisms are relatively seldom found in the normal secretion, being generally *Staphylococci*, *B. coli* and *B. pseudodiphtheriticus*.

With regard to the normal vaginal secretion during the puerperium, its bactericidal powers are markedly increased by the lochia and they do not return to normal until several days after the birth of the child. Notwithstanding this fact obligatory and facultative anaerobic streptococci, staphylococci, and bacteria are to be found, as has already been indicated, and this fact appears to us to be of the greatest importance when considering the method of infection of Puerperal Fever.

The secretion of the normal uterus is, by a consensus of opinion, considered to be sterile.

The practical part of these findings was emphasized in 1911 by Burckhardt and Kolb demonstrating that antiseptic vaginal douches definitely caused a diminution or disappearance of the vaginal organisms and also reduced the morbidity of the douched as compared with the undouched cases of confinement.

It would thus appear as though Geddes was correct in throwing the responsibility of puerperal infection upon the attendants, as both autogenetic and heterogenetic infections are probably due to

them in some way, but the former is much more difficult to prevent than the latter.

Having cleared the ground as to the organisms known to cause puerperal fever and their methods of infection, we will now turn to consider the Khartoum puerperal streptococci.

The Khartoum Puerperal Streptococci.—We obtained the strains about to be described in pure culture from the intra-uterine discharge of six cases of puerperal fever occurring at intervals in the towns of Khartoum and Omdurman.

These six strains are divisible by the fermentation or non-fermentation of salicin into two series: Series A, composed of Strains I, III, and IV, is the salicin non-fermenting group; while Series B, containing Strains II, V, and VI, is the salicin fermenting group.

As the strains contained in the different series are very alike they will be described as though exactly similar, but such differences as have been found will be duly noted.

Series A.—The organisms composing strains I, III, and IV possess the following characteristics:—

Morphological Characters.—They are non-motile cocci, measuring from 0·7 to 0·9 microns in diameter in the living condition, and usually found in short chains, but may be present in pairs, in double chains, or even in small groups, but have never been observed in packets or surrounded by a capsule.

In preparations made from the uterine discharge they appear as single or pairs of cocci, or as short chains engulfed by the polymorphonuclear leucocytes, or as cocci or diplococci lying free between the cells, and that not merely in the three cases from which it was possible to obtain them in pure culture, but in other cases from which smears of the intra-uterine contents, more or less severely contaminated, were sent to these laboratories.

In all cases the streptococci were Gram-positive, but not acid-fast, as tested by the Ziehl-Neelsen method.

Biological Characters.—The variety of streptococcus thus obtained produced the usual meagre growth, typical of the genus, when grown under aerobic conditions upon agar at 22° C., 30° C., 37° C., and 40° C., but it did not grow at 60° C.

It is also a facultative anaerobe producing at 37° C. about the same amount of growth on agar as when grown aerobically on the same medium and at the same temperature.

Cultural Characters.—When grown upon agar-agar slants it produced small discrete translucent colonies, while in stabs it formed small translucent colonies along the track of the needle, but did not spread out into any surface growth. It grew well on glucose-agar, maltose-agar, and glycerol-agar.

As a rule it grew slowly upon gelatine, which it failed to liquefy, but sometimes it did not grow at all on this medium at 22° C., no matter whether the culture was made upon a slant or as a stab.

In broth it produced a general turbidity which, when examined microscopically, was found to consist of cocci and short chains. There was no visible growth on potato.

Biochemical Reactions.—Its qualitative carbohydrate glucoside and alcoholic reactions were determined in peptone media containing 1 per cent. of the reagent to be tested. The indicator was acid fuchsin, used in the manner recommended by Andrade in 1906 and by Holman in 1914, which we have found to be more satisfactory than litmus. All tubes were read at the end of two days and again at the end of a week, though there does not appear to be much advantage gained by a longer incubation than that of forty-eight hours at 37° C. Controls were, of course, used and the inoculated tubes examined microscopically. Acid, but no gas, was produced in the following media:—

Monosaccharides.—Hexoses: Glucose, fructose (lævulose), and galactose.

Disaccharides.—Lactose, saccharose, and maltose.

Trisaccharide.—Raffinose.

Glucosides.—Amygdalin and, in Strain I, helicin.

The streptococcus produced neither acid nor gas in:—

Monosaccharides.—Pentoses: Arabinose, xylose, and rhamnose.

Polysaccharides.—Inulin, amylum, glycogen, and dextrin.

Glucosides.—Salicin and helicin, but the latter only in Strains III and IV.

Alcohols. — Trihydric: Glycerol. *Tetrahydric:* Erythrol. *Pentahydric:* Adonitol. *Hexahydric:* Dulcitol, mannitol, and sorbitol.

Phenol.—Hexahydric: Inosite.

Quantitative estimations of the acidity were made by growing the organisms in a medium composed of Lemco 1·2 per cent., peptone 1 per cent., carbohydrate or alcohol 1 per cent., salt 0·5 per cent., the whole being adjusted to + 10 per litre, which is the equivalent of Fuller's + 1·0 per cent. After incubation for forty-eight hours the inoculated tubes were examined microscopically, and those which showed a fair to good growth were tested.

The amount of acidity contained in 5 c.c. of the control tube was first estimated by titration against $\frac{N}{20}$ KOH, in the cold, with phenolphthalein as an indicator, and then a like amount of the inoculated tube was similarly titrated. The difference between the titration of the inoculated and the control tubes expressed in cubic centimetres of $\frac{N}{20}$ KOH (which is the same when calculated as normal KOH per cent.) gave the following results:—

Strains	Glucose	Lactose	Saccharose	Raffinose	Salicin	Mannitol
III	2·6	2·6	2·4	4·0	0·1	0·0
IV	3·6	2·9	3·4	3·6	0·0	0·0
Average	3·1	2·7	2·9	3·8	0·0	0·0

Strain I could not be tested as it had died out before it was determined to use this method.

We are acquainted with the mistakes which are possible in titrating such a complex medium as the one indicated above, and we are also aware of the increased error incurred when 1 per cent. peptone is used, but we consider that these titrations are valuable in keeping a check upon the qualitative tests as they are more accurate.

Hæmolysis was tested in two different ways by

North's test and on blood agar with human, sheep, and rabbit's blood, but no lysis was observed.

North's method consists of adding 0·5 cc. of an 18-hour old culture in ascitic broth to 1 c.c. of a 5 per cent. suspension of washed sheep or human red blood cells, and observations are made in two hours and again after twelve to eighteen hours at the room temperature.

When grown upon blood agar the streptococci produced green colonies.

It appeared to us to be interesting to inquire how this green colour originated and the explanation at which we arrived is as follows:—

Agar, a colloid substance prepared from marine algæ, contains a carbohydrate called *gelose* or more correctly *d-galactan*, which has the formula $(C_6H_{10}O_5)_n$ and which is converted into the monosaccharide *d-galactose* by boiling with dilute mineral acids. Now d-galactose is a constituent of lactose and also of raffinose, and belongs to the Dulcitol series of the Hexoses, and is more difficult to ferment than glucose.

When a sugar is fermented the end products are carbon dioxide and ethyl alcohol, but the intermediate products are still a matter of controversy and may possibly include formic acid, lactic acid and dihydroxyacetone, which has probably to be converted into a hexose before further fermentation can take place, and this, together with the fact that this further fermentation is probably a more difficult process, induces a halt at this stage, and hence the acid reaction of the sugar tests.

These acids, formic and lactic, appear to act upon the hæmoglobin of the red blood corpuscles contained in the blood agar, converting it into the dark brown acid-hæmatin, and, if the process stops at this point, the colonies may be grey, brown or even black, while broth remains brownish in colour; but if the organism is capable of converting the hæmatin into hæmatoidin or (bilirubin) then the oxygen of the air converts this into biliverdin, which in the presence of an acid is green, and therefore colonies possessing this action appear greenish in colour.

In *milk* the strains produced acid and clot, except with (I). The variation in this instance was probably due to the strain being old and feeble when tested, as it produced acid, but apparently not in sufficient quantity to effect coagulation.

In *neutral red peptone or broth* the strains failed to produce a green fluorescence when tested aerobically and anaerobically.

Nitrates were not reduced and *Indol* was not produced, nor was the *Voges-Proskauer* reaction given, but *Serum-glucose-agar* was clouded.

There was no plasmolysis when *bile* (Neufeld's test) or *bile salts* were added to broth cultures.

The technique of the bile test was performed as follows:—0·2 c.c. of sterile ox or rabbits' bile was added to one cubic centimetre of a 24-hour broth culture and the mixture incubated at 37° C., readings being taken after thirty minutes and two hours. And that with the bile salts in the following manner:—

An equal quantity of a 1.0 per cent. watery solution of sodium taurocholate was added to an 18-hour old broth culture and readings taken after thirty minutes' incubation at 37° C.

Strains I, III, and IV were not tested as to the presence or absence of lysis in salt solutions (Wadsworth's test), but there was no production of *sulphuretted hydrogen* in lead acetate broth.

Pathogenicity.—After cultivation upon artificial media the strains were non-pathogenic to rabbits when inoculated intravenously and intra-peritoneally.

In human beings they caused puerperal fever. The case from which Strain I was obtained ended in recovery, while those from which III and IV came were fatal. As cultures of the peripheral blood of one of these cases taken on the day before death remained quite sterile, we conclude that in that case, at all events, there was no septicæmia.

Series B.—The strains composing this group are II, V, and VI, and the characteristics of the streptococcus are as follows:—

Morphological Characters.—It is a non-motile coccus, measuring from 0·7 to 1 micron in transverse diameter in the living condition, and usually found in short chains, and may be present in pairs, but has never been seen in packets or surrounded by a capsule.

In preparations made from the uterine discharge it appears as single or pairs of cocci, or as short chains lying in the polymorphonuclear leucocytes, or as cocci or diplococci lying free between the cells. These cocci were in all instances Gram-positive, but not acid-fast, as tested by Ziehl-Neelson's method.

Biological Characters.—It grew aerobically in a typical manner on agar-agar at 22° C., 30° C., 37° C., and 40° C., but did not grow at 60° C. It was also a facultative anaerobe.

Cultural Characters.—As already stated, it produced typical discrete small translucent colonies on agar. It grew slightly on gelatine, which it did not liquefy. It showed cloudiness in glucose-agar-serum, and a general turbidity in broth, but there was no visible growth on potato.

Biochemical Reactions.—Acidity, without gas formation, was produced by growth in the following carbohydrate, glucoside, and alcoholic media:—

Monosaccharides.—Hexoses: Glucose, fructose, and galactose. *Pentoses:* Rhamnose by Strain V only.

Disaccharides.—Maltose, lactose, and saccharose.

Trisaccharide.—Raffinose.

Polysaccharides.—Dextrin, while inulin was fermented by V only.

Glucosides.—Salicin, amygdalin, and helecin.

No fermentation was observed in:—

Monosaccharides.—Pentoses: Arabinose, xylose, and rhamnose (Strains II and VI only).

Polysaccharides.—Amylum, glycogen, and inulin, by the last only in Strains II and VI.

Alcohols. — *Trihydric:* Glycerol. *Tetrahydric:* Erythrol. *Pentahydric:* Adonitol. *Hexahydric:* Dulcitol, mannitol, and sorbitol.

Phenol.—Hexahydric: Inosite.

Quantitative determinations gave the following results:—

Strains	Glucose	Lactose	Saccharose	Raffinose	Salicin	Mannitol
II	1·2	2·2	2·3	0·3	2·7	0·0
V	2·8	2·9	2·7	2·9	2·3	0·1
VI	2·9	2·7	2·8	2·8	1·9	0·3
Average	2·3	2·6	2·6	Two strains only 2·6	2·3	0·1

The determination to use quantitative analysis being only arrived at when Strain II was old and

feeble, its power of fermenting raffinose became practically *nil*, while some time previously it had given excellent qualitative reactions. Its figure 0·3 for raffinose must be considered to be much too low, as also its figures for glucose, and to a less extent those for lactose and saccharose.

It, however, fermented salicin very well.

No *hæmolysis* was observed when tested with human, sheep, and rabbits' blood on agar plates and by North's method.

In *milk* the strains produced acid and clot, but there was no reduction of *neutral red broth* when tested aerobically and anaerobically.

Nitrates were not reduced and there was no lysis when *ox bile* or *bile* salts were added to cultures, nor was there any lysis in *salt* solutions.

As we have found no records of Wadsworth's test having been previously performed in the Tropics it may perhaps be interesting to note our technique.

We prepared a 24-hour old culture in broth (5 c.c.) and to this added 3 c.c. of a 25 per cent. solution of NaCl in water and added 7 c.c. of uninoculated broth and then floated a few cubic centimetres of ether upon the surface of the medium.

We then closed the tube with the cotton wool plug and covered this with plasticin and inserted the whole into a Buchner's tube which we closed with an indiarubber cork and sealed with paraffin and then incubated the whole at 37° C. for about 16 hours, when no lysis was observed.

There was no production of *sulphuretted hydrogen* in lead acetate broth.

Pathogenicity.—After sub-cultivation for some time it was non-pathogenic for rabbits when inoculated intravenously and intraperitoneally, and no signs of arthritis or heart disease were observed.

In human beings it produced two cases of *Febris puerperalis* (Strains II and VI), and one mild case, which might be classified as *Febris in puerperio*, or as mild *Febris puerperalis* (Strain V). Of the two severe cases one ended in recovery and the other in death, and in the latter no growth was obtained in cultures of blood taken from a vein on the day before death, and therefore there was no sign of a septicæmia in this case.

Generic Classification.—We believe that all six puerperal fever strains belong to the genus *Streptococcus* Billroth 1874, because :—

(1) They are Gram-positive cocci, not encapsulated, occurring in short chains in broth cultures.

(2) On agar at 22° C. and at 37° C. they produce small discrete translucent colonies or an effused translucent growth, with little or no surface development in stab cultures.

(3) There is a cloudiness in growths on serum-glucose-agar.

(4) Certain carbohydrates, glucosides and alcohols are fermented.

(5) Inulin, usually, is not fermented.

(6) Nitrates are not reduced.

(7) There is no visible growth on potato.

(8) There is no lysis when bile salts are added to broth cultures.

(9) There is no autolysis is salt solutions.

(10) They are parasitic cocci.

Though none of the above characters, regarded singly, is an infallible test for a streptococcus, still, taken together, they indicate Billroth's genus fairly well.

PROVISIONAL DIAGNOSTIC TABLE OF STREPTOCOCCAL GROUPS.

A. Parasitic on plants. Grow in broth but not on agar or gelatine		*I. Sphagni group.*
B. Parasitic in animals. Grow in broth and on agar and usually on gelatine :—		
F. Obligatory anaerobes ...		*II. Fœtidus group.*
G. Aerobes, facultative anaerobes :—		
M. Pigment present ...		*III. Sanguineus group.*
N. Pigment absent :—		
R. Gelatine actively liquefied		*IV. Gracilis group.*
S. Gelatine usually not or rarely slightly liquefied. Inulin usually not fermented :—		
I. Gas produced ...		*V. Mastitidis group.*
II. Gas not produced :—		
Non-fermenters	(a) Glucose and other sugar media not fermented ...	*VI. S. H. & S. (I) group.*
Monosaccharide fermenters	(b) Glucose usually and other sugars generally *fermented* :—	
Equine fæcal type	1. *Glucose alone* or with *saccharose* and *salicin*, but not with lactose, *fermented* ...	*VII. Equinus group.*
Disaccharide fermenters Human fæcal type	2. *Lactose, glucose, saccharose and salicin, and sometimes mannitol* but not raffinose, *fermented* :—	
	(a) Mannitol not fermented ...	*VIII. Erysipelatis group.*
	(b) Mannitol fermented ...	*IX. Fæcalis group.*
Trisaccharide fermenters. Bovine fæcal type	3. *Raffinose, lactose, saccharose, usually glucose, sometimes salicin and rarely inulin*, but not mannitol *fermented* ...	*X. Salivarius group.*

Specific Classification.—The recognition of a species belonging to the genus *Streptococcus* Billroth 1874 is a matter of great difficulty, but need not be mentioned here except to invite attention to the references given in the paper quoted below on *Streptococcus equinus septicæmia*, by Haddad and one of us, and to the paper by Andrewes quoted in the references given below.

Our views as to the grouping of the species of the genus may be gathered by reference to the Provisional Diagnostic Table printed below, which explains itself with the exception that "VI S. H. and S. (I) Group" refers to Group I, as described by Stowell, Hilliard, and Schlesinger in 1913, and

further details with regard to this table will appear in a further paper.

By examining this table it will be observed that in both Series A and B the organisms which we are considering come under the division (B), because they are parasitic in man, and under (G) because they are facultative anaerobes; (N) because pigment is not produced; (S) because gelatine is not liquefied; (II) as no gas is evolved; (*b*) because glucose is fermented, and finally under (3) because it acidifies saccharose, lactose, and raffinose, while salicin may or may not be fermented. They therefore belong to *X, the Salivarius Group*, which owes its inception to the work of Andrewes and Horder, who named the so-called *Streptococcus brevis* of the mouth *S. salivarius* in 1906 because it was the common species found by Gordon, Houston, and themselves in that cavity.

The group agrees with Kligler's definition given in March of this year, which is as follows:—

> "*S. salivarius:* Raffinose fermenters, usually ferment salicin but do not ferment mannite, generally produce a green colony on blood agar and usually cause subacute and chronic infections."

S. salivarius is, however, not the sole representative of the group known at the present time as allied species, belonging to same group, are: *S. anginosus* Andrewes and Horder 1906, and *S. mastitidis* Savage 1908 (which must not be confused with other, quite distinct, species bearing the same name).

> Before giving an analysis of the species of the group it is necessary to be quite clear as to the position of the organism *S. mastitidis*, Savage, 1908, which was found by him to be present in 68 per cent. of thirty-six cows suffering from mastitis. With regard to the comparison between this organism and *S. anginosus* he says:—
>
> "it was found that, morphologically and culturally, they were *quite indistinguishable* even when the different sugar alcohol tests were employed. In addition the commonest cultural deviations from the type were the same in both cases."
>
> The only difference which he insists upon is the low pathogenicity of *S. mastitidis* towards mice while *S. anginosus* has considerable pathogenic action, but we do not believe that mere pathogenicity or non-pathogenicity is of value in separating streptococcal species as a non-pathogenic species can be educated so as to become pathogenic by passage through animals, and a pathogenic rendered non-virulent by cultivation.
>
> We therefore believe that *S. mastitidis*, Savage 1908, is the same as *S. anginosus*, Andrewes and Horder 1906, on the ground that its discoverer says that they are indistinguishable except by their pathogenicity.

The group also embraces Gordon's salivary strains, 3*c*, 4*d*, 4*f*, 4*i*, 5*a*, 5*b*, 5*e*, 5*k*, 5*k*, 6*a*, 6*b*, 6*f*, 7*a*, 7*b*, 7*c*, 8*a*, and Houston's "lamirasac, lamirasacsal, larasac, larasacsal," and Stowell, Hilliard and Schlesinger's groups VI, VII, VIII, and IX, and some of Fuller and Armstrong's strains, Winslow and Palmer's lactose and raffinose, glucose, lactose and raffinose, glucose and raffinose groups, and Hopkins and Lang's groups 2, 3, and 4.

When the reactions of the group are studied it is seen that it is capable of division into a *Typical Sub-group*, composed of species which ferment glucose, lactose, saccharose, and raffinose, but do not acidify inulin, and an *Atypical Group* in which some of these characters are altered.

The Typical Sub-group is again sub-divided according to the fermentation or non-fermentation of salicin, the latter being a characteristic of *S. salivarius* and *S. anginosus*, while the former includes the following sets of strains:—

(1) Andrewes and Horder 2*c*, 2*f*, 2*i*, 2*b*.
(2) Stowell, Hilliard and Schlesinger, Group VI.
(3) Broadhurst, Group E.
(4) Gordon's 2*c*, &c.
(5) Fuller and Armstrong.
(6) Hopkins and Lang (3).
(7) Perhaps some of Houston's *lamirasacsal, larasacsal*, and *larasal*.
(8) Lewis's 6 and 7.
(9) Khartoum puerperal Strains II, V, and VI, which form Series B, as described above.

This sub-division, which agrees in its reactions with *S. salivarius*, except that it ferments salicin, seems to be more pathogenic to man than *S. salivarius* itself, because Andrewes and Horder record against its strains ten out of twenty-six cases of disease in which *S. salivarius* and its typical non-hæmolytic allies are concerned.

They mention four non-hæmolytic strains which ferment glucose, lactose, saccharose, raffinose and salicin, viz.:—

2*c* - *Neutral red* not reduced, *coniferin* not acidified, *milk* clotted.
2*f* - *Neutral red* not reduced, *coniferin* acidified, milk clotted.
2*i* - *Neutral red* varied, *coniferin* acidified, milk clotted.
2*l* - *Neutral red* reduced, *coniferin* acidified, *milk* not clotted.

As it is not possible to purchase coniferin at the present time, it is obvious that our strain which did not reduce *neutral* red and clotted milk is not capable of differentiation from 2*c*, 2*f*, or 2*i*. With regard to these two tests we agree with Hopkins and Lang that they are not reliable as bases of classification.

As Andrewes and Horder believe these salicin fermenting strains to be responsible for a certain number of terminal septicæmias, and as we believe one of them to be capable of producing puerperal fever, it is obvious that they are of some importance, while their points of difference from one another are only of minor value.

The studies of Hartzell and Henrici, published in March of this year, with regard to pyorrhœa alveolaris also demonstrate the existence of forms fermenting salicin about the teeth, and, as would appear from the *résumé* before us, some of these also ferment lactose, saccharose, and raffinose, and therefore agree with the characters of the salivarius group.

Moreover, their features as fermenters of glucose, lactose, saccharose, raffinose and salicin appear to make them stand out among the *animal parasitic, facultative anaerobic, non-pigmented, non-liquefying, non-gasogenous streptococci* as a distinct group and therefore to be worthy of a name.

As this salicin fermenting section of the salivarius group is often met with in the fæces of bovines, we give it the name *Streptococcus bovis* and define it as follows:—

> *Streptococcus* living in the alimentary canal of hovines and in the mouth cavity and intestines in man, capable of growing in broth as short, non-encapsulated chains, and in the form of typical small discrete translucent colonies on agar and less commonly on gelatine which it does not liquefy, without pigment or gas production, and capable of producing acidity in glucose, lactose, saccharose, raffinose and salicin, but not in mannitol, and not capable of producing hæmolysis on human blood agar or of being dissolved by bile salts or salt solutions, and usually acidifying and clotting milk but not reducing neutral red, and capable of causing disease in man if it enters the tissues. *Habitat:* the intestinal tract of hovines.

S. salivarius the type of the group, *S. anginosus* and *S. bovis*, however, do not cover all the strains which have been met with by various observers, for, as Andrewes and Horder pointed out, *S. salivarius* varies with regard to raffinose and inulin at times.

There exists therefore an atypical sub-group of strains which are probably only variants of the typical sub-group, but which must be mentioned in a differential diagnostic table of the group until their real position becomes better known.

The whole group can now be arranged in a diagnostic table as follows:—

SALIVARIUS GROUP.

Definition.—Streptococci parasitic in animals as facultative anaerobes growing in broth and on agar without pigment formation, with slight or no growth at 22° C. on gelatine, which is not liquefied and capable of fermenting glucose, lactose, saccharose and raffinose, but not mannitol and usually not inulin, and generally of clotting milk.

A. *Glucose, lactose, saccharose and raffinose* but not inulin *fermented*	*Typical group.*
I. Salicin not fermented:—	
(a) Hæmolysis marked ...	*S. anginosus.*
(b) Hæmolysis absent ...	*S. salivarius.*
II. Salicin fermented ...	*S. bovis.*
B. *Saccharose, raffinose* and sometimes glucose, lactose, or inulin *fermented*... ...	*Atypical group.*
I. Glucose, lactose, saccharose, raffinose and inulin fermented	Hopkins and Lang 4.
II. Glucose, lactose, saccharose, salicin and inulin fermented	S. H. & S. (VII) Khartoum Puerperal V
III. Lactose (saccharose?), raffinose (salicin?) but not glucose fermented ...	Winslow and Palmer.
IV. Glucose (saccharose?), raffinose (salicin?) but not lactose fermented ...	Winslow and Palmer.

From this table it is obvious that the Khartoum puerperal streptococcal Strains I, III, and IV closely resemble *S. salivarius* Andrewes and Horder, which is described by these authors as being typically short chained and as producing a uniform turbidity in broth, while it behaves less constantly than other types with regard to gelatine at 20° C. in that sometimes it grows and *sometimes it does not*. It *almost* always clots milk, and in its typical form reduces neutral red, though some variants fail to do this. It ferments, typically, saccharose, lactose, and raffinose, but the last is less constantly affected than the other two. It only very rarely ferments inulin and typically it does not acidify salicin, while alcohol reactions are mentioned without giving names and details. It is one of the causes of infective endocarditis and probably includes some of the strains of the so-called *Rheumococcus*, though other strains are more probably a separate species nearly allied to *S. fæcalis*.

If now a comparison is made between this original description of *S. salivarius* and the Khartoum Strains I, III, and IV a striking similarity will be observed, as is shown in the following table:—

No.	Reaction.	*Streptococcus salivarius.*	Khartoum Puerperal Streptococcal Strains.		
			I.	III.	IV.
1	Morphology	Short chains ...	Same	Same	Same
2	Broth ...	Uniform turbidity ...	Same	Same	Same
3	Gelatine at 20°-22° C.	*No liquefaction* little or no growth	*Same* slight growth	*Same* no growth	*Same* no growth
4	Milk ...	Almost always clotted	No clot	Clotted	Clotted
5	Neutral red	May or may not be reduced ...	No reduction	No reduction	No reduction
6	Saccharose	Acid	Same	Same	Same
7	Lactose ...	Acid	Same	Same	Same
8	Raffinose ...	Usually acid except in atypical strains	Acid	Acid	Acid
9	Inulin ...	No acid except in atypical strains	No acid	No acid	No acid
10	Salicin ...	No acid ...	Same	Same	Same
11	Hæmolysis	Absent ...	Same	Same	Same

We may therefore conclude that Strains I, III, and IV are *Streptococcus salivarius* Andrewes and Horder 1906.

With regard to Strains II, V, and VI, while they agree with the classical *S. salivarius* in most details, still they differ in fermenting salicin, and therefore are classified as *S. bovis* Chalmers and Atiyah 1915, the description of which is given above, while Strain V is atypical in that it ferments inulin, but this, to our minds, is insufficient to make a new species.

We look upon the fermentation of inulin as merely a step in a reversion to an ancestral type, as indeed we regard Rosenow's mutation experiments in which a given strain of a streptococcus will, under certain apparently adverse conditions, divide into two strains, one of which clings to the streptococcus hæmolytic type, while the other reverting first to the non-hæmolytic type can be converted into a pneumococcus.

We therefore believe that the organisms of the atypical Group No. II should be regarded as belonging to the species *S. bovis*, while those of No. I

should come under *S. salivarius*. The reactions given for Nos. III and IV are too few, but, personally, we suspect that they belong to one of the three described species.

Differentiation of Puerperal Streptococci.—With regard to the other known varieties of puerperal streptococci mentioned above, we may note that the obligatory anaerobes *S. fœtidus* Veillon 1893 and *S. anaerobius* Lewkowicz 1901 belong to II Fœtidus Group, as set forth in the Provisional Diagnostic Table given above, and therefore they can be differentiated from the salivarius group and from one another by the following characteristics:—

II.—Fœtidus Group.

Definition.—Streptococci parasitic in animals, obligatory anaerobes growing well at 37° C., and poorly or not at all at 20° C.:—

I. Fœtid gas produced; milk usually acidified and slowly clotted	*S. fœtidus.*
II. Fœtid gas not produced; milk unchanged	*S. anaerobius.*

There now remain only the facultative anaerobes *S. erysipelatos* Fehleisen 1883, *S. mitior* Schottmüller 1903, and *S. puerperalis* Furneaux-Jordan and Mackay 1912, to be discussed.

As none of them produce pigment, actively liquefy gelatine, ferment inulin, or produce gas, they all belong to (II) on the Provisional Diagnostic Table. As they ferment glucose, saccharose, lactose, and salicin and do not acidify raffinose or mannitol they all belong to VIII, the Erysipelatos Group, and can be distinguished from the Salivarius Group and from one another in the following manner:—

VIII.—Erysipelatos Group.

Definition.—Streptococci parasitic in animals, facultative anaerobes without pigment and usually growing on gelatine at 20° C. without liquefaction and usually neither fermenting inulin nor producing gas. Typically fermenting glucose, lactose, saccharose, and salicin, but not raffinose or mannitol.

A. Colonics on agar large white and opaque at the end of forty-eight hours resembling those of an albococcus milk clotted. Hæmolytic action unknown	*S. puerperalis.*
B. Colonies on agar small translucent not resembling, at the end of forty-eight hours, those of an albococcus:—	
I. Hæmolysis present:—	
(a) Milk clotted:—	
1. Some kind of a capsule present, colonies on agar typical	*S. epidemicus.*
2. Capsule absent, growth on agar may be absent or in the form of very fine or at times watery colonies, but typical on ascitic agar ...	*S. equi.*
(b) Milk not clotted:—	
Capsule absent, colonies on agar typical	*S. erysipelatos.*
II. Hæmolysis absent:—	
(a) Milk clotted	*S. mitior.*
(b) Milk not clotted	*S. mitis.*

It is obvious that the name *S. puerperalis* Furneaux-Jordan and Mackay 1912 must give way to *S. puerperalis* Arloing 1884 if they are different organisms, but we have been unable so far to obtain Arloing's original description, and moreover we have been unable to trace any full description of Furneaux-Jordan and Mackay's organism. We have, therefore, provisionally retained both names, viz., Arloing's as a synonym of *S. erysipelatos*, and Furneaux-Jordan and Mackay's for a separate species until further information is obtained.

It may be that *S. mitior* and *S. mitis* are merely variations of one organism, and if this is so, then the name *S. mitior* Schottmüller 1903 has priority.

Thus *S. salivarius* and *S. bovis* can be differentiated from the other streptococci found in association with puerperal fever and from one another, and are now for the first time, as far as we know, reported in this connection. It therefore behoves us to inquire as to whether or not they had any etiological *rôle* in the production of the puerperal fever with which they were found to be associated.

Etiological Rôle.—It is difficult to prove that a streptococcus found in any given case of puerperal fever is the true etiological factor of the disease, but with regard to *S. bovis* and *S. salivarius* the following points may be noted.

S. bovis was present in pure culture in the discharge from the interior of the uterus in Case II, when this was taken carefully and with aseptic precautions.

At first the patient was very seriously ill and the streptococci were present in large numbers in smears made from the uterine exudate, but as the symptoms abated these organisms were observed to diminish in numbers most remarkably and to cease entirely, as tested by cultivation, when the patient was well on the way to recovery.

Another point also with regard to *S. bovis* was studied in Case V, and this was the rise of the opsonic index from 0·6 when the patient was ill to 1·0 when the symptoms abated, while with regard to *S. salivarius* the opsonic index remained low in Case IV, which was fatal.

These findings with regard to the opsonic index receive support from the work of M'Cririck, who observed that in puerperal fever due to *S. erysipelatos* it remained remarkably subnormal in fatal toxæmic cases, but rose to, or above, normal with the subsidence of the symptoms, while it varied within normal limits if the infection was not due to a streptococcus.

We are therefore of the opinion that *S. salivarius* Andrewes and Horder 1906 and *S. bovis* Chalmers and Atiyah 1915 are causal agents of a type of puerperal fever occurring in Khartoum and Omdurman at the time of writing, though, of course, other causal agents of the disease may be found at any time in the future.

We have attempted to throw more light upon the etiological *rôle* of these streptococci by injecting cultures of *S. salivarius* from Case IV, which ended fatally, into the uterus of a cat which had recently given birth to kittens, but failed to obtain an in-

fection, which may have been due to the fact that the organisms had been weakened by repeated subcultivation, or perhaps because cats are resistant to this variety of streptococcus, or possibly to a combination of both circumstances.

Epidemiology.—We have now traced the six cases of puerperal fever which we began to study to the action of two closely allied streptococci, viz.: *S. salivarius* and *S. bovis*, both of which are known to occur in human saliva and cow's dung, while *S. bovis* is also found in human fæces, and the question before us resolves itself into two points:—

(1) Did the infection come from a human source and was it therefore most probably autogenetic?

(2) Did it come from a bovine source and was it therefore most certainly heterogenetic?

In order to answer this question we investigated saliva from the mouths of natives living in Khartoum, and although this work, which is as yet merely commencing, belongs to another paper, still we may say that we have met with types which fermented glucose, lactose, saccharose, and raffinose, but not salicin or mannitol, and which clotted milk and therefore agreed with *S. salivarius*.

> With regard to the presence of this organism in the human mouth it is interesting to note that Gordon's researches, performed in London, have shown that at birth that cavity is sterile though it quickly becomes infected with *Staphylococci* and by *Streptococcus equinus*, which is the common aerial streptococcus of that city, it does not acquire *S. salivarius* until some seven hours later, *i.e.*, about the same time as that at which it shows *S. pyogenes*. The infection would most probably come from other human beings *via* the air to the mouth of the newly-born child.

With regard to the presence of *S. salivarius* in human fæces the researches of Houston and those of Fuller and Armstrong have shown that it is but seldom present.

On the other hand, *S. bovis* in typical and atypical varieties is present in human fæces and possibly it is this species which Winslow and Palmer found in 5 per cent. of human fæcal streptococci and which they named *S. salivarius*, because glucose, lactose, and raffinose were fermented, and which could not be distinguished from that organism because they did not use salicin.

It is therefore possible that the infection in the cases caused by *S. bovis* may have been *autogenetic* in origin, but it may also have come from the same source as the infection by *S. salivarius*, which indeed is rendered probable by its scarcity in human fæces.

The only part of human organism in which *S. salivarius* is commonly found is in the mouth, and it appears to us difficult to imagine how infections of cases situate in two separate towns and with quite different attendants could come from this source.

On the other hand, this organism forms 64 per cent. of the streptococci found in bovine fæces in America by Fuller and Armstrong, and therefore it is reasonable to look for the infection of these cases, and perhaps also of those caused by *S. bovis* from a bovine fæcal source.

There are three native uses of cows' dung which require investigation with reference to this point, and they are:—

(1) *Cow-dung poultice.* — This is commonly used by natives throughout the Sudan, and is placed on any painful region of the body, and is, at times, applied to the lower part of the abdomen and even to the external genitalia of the pregnant woman, and in this way may bring about an infection of the vagina with bovine types of streptococci.

(2) *Cow-dung wash.*— In many parts of the Tropics it is not uncommon for the natives to use a cow-dung wash for the floors and walls of dwelling rooms for the purpose of keeping away biting insects and also white ants, and although the practice does occur in the Anglo-Egyptian Sudan it is not so common as in other parts of Africa and in parts of Asia.

Cow-dung, however, is used in Khartoum and Omdurman as a wash for the tops of ovens, and especially of those used for baking bread, and also for the walls of outhouses, especially those used for storing grains.

(3) *Zibla.*—It is also used at times in lieu of horse-dung as a constituent of a mixture called zibla which is applied to roofs and walls.

As this wash dries it must form dust, which must pollute the air and be driven hither and thither by the strong winds, which are often present in certain areas of the Sudan, and as the researches of Andrewes and Horder have demonstrated that streptococci are resistant to desiccation it is possible that the dust derived from dried cows' dung may contaminate the sterile instruments and hands of the attendants on the parturient woman and so bring about puerperal infections, which would belong to the heterogenetic type. We are, however, unable to prove this point at present and we merely give it as a possible solution of the problem of infection.

Once the disease has been started it is always possible for new cases to be infected from previous cases by the agency of attendants, and in this way an epidemic may arise at any time, or failing this, the infections may be kept up indefinitely by the same means.

Pathology.—We have demonstrated that in two out of our three fatal cases there was no septicæmia and we are inclined to view the pathology of our cases as being septic infections of local character giving rise to endometritis and metritis and sometimes perimetritis and pelvic abscess.

We have unfortunately been unable to make any *post-mortems* on our fatal cases and therefore cannot give the morbid anatomy, but our researches in other tropical climates agree so exactly with the findings described by Schottmüller that we must conclude that the *post-mortem* anatomy will be found to show some of the features well known in Europe.

Clinical Remarks.—There seems to be no doubt that the same organisms can cause the mild "Febris in Puerperio," as exemplified by Case V, and the severe "Febris Puerperalis" as shown by Cases II and VI.

Why there should be such a difference is not clear to us and must depend in some way or another upon the general bodily condition of the patient, and perhaps upon the strength of the streptococcal

strain, which, as is well known from laboratory experiments, varies considerably.

Be this as it may, there can be no doubt that one and the same organism infecting the uterus can cause the mild "Febris in Puerperio" or "milk fever," and the more severe and even fatal "Febris Puerperalis," the symptoms of which vary according as to whether there is a local, more or less extensive, infection, or a septicæmia.

A prognosis may be arrived at by observing improvement or the reverse in the clinical symptoms, but more accurate decisions may be deduced by a study of the opsonic indices taken daily, provided that the causal organism is known and is available in pure culture. The index, as already stated, remaining low or sinking in serious or fatal cases, but rising as improvement sets in.

Diagnosis.—It is of the utmost importance that any fever attacking a puerperal woman in the Tropics should be assumed to be *puerperal fever* until it is proved to be something else.

The presence of one of the varieties of puerperal fever can be confirmed:—

(1) By microscopical examination of stained smears of the intra-uterine exudate taken aseptically by a sterile swab passed through a sterile speculum inserted into a previously douched vagina.
(2) By cultural examinations in ascitic broth of the same exudate taken in the same way, and incubated aerobically and anaerobically at 37° C. and examined at the end of 24 and 48 hours.
(3) By a low opsonic index in the case of the streptococcal infections as tested against the causal organism. This of course is especially applicable in small or large local epidemics when the causal organism will be available in pure culture in the local bacteriological institute.

We have tried the agglutinin reactions in several of the above cases and have failed to obtain satisfactory results.

With regard to the *differential diagnosis*, the most important fever which requires attention is *malaria* occurring in the puerperium, and this should be capable of easy differentiation by:—

(1) An examination of peripheral blood smears for the parasites, or, if they cannot be found, by:—

(2) A differential leucocytic count with the discovery of a distinct mononucleosis which cannot be explained by other protozoal infections, such as amœbic dysentery, kala-azar, &c.

(3) Enlargement of the spleen, not due to one of the forms of tropical splenomegaly.

If these three tests fail to decide the presence or absence of malaria then a few doses of quinine should be administered and can do no possible harm and may even benefit the patient if a puerperal infection due to streptococci or bacteria is present. In our experience this quinine is best administered by intramuscular injections, with or without oral administration, and should, in nervous patients, be associated with a dose of sodium bromide. If the temperature rapidly declines and the symptoms improve with the quinine therapy, then the diagnosis of malarial fever may be made, but if, as has more often happened in our experience, the fever continues, then the disease is not solely caused by malarial parasites. If there is reason to suspect that the puerperal fever is septicæmic in type, or if early enteric fever in its broadest sense is feared, then the diagnosis can be effected by removing aseptically 1 c.c. of peripheral blood from a vein and immediately adding this to nutrient broth medium contained in a flask, half of which is then incubated aerobically at 37° C., while the other half is incubated anaerobically at the same temperature, and both are examined at the end of twenty-four and forty-eight hours.

By these methods, and by these alone, as far as our experience goes, can a case of puerperal fever be accurately diagnosed.

Treatment.—The aim of the rational treatment of puerperal fever must be to:—

(1) Kill the causal organisms.
(2) Neutralize their toxic effects.
(3) Promote the normal action of the patient's organs.

In order to kill the causal organisms they must be attacked in the positions in which they are living, and as this is usually the wall of the uterus, it is necessary to give the patient an anæsthetic as soon as possible and to thoroughly investigate the walls of the uterine cavity in order to discover any portions of placenta, membranes, or blood-clot, and at the same time to observe whether there is any abscess formation in the vicinity of the uterus and also whether there is any inflammation of the tubes, both of which conditions being treated if present.

Usually all that is necessary is the removal of offending substances from the uterus by means of a mild and modified form of curettage, followed by a thorough antiseptic irrigation of its cavity, which is then drained.

After this the vagina and uterus should be irrigated twice or three times a day with an antiseptic solution in bad cases, and less frequently in mild cases.

With reference to the second heading, viz., the toxic effects of the organisms, if these are at all marked they should be combated at once by means of saline subcutaneous or intravenous injections, and these should be given early and not reserved until too late for beneficial results to follow.

The third point is a matter of common knowledge and need not delay us here.

Having thus briefly discussed the essential features of the treatment we may advert to the employment of serum and vaccine therapy.

With regard to the ordinary commercial antistreptococcal serum we are faced with the difficulty that it is prepared to combat the action of streptococci which are quite distinct from *S. salivarius* and *S. bovis* upon which it does not appear, from one experiment which we performed, to have any lytic action *in vitro*, nor was its opsonic index satisfactory when tested against these organisms on one occasion. On the other hand in does no harm when injected into patients and we have suspicions that it tends to increase the opsonic index in some cases, and it may have a slight antitoxic value also. On the whole we are inclined to believe that it is beneficial when injected into a patient, and we rather suspect that, judging by Weaver and Tunnicliff's experimeuts, it becomes reactivated by the patient's serum and, judging by our experience, this is more likely to occur in mild cases than in severe. Possibly the increased

phagocytic action which we suspect it to be capable of producing in mild cases may be due to this reactivation, but these remarks are purely tentative as our observations are few; at all events we feel that it is worthy of use, especially in mild cases, which of course might develop into severe types of the disease.

We have no practical experience of vaccine therapy in this fever, but we have prepared a vaccine and should we obtain any further cases we shall try it, but in very much larger dose than those usually laid down for such treatment.

Prevention.—The prevention of puerperal fever is a difficult task in civilized Europe and America, and therefore how much more difficult must it be to do this effectively in the Tropics, and especially in the dust-laden air of the Anglo-Egyptian Sudan where the sterilized media of the laboratory are apt to become contaminated by aerially conveyed moulds and bacteria.

Our cases, up to the date of writing, do not appear to be in the form of an epidemic or to be restricted to the practice of any one attendant, and as we have already pointed out, we suspect that the vagina and hence the uterus becomes infected by bovine fæcal streptococci conveyed either through the agency of the patient's own fæces to the vagina or by dust to the hands and instruments of the attendants, and hence we are inclined to believe that the only real protection is *pre-* and *post-partum* antiseptic vaginal douching associated with antiseptic intra-uterine irrigation in such cases as it may be necessary to introduce the hand or an instrument into that cavity.

Sterility as regards instruments and rubber gloves alone will fail to protect the parturient woman, and every antiseptic precaution must be more forcibly insisted upon in the Tropics than in temperate climates.

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FLIES AS A CAUSE OF INFANT DIARRHŒA.

THE report of the Department of Health of New York shows that almost twice as many infants have diarrhœa among fly-exposed as among the fly-protected infants, and that almost twice as many infants have diarrhœa in dirty homes as in clean homes. On this showing, the relative importance of flies and dirt in the production of this disease seems to be about the same. Artificial feeding, however, was found to be a more important factor than either of the others. Almost two and one-half times as many infants were attacked by diarrhœa among artificially fed as among breast-fed infants. If it had not been for careful selection of food and instruction to mothers, the proportion of cases among artificially fed infants would have been even higher. As it is, the influence of flies and dirt combined is of about the same importance as artificial feeding alone in the production of this disease. Artificial feeding and dirt combined are responsible for a still larger percentage of the cases, three and one-half times as many artificially fed infants in dirty homes being attacked as in the case of breast-fed infants in clean homes. While the report shows that flies form one of the three main causes for diarrhœal diseases among infants, and constitute one of the two lesser causes out of the three, the demonstration that twice as many infants are the subject of diarrhœal diseases among fly-exposed as among fly protected infants is ample justification for continued prosecution of the anti-fly campaign. The ideal condition for the reduction of the infantile death-rate to the minimum is breast feeding in a clean and fly-protected home for each baby.

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WOMEN'S WORK IN PEACE AND WAR.

IN Western Europe, and more especially in Britain, as well as in Northern America, women have, for a generation or two, been gradually disappearing from out-of-door work on the land. They were wont to be engaged as members of the permanent outdoor staff on the farm, their work consisting of hay-making, gathering the corn in sheaves as it fell to the scythe, hoeing turnips, potatoes, beans, &c., assisting in the barn—be it at the threshing by mill or by flail—milking cows, feeding cattle, pigs, &c. Gradually women appeared less and less in the fields, until at the present day in many parts of England no women are to be found in the fields or engaged in farm work of any kind, not even at the milking of cows. The reasons for this and the explanations of the change need not be discussed. Suffice it to say that the factories have attracted women in the neighbourhood of the large manufactories; also such occupations as teaching, shop assistants, and the many venues which wealth and luxury have created serve to employ others. The land knows them not; outdoor work in the open air is a thing of the past, and an enervating indoor life has taken its place.

Curiously enough, wealth and luxury have developed from amongst women another class of out-of-door "workers," and this, curiously enough, is at the other end of the social scale from those who have been sucked into the maelstrom of factory and town life employment. The young women of the "idle" class have taken to golf, hockey, tennis, hunting, and out-of-door sports generally to an extent hitherto unknown. Some become doctors of medicine, some students in various branches of arts and science. It is amongst this class also that we find women putting on uniform in wartime and doing the work which used to be considered men's work pure and simple; and as the defence of one's home—and consequently of one's country—is the primitive instinct of every human being, it is the bearing which all these occupations in time of peace have upon women in the time of war that the defence of the nation largely depends. If the woman in time of war cannot do the necessary work to keep the nation going in food and raiment, then that nation collapses before the aggressor who is better supplied. In Britain at the present time the farm labourer is especially specified as one of the sections of the community which should not be called up for military service. A few generations ago, had this law been in force, there would have been few men to call up, for the population of this country, and of all other countries, was mainly, and in many cases wholly, agricultural. Had conscription obtained, and the women of a previous day been as they are to-day, the fields would have remained untilled, the cattle untended, and the soldiers and the nation would have been starved into submission. The fact that women have left off taking part in the field and stable work on farms has prevented hundreds of thousands of the best men of Britain joining the Army. The most physically fit people in any nation are, and must be, those who are engaged in out-of-door life; take away these—that is, the farm hands—from an army, and one has lessened the power of that army for fighting purposes.

We are, therefore, in this country keeping perforce from our Army the most physically fit section of our community, owing to the fact that the women of the country are no longer able to do their work.

In other countries of Europe and elsewhere, how different is the tale to be told! Our soldiers, even in France and Belgium—but a few miles from our shores—see the women doing the farm work, and that, too, close up to the fighting line: ploughing, hoeing, threshing, feeding and milking cows,

yoking and driving horses, and all the ordinary work of the farm. Proceed further afield across Europe, and the same evidence of women's work on the farm is accentuated. Pass into Asia, and there the field work seems the woman's natural sphere. The men are said to be too lazy to do the work; but it is really the absence of protection by the ruling authorities that keeps men armed and ever on the watch against intrusion upon their lives and their property. Were men to do the work in the time of peace, the women would be incapable of carrying it on in time of war.

This, it may be said, refers only to the lower classes of women. But the better-class woman not a century ago in this country went to market with the wool, the produce of the poultry yard and dairy, and in many cases with the pigs and grain as well; she was accustomed to buy and sell. To-day in most lands she does the same thing. In fact, the man in this connection is but a recent recruit, for not so long ago woman did it all. If she does not do it in peace, she is unfit for it in war. It will be said by our modern women of the better class—the product of modern wealth and luxury—" Surely you do not mean persons in our position to do this?" If not, then do not expect to be entrusted when war breaks out. Farm work and buying and selling are expert work not to be learned in a month or two, not at schools or colleges, but in the hard daily contact with others in the market-place or in the auction room.

Having, as the above would seem to show, brought the story to the bedrock of existence, the way out of the difficulty is not so easy. It is all very well to say the women ought to do so-and-so in peace time to prepare for war; but will they? The wife of the farm hand in our country villages will not even trouble herself to pull the blackberries on the hedge at the foot of the garden to make her own jam; she replies she can buy it in the shops. Her children's clothing is all too often bought ready-made at the nearest clothes store; keeping even a few fowls is a bother. She has less pride in her household affairs, and is content to buy what she wants in the shops. She becomes, therefore—having lost her pride—slovenly and extravagant. The effect upon the husband is deleterious and summed up in the word " public house," where he meets men from a similar home environment.

The way out of the dilemma did universal service obtain is more apparent; but with the present haphazard methods of filling the ranks of our armies it is difficult to bring it home to women even in the country, if not well-nigh impossible. The present War has not, luckily (from some points of view), brought invasion and occupation of the country upon us, but theoretically it would have taught us the lesson that we have lost touch with Nature, and forgotten the lessons of both Biblical and secular history.

Women have in many ways played a noble part during the War; but in the most essential point of all, namely, allowing the men best fitted for the hard work of war to go forth to fight our country's battles, their failure has been complete.

It will no doubt be pointed out that women are fulfilling the above conditions. Are there not women learning agriculture and actually doing the work on certain farms? Are not women taking up duties as lady gardeners, &c.? Yes; but when one inquires into it, the lady gardener superintends and a man does the work; and the lady agriculturists are but an infinitesimal fringe of the community. Until the women of the working classes regenerate, the nation will not benefit. All credit to those women who are showing the way; and it is to be hoped their good example may bear fruit and encourage the women to do the work Nature intended them to do—a helpmeet for man, whether in making home attractive or performing work which will permit the best men to go forth to defend their hearths and homes from the enemy.

Annotation.

Endemic Typhus in the Philippine Islands (G. B. Foster, *Archives of Internal Medicine*, September). —Twenty-three cases occurred among Filipinos. The first case was erroneously diagnosed as malaria. Tentative clinical diagnoses of typhus were made by elimination, but in the absence of confirmatory laboratory evidence, the first positive diagnosis was not made until October 12, 1914. The disease observed here corresponds with the acute infectious disease described by Brill, but the period of incubation appeared longer, the average leucocyte count was less, and marked nervous manifestations —absent in Brill's cases—were not uncommon. The onset was characterized by chill in twenty-one cases, headache in nineteen and by vomiting in six. Lumbar pain and pains in the extremities occurred in eight cases, and vertigo was recorded once. In two of the cases the onset was gradual and fever was the first symptom noted. There was intense pain in the chest in one case at the onset, probably due to pulmonary congestion. The facies at the onset was that of intense congestion. The expression in some cases was anxious and in others dull and stupid. The colour remained good until the crisis, after which pallor was evident for a variable time and the patient exhibited a " washed out " appearance.

The temperature rose rapidly during the stage of invasion, reaching the fastigium on the second to the sixth day. The average fastigium in twenty-one cases was 103·5° F., the lowest 102° F., and the highest 104·6° F. The fastigium was reached on the third or fourth day in 50 per cent. of the cases. The eruption occurred in sixteen cases, was absent in two cases and in the remaining five cases was either absent or overlooked. It appeared on the fifth day in two-thirds of the cases, but in isolated cases it was observed as early as the fourth day and as late as the eighth day. It appeared first on the abdomen and chest and, developing rapidly and not in crops, had extended to the back, shoulders, arms, hands, legs and feet, and in two cases to the face, within twenty-four hours. The

lesions were discrete, slightly raised, rose-red to dark red, irregular in outline, and measured from 2 to 8 mm. in diameter. In the average case the spots were much more profuse than the rose spots of typhoid and less numerous than the lesions in the average case of measles. The eruption faded rapidly with the crisis and had disappeared by the tenth day. Desquamation did not occur.

The blood showed certain constant changes. The leucocyte count, in sixteen cases, varied from 4,000 to 18,000, the average count being 7,865. Differential leucocyte counts showed a rather consistent increase in the percentage of large mononuclear cells, with a corresponding decrease in the number of polymorphonuclears. Eosinophiles were not present in appreciable numbers during the febrile period. Blood cultures in fifteen cases gave negative results. The pulse exhibited no characteristic features. The heart showed no variations from the normal except in one case. A soft blowing systolic murmur was audible in this case following the crisis. Anorexia developed early and persisted throughout the febrile period. Epistaxis, so constant a feature in typhoid, occurred but twice. Signs referable to the nervous system were common, and it appeared to stand the brunt of the infection. Retention of urine occurred rather persistently in one case, necessitating frequent catheterization. Polyuria was an almost invariable concomitant of the crisis. A relapse, intercurrent in character, occurred in one case. One death, due to acute ulcerative endocarditis following the crisis, occurred in the series of twenty-three cases, establishing a death-rate of 4·34 per cent.

LIVINGSTONE COLLEGE.

The work of training missionaries going abroad in the elements of medicine, surgery, and hygiene, especially applicable to tropical countries, which has been brought to such perfection at Livingstone College and carried on now for twenty-two years, has been suspended temporarily owing to the War. Many of the staff, including Dr. Harford, formerly Principal of the College, having volunteered for work with the R.A.M.C., explains this step; but the prospect of few students coming forward during the active period of the War proved the more decisive argument in favour of such a step. Let us hope that the valuable work heretofore carried on will be continued at the very earliest opportunity.

At the commemoration meeting on June 3, 1915, Mr. F. H. Hawkins, Secretary of the London Missionary Society, gave valuable testimony to the good work the College was doing. In the course of his address he said: "Reference has already been made to the fact that the training here given enables men to look after their own health, and that is a most important point. Let me illustrate it: I think these figures are tremendously significant. I do not mean to give all the credit to Livingstone College, but I do give it a great deal of credit. In the first ten years of the history of our Mission in Central Africa, eleven of our missionaries died, and six were invalided home, and with one exception were never able to return to their work. In the last twelve years we have not had a single death in the Mission, nor a single case of a man being invalided home. Let me put it another way, and I think from a still more significant point of view. Take the first ten men who were sent to Central Africa, and we find that their average term of service was well under three years; take the last ten men sent to Central Africa, already their average term of service is over fourteen years, and their average age about 40. The explanation of this is to be found in the fact that men have learnt what you at Livingstone College are teaching them, the care of their own health, hygienic conditions, the need for building their houses in a healthy position; the need for trying to drain the land round their houses to avoid mosquitoes; the need for taking care of their heads when they are out in the sun. All these things you are teaching men, and the men carry with them the lessons which they have learned here; the result is that the missionary societies benefit tremendously, not only in the matter of health of the missionary, but by being saved an enormous amount of money in bringing invalided missionaries home and sending out new missionaries; and the missionary societies are very grateful to Livingstone College for the splendid services it has rendered."

Since the College was opened 542 students have profited by the instruction afforded. The students come from many countries in Europe, and the College is open to men of all denominations. The College with its beautiful grounds and environment has been given over to the military as a hospital, and ever since the month of July, 1915, it has been so used. No fewer than 170 sick and wounded soldiers were treated at the College during the months of August and September. The supervision and general direction of the hospital are in charge of Dr. L. E. Wigram and Mrs. Wigram.

LONDON SCHOOL OF TROPICAL MEDICINE.

Examination Result. Forty-ninth Session. October—December, 1915.

Pass List.—V. A. Goonetilleke (Ceylon Medical Service), L.R.C.P., L.R.C.S.Edin., L.M.S.Ceylon. M. de Costa, M.R.C.S., L.R.C.P., D.P.H. E. J. Rowbotham, M.R.C.S., L.R.C.P.Lond. T. Ryan (West African Medical Service), M.B., B.Ch., B.A.O. R. J. Tata, L.M. and S. (Bombay).

A vanilla-producing plant, the *Vanilla ovalis*, has been discovered in the Philippines on the island of Mindoro. The plant resembles in many respects anilong (*Pothos rumphii*). The newly found plant is being investigated with a view to its development for trade purposes.

Rabbits from New Zealand reach Britain by cold storage in crates in enormous numbers. The further south the region in New Zealand one travels the rabbits are found to be bigger and fatter, and the fur is more valuable for purposes of felting.

Original Communications.

NOTES ON PELLAGRA.

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Prior to the year 1900 pellagra was considered to be a peculiar disease confined to certain districts in Spain, Italy, and Roumania, and attracting little attention outside of these countries.

In 1903 Sandwith reported it in Egypt, and in 1907-8 universal attention was attracted to the disease by the occurrence of a large number of cases in the Southern States of America. This interest was intensified by the subsequent reports of a number of cases from the British Isles.

Its etiology remains obscure. For some time the opinion of the Italian authorities that the disease was caused by the consumption of spoiled maize was almost universally accepted.

In 1905 Sambon brought forward the theory that the disease is of protozoal origin and that the agent of transmission was most probably the Simulium fly.

This theory attracted a very large number of adherents, with the result that the spoiled maize theory fell into disrepute for some years. Recently, however, the failure of Dr. Sambon and his adherents to produce convincing proof in support of their theory and the occurrence of pellagra, in certain regions in which the Simulium fly does not exist, have caused the pendulum of opinion to swing back to the theory that pellagra is a food disease, though opinion is now divided as to whether it is caused by the consumption of maize *per se*, or of spoiled maize, or of a diet which is deficient in what may be termed the "pellagra preventing vitamine." In addition to these theories a completely new theory has recently been advanced by Professors Scala and Alessandrini, of the University of Rome, that pellagra is due to a chronic poisoning brought about by the silica in colloidal solution in waters of determined composition. In other words that pellagra is attributable to mineral colloids, and that clay is the first cause of the evil, for the rain-water present in the ground reacts upon clay which is silicate of alumina producing a hydrolysis that brings about the formation of silicic acid and hydrate of ammonia, both of which compounds can pass into the water in the colloidal form.

In support of this theory it is urged in the investigator's own words:—

(1) That silica in colloidal condition and in a gelatinous condition produces chronic poisoning when administered to guinea-pigs, rabbits, dogs, and monkeys.

(2) That patients suffering from pellagra are cured or their condition is greatly improved by the use of neutral citrate of sodium; *that is to say, they are cured when the malady is of relatively recent date*, or when the free mineral acids have not caused irremediable lesions as must occur in toxic action of long standing.

In regard to (1), it should be remembered that Lombroso urged, as convincing proof of the spoiled maize theory of etiology, the fact that he had produced poisoning with symptoms resembling pellagra by administering a product of spoiled maize to dogs, cats, rats, chickens, and frogs. And, again, that Tizzoni claimed that he had produced symptoms of pellagra in guinea-pigs and other animals which he had inoculated with a specific micro-organism which he had isolated from the blood of pellagrins.

None of these investigators, however, have succeeded in proving that the disease produced in animals is identical with the disease pellagra in man. Unless, therefore, it is proved beyond doubt that the "chronic poisoning" produced in animals by Alessandrini's experiments is in fact pellagra as we know it in man, these experiments cannot be held to be proof of the correctness of his theory.

With regard to (2), it is difficult to attach any importance to the cure of the disease in its early stages, for it would appear that the disease in its early stages tends to cure itself or to improve either without treatment or in spite of treatment, and that it gets worse on each recurrence. Further, it would appear that in the early stages it does not recur very rapidly, often not for two years, but that as it progresses it tends to recur more frequently and with increasing severity until it either assumes a chronic form or the patient dies in a severe attack.

In a paper to the *Lancet* in January, 1915, I drew attention to a number of cases which had undoubtedly originated in Antigua, which combined with the fact that the Simulium fly had not been found in Antigua, though it had been searched for by Dr. Sambon himself and by Mr. Jennings, Entomologist to the Thompson-McFadden Expedition, offered a distinct negation to the theory of transmission by the Simulium.

I also drew attention to certain other factors which appeared to point to a deficient or ill-balanced diet as the probable cause of pellagra. My subsequent study of the disease here and of its literature in other places tends to confirm me in this belief.

Pellagra from the time it was first reported in Europe has been recognized as being associated with extreme poverty and as occurring among the poorest classes.

The theory of its causation by maize or spoiled maize is based entirely on its great prevalence among the poorer classes whose staple diet was maize, principally because it was cheap and they could not afford other or better food.

Also an argument which is frequently quoted in favour of the maize theory is that "while the natives of Corfu, prior to 1857, grew their own maize and ate only sound grains there was no pellagra, but later, when the corn was less profitable, and grain was imported from Roumania, much spoiled maize was brought in and pellagra made its appearance." But it would appear to be at least possible that when these inhabitants grew their own maize and ate it they were in such a prosperous condition that they were able to supplement it by

an otherwise varied diet, but "when the corn crop was less profitable" the people grew more poverty stricken, and while retaining the imported maize as their diet, were not able to supplement it to the same extent by other or more expensive food.

All records prove that pellagra is peculiar to the poorer classes in all countries, *i.e.*, the classes which cannot afford a variety of diet. The fact that a very few cases have occurred among well-to-do persons cannot be held to disprove the theory that the causative agent is an ill-balanced diet, for it is well known that many well-to-do persons are food faddists, and while able to afford an infinite variety of diet, yet voluntarily limit their diet to a very few articles of food which happen to suit their peculiar taste.

With regard to the extraordinary increase of pellagra in the Southern States of America, it would be very interesting to note whether this increase coincides with a general decline of prosperity among the labouring classes there.

Alsberg has noted that new methods of harvesting corn have become common in these Southern States, which methods he considers contribute to the quicker spoliation of maize.

May it not be that these new methods requiring fewer labourers may indirectly contribute to increase of poverty among the labouring classes?

Be this as it may, however, I am of opinion that no investigation into the etiology of pellagra can be complete which does not include within its scope the determination of the absent element in the dietary of pellagrins.

On the assumption that all fatty articles of diet, such as butter, cream, &c., are more or less expensive and therefore not obtainable by the poorer classes, it is possible that a deficiency of fat in the diet may prove to be a factor in its causation. The fact of the great prevalence of pellagra in State institutions in all parts of the world as compared with its total absence among attendants and employees in such institutions is rather in favour of this theory, for the inmates are entirely restricted to the institutions' dietaries, which dietaries are, as a rule, very deficient in fatty elements, whereas the attendants, even in cases where rations are provided, are at liberty to supplement their diet at will. But whether the deficiency be of fat or of some other element of diet, I believe that pellagra only occurs among those persons who by reason of poverty or confinement in an institution, or eccentricity of taste or constitution, such as dyspepsia, are debarred from exercising a natural selection in regard to articles of diet.

Incidence.—In the Central Lunatic Asylum, Antigua, I have had under my care forty-four cases within the last two and a half years. Of these fourteen cases were from Dominica, fourteen from St. Kitts, twelve from Antigua, three from Montserrat, and one from the Virgin Islands.

A few of these cases occurred in inmates who had been some years in the asylum, but the majority of cases occurred within a year of admission, and in six cases the typical symptoms were noticed on admission. Twenty-one of these cases were acute—*i.e.*, running a course of from one to five months, and fatal; three were acute with recoveries; three were slight with recurrence; four are slight and are still under treatment; eight others have completely recovered and so far have not recurred; and the remaining five are of an apparently chronic nature exhibiting the typical cutaneous manifestations, together with stomatitis and debility, continuously for months at a time, in one case for over a year. Cases of pellagra exhibiting a pellagrous eruption of a chronic nature have not to my knowledge previously been reported.

It has been impossible to trace with any degree of accuracy the previous history of these cases. I have only been in charge of the institution for two and a half years. Prior to that time two cases of pellagra were reported from the asylum, but I am of opinion, in view of the severity of the symptoms met with, that the majority of the cases under review are of long standing, even in the case of inmates who have been for a long while in the institution, and in many cases where severe attacks have occurred soon after admission there is every reason to infer that the patients have suffered from pellagra at intervals for many years, and that the insanity for which they have been sent to the asylum is in reality the outcome of repeated attacks of pellagra which had not previously been recognized.

In regard to Alessandrini's drinking water theory, it is interesting to note that these cases occur in almost equal numbers among the natives of Antigua, Dominica, and St. Kitts, and that the character of the water supply is essentially different in the three islands. While in Antigua the water supply of the labourers is derived from collections of rain-water on a clayey soil, thus appearing to bear out Alessandrini's theory, yet in St. Kitts the water supply is derived from springs emanating from mountains of volcanic origin, and in Dominica it is derived from rivers which are often in flood and therefore likely to contain sediment.

The only conditions which are common to the cases in all the islands are poverty and a maize diet, but the significance of a maize diet as a factor in the causation of pellagra is greatly lessened by the fact that maize is a daily article of diet among the well-to-do classes in all the islands also, and yet no case of pellagra has ever been reported in a well-to-do person in any of these islands, which appears to point to the fact that maize diet is not a factor in the causation of pellagra, except when it is associated with poverty. As to seasonal incidence, eleven cases occurred in March, seven in May, four in June, four in February, three in August, October, November, December, two in January, one in April, and none in September.

Symptomatology.—The symptomatology of pellagra has been divided into three groups: Cutaneous, gastro-intestinal, and nervous. In this series of cases the cutaneous and gastro-intestinal symptoms in particular present many points of interest; the

first of these is as regards the relation of the cutaneous manifestations to the course of the disease. Wood has stated that the severity of the skin eruption bears no relation to the severity of the disease, that cases with severe skin symptoms often run a very slight course, and *vice versa*. My own experience is directly the opposite of this. In every case the skin manifestations have accurately forecasted or coincided with the progress of the disease.

I attach histories of four fatal (Cases 1, 2, 3, 4) and four non-fatal (Cases 5, 7, 8) illustrating this agreement of symptoms, and also a history of one case (Case 9) in which skin eruption and stomatitis were the only symptoms. The most noticeable feature of the eruption is its absolute symmetry. We cannot say that a pellagrous eruption will appear always in any one part of the body, but we can be quite sure that if it appears on one hand, we will find it in symmetrical agreement on the other hand. The most usual parts for the eruption to appear are the hands, feet, and neck. In these forty-four cases it has appeared as follows:—

Hands	42 cases.	Ears	1 case.
Feet	30 ,,	Stomach	1 ,,
Neck	17 ,,	Elbows	1 ,,
Legs	4 ,,	Eyes	1 ,,
Knees	3 ,,	Other parts of body	2 cases.
Shoulders	2 ,,		
Hips	1 case.		

As to gastro-intestinal symptoms, stomatitis has occurred in every case. I should regard it as a symptom of great diagnostic value. It is the only symptom with the exception of skin eruption which is consistently met with in all cases. For diagnostic purposes it might be asserted that any symmetrical skin eruption which is accompanied by stomatitis with a very red tongue is pellagra.

I have not found diarrhœa to be as common a symptom as one would suppose. It has occurred in fifteen fatal cases, in five chronic cases, and in one acute case which recovered; six fatal cases had no diarrhœa, and it was absent also in the remaining sixteen cases.

General Symptoms.—Emaciation appears to be a marked feature of the disease, and increase of cutaneous manifestations appears to coincide with increased debility. Increased salivation was met with in many cases, and muscular weakness of the legs in all cases, though this symptom varied in degree; in some cases it was manifested only by a slightly uncertain gait, in others the patient fell backwards on attempting to walk, and in a few cases the patients were unable to walk for months at a time (see Case Histories Nos. 5, 6, 7). Very few patients complained of pain.

Treatment.—I have not found any treatment which could be considered successful. These cases were all treated with arsenic, but it did not seem to have much effect on the course of the disease. Diarrhœa when it occurred was treated with the usual remedies. In mild cases rest and increased dietary appeared to benefit the patient.

CASE HISTORIES.

1. L. A., negress from Dominica, admitted September 3, 1914. Age 35.

Pellagrous eruption.	*Other symptoms.*
1914	
May 5.—Slight on hands, feet, face.	Red tongue.
June 13.—More marked.	Lips cracked, tongue redder. Diarrhœa.
July 20.—Less marked.	Diarrhœa improved.
Aug. 23.—Worse and spreading.	Lips cracked and sore. Diarrhœa worse, weak.
Sept. 9.—Worse and sore.	Diarrhœa worse, weaker.
Oct. 6.—Still very raw.	Diarrhœa weaker, unable to walk.
Nov. 24.—Remained in same condition until on this date she died.	

2. P. L., negro from Dominica, aged 19, admitted February 13, 1914.

Pellagrous eruption.	*Other symptoms.*
1914	
May 1.—Slight on hands, feet, neck.	Lips cracked, tongue red.
May 12.—More marked.	Lips sore.
June 13.—Worse.	Lips sore, tongue red, weak.
,, 15.—Same condition.	Lips sore, increased salivation.
,, 18.—Worse.	Lips sore, increased salivation and diarrhœa.
,, 19.—Much worse.	Lips sore, much worse diarrhœa.
,, 23.—Died.	

3. H. A., negro from Dominica, aged 23, admitted March 27, 1914.

Pellagrous eruption.	*Other symptoms.*
On admission.—Neck, hips, body.	Slightly red tongue.
1914	
June 6.—More marked, also nose.	Lips cracked and sore.
,, 15.—Spreading on face, hands and feet.	Tongue very red.
,, 29.—Much the same.	Losing flesh and getting weaker.
July 3.—Worse.	Severe diarrhœa.
,, 11.—Died.	

4. C. B., negro from Dominica, aged 30, admitted February 27 1913.

Pellagrous eruption.	*Other symptoms.*
1913	
Feb. 11.—Hands, feet, neck.	Sore mouth, red tongue.
Mar. 3.—Recovered.	Recovered.
Dec. 16.—Marks on hands and feet.	Sore mouth, red tongue.
,, 17.—Feet start stripping.	,, ,,
1914	
Jan. 5.—Much worse. Feet ulcerated on front, leaving large sore surface.	Bad diarrhœa.
,, 27.—Died.	

5. R. S., negress from Antigua, aged 27, admitted July 12, 1914.

Pellagrous eruption.	*Other symptoms.*
1912	
Aug. 16.—Hands, feet, neck.	Red tongue, cracked lips, sore mouth.
Sept. 8.—Improved, still faint marks.	Better.

1914	
Jan. 19.—Very marked on hands, feet, neck, black marks under eyes.	Red tongue, uncertain gait.
April 5.—Stripping of hands and feet.	Red tongue, sore lips, falls backwards on attempting to walk.
June 13.—Much improved.	Is able to walk, but has to be very careful.
Aug. 16.—More marked.	Diarrhœa.
Nov. 5.—Much improved.	Diarrhœa better.
Dec. 20.—No skin eruption.	No other symptoms, walk easily.

6. H. L., negress from Antigua, aged 40, admitted January 21, 1914. (Chronic case.)

Pellagrous eruption.	*Other symptoms.*
On admission.—Feet, neck.	Lips cracked, tongue red.
1914	
Mar. 14.—More marked.	Weak, falls backward on attempting to walk.
,, 19.—Still bad.	Lips and tongue sore.
May 13.—Worse on feet.	Lips and tongue sore, still unable to walk.
June 13.—Improving.	Tongue still sore, not able to walk.
Oct. 17.—Still improving.	Can walk a little with assistance.
1915	
Jan. 5.— ,,	Much stronger.
June 27.—Very much improved.	Can walk alone.
Aug. 17.—Still has slight eruption on feet and neck.	No other symptoms, can walk firmly.

7. L. F., negress from Antigua, aged 39, admitted September 12, 1913. (Chronic case.)

Pellagrous eruption.	*Other symptoms.*
1914	
May 1.—Hands, neck.	Lips sore, tongue red.
,, 13.—More marked, face affected.	Tongue sore, weak.
,, 27.—More marked, feet affected.	Lips worse, weaker, unable to walk.
June 13.—Still marked.	Lips and tongue worse.
Aug. 28.— ,,	Very weak.
From May to September unable to walk, still very weak, began to improve in October, 1914.	
Oct. 3.—Skin eruption much improved.	Able to walk.
1915	
Aug. 1.—Skin eruption which has never completely disappeared is now very faint. She is much stronger and has no other symptoms.	

8. A. A., negress from St. Kitts, aged 48, admitted January 22, 1915.

Pellagrous eruption.	*Other symptoms.*
1915	
May 13.—Hands and face.	Red tongue.
,, 19.— ,, ,,	Red tongue, diarrhœa.
June 20.— ,, ,,	Diarrhœa, improving.
July 13.—Improving.	Diarrhœa much better.
Aug. 10.—Nearly better.	Diarrhœa cured.
,, 28.—Cured.	Cured, no symptoms.

9. E. E., negress from Dominica, aged 28, admitted November 21, 1913.

Pellagrous eruption.	*Other symptoms.*
On admission.—Hands, under eyes.	Red tongue, sore lips.
1914	
Feb. 3.—Marks on body and neck, hands worse.	Red tongue, sore lips.
Mar. 30.—Fingers stripping.	Very weak, sore lips.
Apl. 23.—More marked on feet, hands and hips.	—
1914	
Apl. 30.—Much worse. Stripping of skin on hands and feet.	Weaker.
May 6.—Worse. Large sore surface.	Wasted and weaker.
,, 9.—Died.	

N.B.—The term "hands" is used throughout to signify the typical pellagra "gauntlet" on hands and wrists.

THE OCCURRENCE OF BODIES RESEMBLING "SEIDELIN BODIES" (*PARAPLASMA FLAVIGENUM?*) IN ANÆMIC AND FŒTAL BLOOD, WITH SOME REMARKS ON THEIR PROBABLE NATURE.

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STUDENTS of tropical medicine are well acquainted with the discovery by Seidelin in the blood of patients suffering from yellow fever of certain "bodies" which he believed to be the cause of this disease. These bodies are found in scanty numbers in the red blood corpuscles, and their typical appearance may here be described briefly as the association together, after suitable staining, of one or more minute scarlet dots or granules with a bluish body whose shape and size may vary considerably. As a result of further investigations Seidelin still maintains that the bodies are phases in the development of a parasite which is specific to yellow fever, and he is supported in this belief by Macfie and Johnston, who claim to have inoculated the parasite into guinea-pigs. Other workers, notably Schilling-Torgau, Agramonte, and Wenyon and Low, are equally emphatic in opposing the views of the first named and state that bodies identical in appearance with "Seidelin bodies" can be found in the blood of human beings suffering from diseases other than yellow fever, and in the blood of healthy guinea-pigs, dogs and rats.

At the request of the Yellow Fever Commission (West Africa) a search for the bodies was made by one of us in the blood of anæmic adults and children resident in England. In the blood of 102 persons (70 per cent. of whom suffered from anæmia) only five definite bodies could be found. These occurred in children with a moderate degree of anæmia. The investigation was continued by both of us, acting on the suggestion of Wenyon and Low, that "a further study of the exact nature of these bodies would be of interest with a view to determining whether they are developmental or degenerative in origin." For this purpose we have examined more samples of human blood, both adults and children, anæmic and healthy, and also blood from a case of

pernicious anæmia, human fœtal blood (eight cases), and newly born kittens' blood (six cases).[1] We have also recently been able to confirm Wenyon and Low's results by finding the bodies in the blood of fœtal guinea-pigs.

Method for finding the Bodies.

The blood was taken from the finger with a sterile needle and a drop was immediately smeared on a microscope slide by means of cigarette paper. In the case of the human fœtus the blood was obtained from the cut end of the umbilical cord at birth, and the newly born kitten's blood was taken from the heart. The films were dried rapidly by waving in the air and they were then fixed and stained in the way originally recommended by Seidelin, viz.: Fixed about an hour in absolute methyl alcohol; stained twenty-four hours in diluted Giemsa (one drop in 1 c.c. distilled water, *i.e.*, 1 in 20), or one to two hours in this dilution and then twenty hours in a dilution of 1 to 30 or 40. Equally good results were obtained by dissolving one eosin-azur soloid (Burroughs Wellcome and Co.) in 10 c.c. pure methyl alcohol and diluting this to the proportion of 1 in 20 with distilled water.

We must emphasize the fact that if a search for these minute bodies, in such scanty numbers as we have found them in ordinary anæmic blood, is to be successful, the preparation and staining of the blood-films must be carried out with the greatest care, otherwise the production of artefacts which may closely resemble the bodies may confuse even an experienced hæmatologist, and the uncertainty may discourage him. Particular caution must be exercised in distinguishing stained granules, &c., formed by broken-down blood-platelets or blood dust, which are lying upon the red corpuscle and not within it. In our classification of the bodies found we have not included any forms as "doubtful bodies" which gave any suspicion of being outside the cell. It is necessary also, as pointed out to us by Dr. Wenyon, to be sure that the distilled water used in diluting the stain shows no trace of acidity. We have employed organically pure ammonia-free water rendered faintly alkaline with a drop of 5 per cent. sodium bicarbonate solution in each 100 c.c. It is advisable to use acid-free Canada balsam for mounting the films, as the red staining portion of the bodies appears to fade in ordinary balsam. Alternatively, the films may be examined directly in cedar oil. Lastly, the bodies cannot be recognized without the high magnification of a first-class microscope.

Results of the Examination.

Our examination showed the presence of bodies resembling Seidelin bodies, and the relative frequency of their occurrence in blood from different sources, to be as follows. (The cases marked with an asterisk are quoted from the Report to the Yellow Fever Commission already referred to):—

Source of blood	Number of cases	Number of Cases containing Seidelin Bodies: Positive	Doubtful	Negative
Adults and children (all ages). Not anæmic	26	—	4	22
Adults and children (all ages). Not anæmic	34*	—	—	34
Adults, and children above 5 years of age. Anæmic	12	3	3	6
Adults, and children above 5 years of age. Anæmic	47*	1	5	41
Children under 5 years of age. Anæmic	12	1	1	10
Children under 5 years of age. Anæmic	21*	3	—	18
Pernicious anæmia	1	1	—	—
Human fœtus	8	8	—	—
New-born kittens	6	6	—	—

The features brought out by this table are that, while no Seidelin bodies could be found in the blood of sixty persons without obvious anæmia, and only eight definite bodies in ninety-two cases of ordinary anæmia, slight and severe, yet in the case of pernicious anæmia and fœtal blood every sample contained them. Since on the average three blood-films were made from each case, the search for Seidelin bodies in ordinarily anæmic human blood involves the scrutiny of every cell in thirty to forty blood-films to find a single specimen. This scantiness, in comparison with the number present in fœtal blood, is very striking. The details of the cases are given in the Tables I to IV, and illustrations of some of the bodies in the plate.

Table I.—Persons who were not Anæmic. Adults and Children (all Ages).

No.	Name.	Sex	Age	Remarks	Seidelin bodies
1	Flaxman	M	10	Healthy	Nil.
2	Groom	M	8	,,	,,
3	Harrison	F	11	,,	,,
4	Reid	M	12	Hæmophilia	,,
5	Prout	F	3	Healthy	,,
6	Campbell	M	6	,,	,,
7	Alastair	F	10	Measles	Doubtful bodies.
8	Berry	F	15	Healthy	Nil.
9	Grimwood	M	4	,,	,,
10	Thorp	M	6	,,	Doubtful bodies.
11	Hopley	M	3	Croup	Nil.
12	Collison	F	12	Healtby	,,
13	Malder	F	11	,,	,,
14	Hudson	M	13	,,	,,
15	Thorn	F	20	Epilepsy	,,
16	Mitoire	M	24	Dyspepsia	,,
17	Colley	F	12	Healthy	Doubtful bodies.
18	Taylor	M	16	,,	Nil.
19	Thornton	M	14	,,	,,
20	Joslin	M	22	,,	,,
21	Sprigges	M	40	,,	Doubtful bodies.
22	Burton	F	28	,,	Nil.
23	Sands	F	10	Measles	,,
24	Cox	M	12	Nephritis	,,
25	Halliday	M	8	Healthy	,,
26	Weston	M	14	,,	,,

[1] We desire to express our thanks to Dr. E. Holland, of the City of London Lying-in Hospital, and to Dr. Arthur Fothergill, for most of the material.

TABLE II.—PERSONS SUFFERING FROM ANÆMIA. ADULTS AND CHILDREN ABOVE 5 YEARS OF AGE.

No.	Name	Sex	Age	Remarks	Seidelin bodies
1	James ...	F.	10	Severe anæmia	Linear and irregular bodies.
2	Clayton ..	F.	6	,,	Linear and triangular bodies.
3	Elmes ...	M.	10	Slight anæmia	Nil.
4	Lees ...	F.	22	,,	,,
5	Borrodale ...	M.	48	Carcinoma	Doubtful bodios.
6	Rushey ...	M.	60	Slight anæmia	,,
7	King ...	F.	7	,,	Nil.
8	Hertz ...	M.	42	,,	,,
9	Davis ...	F.	13	A few nucleated erythrocytes	Irregular bodies.
10	Barwood ...	F.	8	Slight anæmia	Doubtful bodies.
11	Maycock ...	F.	20	,,	Nil.
12	Holmes ...	F.	18	,,	,,

TABLE III.—PERSONS SUFFERING FROM ANÆMIA. CHILDREN UNDER 5 YEARS OF AGE.

No.	Name	Sex	Age	Remarks	Seidelin bodies
1	Mathers ...	F.	3	Slight anæmia	Nil.
2	Scott ...	F.	2	—	,,
3	Andrew ...	M.	3	—	,,
4	Calverley ...	F.	2	Slight anæmia	Doubtful bodies.
5	Webster ...	M.	3	—	Nil.
6	Turner ...	M.	4	—	,,
7	Hawkins ...	F.	2	—	,,
8	Lang ...	F.	3	—	Linear bodies.
9	Morris ...	M.	3	—	Nil.
10	Williams ...	M.	4	Slight anæmia	,,
11	Fenner ...	F.	4	After diphtheria	,,
12	Beesley ...	M.	2	Slight anæmia	,,

TABLE IV.—HUMAN FŒTAL BLOOD, BLOOD OF PERNICIOUS ANÆMIA, AND NEW-BORN KITTENS' BLOOD.

No.	Source	Sex	Age	Remarks	Seidelin bodies
1	Human fœtus	F	—	Some nucleated erythrocytes	Many. Various shapes.
2	,,	M	—	,,	,,
3	,,	M	—	—	,,
4	,,	F	—	—	,,
5	,,	M	—	Some nucleated erythrocytes	,,
6	,,	M	—	—	,,
7	,,	F	—	Some nucleated erythrocytes	,,
8	,,	F	—	—	,,
9	Pernicious anæmia	M	—	Nucleated erythrocytes	,,
10	Kitten	F	—	—	,,
11	,,	F	—	—	,,
12	,,	F	—	—	,,
13	,,	M	—	—	,,
14	,,	M	—	—	,,
15	,,	F	—	—	,,

DESCRIPTION OF THE BODIES.

The structure of the similar bodies found in the blood of guinea-pigs has been described so fully by Wenyon and Low that their classification includes all the morphological varieties which we have seen. The bodies are markedly polymorphic, but the larger ones are generally either ring-shaped or curved, while the smaller ones become more irregular. These features are to be expected when their probable mode of formation by nuclear absorption is considered. For descriptive purposes only we divide the bodies we have seen in the red corpuscles into three groups, viz.:—

(1) A single minute, highly refractile, red-staining dot or granule, without any accompanying blue-stained portion. The dot often appears almost black, but careful focussing usually shows the red colour. The dot may be surrounded by a colourless circular halo, or it may appear to have a central more darkly staining portion. Possibly these appearances are optical effects. The dot may be double or more rarely multiple.

(2) Blue staining bodies without any accompanying red granules. In our experience it is common to find definite blue bodies alone. We have seen them ring-shaped, linear, and irregular. There are also certain ill-defined bluish-grey staining areas which, with or without red granules, constitute the majority of the bodies we have classified as "doubtful bodies." Macfie and Johnston have remarked on the "simple ring-shaped bodies that stained blue without a chromatin granule." Seidelin called them "protoplasma bodies without chromatin" and suggested that "the absence of a definite chromatin staining . . . is probably a phenomenon of degeneration."

(3) One or more red granules, together with a well-defined blue staining portion, whose shape may vary considerably, but which appears to be most commonly in the form of a ring. It may, however, be triangular, linear, comma-shaped, Y-shaped, or irregular (*vide* plate). The red dot may appear to be enclosed by the blue portion, or it may be continuous with or external to this. The red and blue bodies are generally close together and their position in the cell is usually excentric. The red dot may be extremely minute and it is often a matter of personal opinion whether it is present or not. The dot may even appear purple or black. We have noticed that the better defined the blue body is, the more the red granule appears to be distinctly spherical. If the blue is not so discrete the red granule may look irregular or even multiple. We think that the departure of the red dot from the spherical shape may be due to the preparation of the specimen. The bodies belonging to this group resemble those usually described as Seidelin bodies, but we see no reason for excluding from the same category the red granules or definite blue bodies which occur alone.

THE NATURE OF THE BODIES.

We have called the bodies we have found "bodies resembling Seidelin bodies" because of their similarity to those which Seidelin has described and figured as the cause of yellow fever. We have, of course, no authority for saying that they are

identical, but if a comparison is made of the coloured plates of Seidelin, Macfie and Johnston, Wenyon and Low, D. Thomson, and of ourselves, we think it would be difficult to draw sufficient distinction to be able to diagnose yellow fever in the one case and not in the others.

In the first place, any suggestion that the bodies we have found are parasitic may be discarded. Apart from the fact that their occurrence in the human fœtus would, if they were parasites, involve passage through the placenta, it is difficult to imagine that newly born infants in England are infected with the virus of yellow fever. Their frequency in the fœtal state and in severe anæmia, where nucleated red cells appear in the circulation, at once directs one's attention to their possible connection with the process of new blood formation. To Schilling-Torgau is due the credit of suggesting that the bodies are produced by degeneration of the nucleus of the erythroblasts of embryonic blood in their conversion into non-nucleated corpuscles. To this Wenyon and Low have added the possibility of some of the bodies being patches of basophilic degeneration associated with one of the red-staining granules which are common in the blood of the newly born, and which diminish in number in later life. From our observations on fœtal and anæmic blood we are in accord with these views. The bodies produced by the basophilic degeneration can, however, usually be distinguished from the typical Seidelin bodies. They have not so sharp a definition as the latter and they stain with a purple tinge. Sometimes, owing to the minute size of these structures, it is difficult to be certain as to their nature and we have described these as "doubtful bodies."

The evidence we have to add in support of the above view is that we have found, in the blood of new-born kittens, nucleated red corpuscles showing stages of degeneration of the nucleus from the normal cell to the ring-shaped blue body, similar to the "protoplasma body" of Seidelin. Some of these, shown in the plate, demonstrate the vacuolation of the nucleus and absorption from the periphery which appears to take place. Such a process would correspond in the main to the reverse of that described by Macfie and Johnston for the phases in the life-cycle of the parasite of yellow fever, viz.: "The earliest form consists of a mere dot of chromatin with a small blue-stained body. Later the blue increases till you get a ring-shaped body. Ultimately you get a body of relatively considerable size." The blue staining matter in the bodies we regard then as the remnants of the degenerating nucleus.[1]

The red-staining granules we believe to be centrosomic in nature for the following reasons. In 1911 E. H. Ross demonstrated that the granular and nucleated red corpuscles in severe secondary anæmias could be induced to divide by means of various auxetics (excitors of cell-division), *e.g.*, creatine, globin, &c., and that before division centrosomes make their appearance. These centrosomes were demonstrated by the jelly method with azur II as minute pink staining dots. Ross describes the process thus:—

> When division of the highly granular cell occurs the centrosome divides and one half passes towards each pole. In extreme anæmia the centrosomes divide into two, three, four or six, according to the number of daughter cells to be produced. Then the granules separate into masses, one for each daughter cell; and lastly the cell itself divides, each daughter cell then passing through the reverse process, the centrosome disappearing, the granules diminishing in numbers, until there remains the normal red blood corpuscle containing its finely granular cytoplasm and hæmoglobin.

Ross warned others against mistaking these centrosomes for parasites. He says:—

> These centrosomes when stained in anæmic blood-fixed films —and they can be found in any form of extreme anæmia— must bear a great resemblance to those chromatic points described variously by authors as solitary parasites, or infective granules, or artefacts. But by the jelly method they are readily distinguished.

With the blood of new-born kittens and that of pernicious anæmia we have been able to confirm Ross's experiments by inducing division in the granular red cells with creatine and choline, and we are of the opinion that the red granules are centrosomes, which, in the so-called resting stage of the cell, are intranuclear as in many protozoa, and which only become visible on division or when sufficient nuclear absorption has taken place to expose the centrosome to view. The frequent occurrence of red granules with no accompanying blue body in the erythrocytes of the newly born indicates that the centrosome is the last portion of the nuclear complex to be absorbed. We have often noticed with the jelly method the resistance of the centrosome to staining and the difficulty with which it parts with the stain when achromasia sets in. This may be due to its denser structure or to some peculiarity of chemical composition.

We would like to suggest, to those who are interested in the subject, that an examination by the jelly method of the blood and marrow of fœtal mammals at different stages of intra-uterine life would throw more light on the vexed question of the mode of development of the normal non-nucleated red blood corpuscles from the primary nucleated condition. At four weeks the human fœtus has only nucleated cells in its circulation, and these diminish in frequency until at birth they are rare. Fœtal rats or mice could easily be examined at corresponding periods.

Conclusions.

(1) The blood in pernicious anæmia and that of the human fœtus and of new-born kittens contains bodies which appear identical with Seidelin bodies

[1] There can be no question that the bodies are phases in the development of the nucleated red cells from the mother cells in the marrow, &c., since they occur in adult cells containing pigment, while developing erythroblasts do not at first contain hæmoglobin.

The bodies which have been previously described as Howell's or Jolly bodies, and the rings known as "Cabot's rings" which occur in pernicious anæmia are believed to be nuclear particles, and are probably closely related to the bodies we have described.

(*Paraplasma flavigenum*, the so-called parasite of yellow fever).

(2) The bodies are apparently absent in the blood of normal and ordinarily anæmic adults. They may rarely be found in the blood of anæmic children.

(3) The bodies are the remnants of the nuclear degeneration (Schilling-Torgau) which takes place in the conversion of the erythroblast into the normal non-nucleated red corpuscle.

(4) The red-staining granules are readily demonstrated by the jelly method of *in-vitro* staining and are probably centrosomes.

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REFERENCES TO PLATE.

FIGS. 1-4.—Bodies found in pernicious anæmia.

FIGS. 5-12.—Bodies found in human fœtal blood.

FIGS. 13-18.—Bodies found in new-born kittens' blood.

FIG. 19.—Doubtful body.

FIG. 20.—Granular-nucleated red corpuscle from new-born kitten showing centrosomes by the jelly method.

FIGS. 21-24.—Nucleated red blood corpuscles from new-born kittens showing changes due to absorption of nucleus.

FIG. 25.—Blue ring-shaped body without red dot.

PRESERVATION OF VACCINE LYMPH IN THE TROPICS (Dr. Rodenwaldt), *Arch. f. Schiffs. v. Trop. Hyg.*, 1914, June, No. 12.—Dr. Rodenwaldt, writing from Togoland, describes a method of preserving vaccine lymph in the Tropics which has proved successful. The arrangement is as follows: A piece of growing banana stem is taken, about 16 in. in length, and having an external diameter at its thinner end of about 6 in. The inner leaf-stalks are scooped out so as to leave a tube, with a cavity measuring about 2 in. across, and having walls about 2 in. thick. It is the property of growing banana stem that its internal temperature remains at a constant figure of 23° to 25° C., whatever the external temperature may be. So that if the cavity of such a piece of hollowed-out stem is filled with tubes containing lymph the vaccine will retain its activity for a full month, provided that the piece of stem lives for that length of time. The ends of the tube should be plugged with two thick pieces of stem cut to shape. Such a receptacle filled with tubes containing lymph can be safely sent by native messengers on foot for a journey of three or four days' duration, without the lymph losing its activity from the heat of the sun.

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THE JOURNAL OF

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JANUARY 15, 1916.

THE DISCUSSION ON THE TREATMENT OF ACUTE DYSENTERY AT ALEXANDRIA, EGYPT. SHORT ABSTRACT.

An important discussion on the treatment of acute dysentery took place at Alexandria on October 17, 1915, being held by order of the Principal Director, Medical Services, Mediterranean Expeditionary Force, Egypt and Malta. The discussion, at the request of the Chairman, Surgeon-General Babtie, V.C., was chiefly confined to treatment.

Sir RONALD ROSS said that, whereas medical


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Plate to illustrate paper on "The Occurrence of Bodies resembling 'Seidelin Bodies' (*Paraplasma flavigenum?*) in Anæmic and Fœtal Blood, with some remarks on their probable nature," by JOHN WESTRAY CROPPER, M.B., M.Sc., and AUBREY HOWARD DREW.

men resident in tropical climates are called upon to treat Europeans long resident in a hot climate and natives of the district, in Egypt at the present time the experience is different, in that we have been dealing with men straight out from Britain, Australia, and New Zealand; and I am inclined to attribute the frequent severity of our cases to the fact that these men must be totally non-immune, at least to amœbic dysentery. We know that a very large proportion of all cases among these British soldiers at present in hospital is due to this disease; but, on comparing the percentage of dysentery cases among the Indian troops, I find that it is much less—the figures being only 7 per cent. of total admissions. We may perhaps infer, then, that this much lighter incidence among the Indian troops may be due to their having acquired partial immunity against dysentery during their previous life in India, just as they certainly acquire partial immunity against malaria. Conversely, I infer that amongst the British soldiers we have been treating cases entirely unmitigated by past habituation—in fact, acute amœbic dysentery in its typical form.

Sir Ronald Ross then proceeded to deal with the subject of the treatment of amœbic dysentery by emetine. He finds that emetine has proved as successful in Egypt as elsewhere, but that for the reasons just given it can scarcely be expected to cure quite non-immune British troops with the short courses of three or four days successfully employed in other localities. Still, a percentage of cases not diagnosed as bacillary dysentery seem to remain refractory to emetine; and these appear to me to be *running dysenteries*, due probably to post-amœbic colitis—that is, cases in which the original trench-work of the amœbæ seems to be followed by an acute general inflammatory condition. Regarding untoward results, said to follow emetine at times, the few cases cited are admittedly very doubtful, and may have been due to the disease itself, to idiosyncrasy, or to chance impurity in the drug.

With regard to the treatment by powdered ipecacuanha root in older cases, especially of running dysentery not cured by emetine, Sir Ronald stated he had a hankering after the ipecacuanha powder —partly because he thought that it was more likely to clear amœbæ and flagellates from the lumen as distinct from the coats of the intestine.

We must beware of believing that a patient is free from amœbæ simply because we find none in two or three samples of his stools. One such sample is an infinitesimal part of the contents of his large intestine on a single day. One might as well declare a man free from malaria because $\frac{1}{10}$ c.mm. of his blood contains none. Yet as long as a few amœbæ remain alive in the intestine, so long may a patient still be subject to the danger of amœbic abscess.

Major McCarrison, I.M.S., said that the total number of Indian patients admitted from all causes in the hospital under his charge, including wounds and disease, from this force is 2,701; dysentery has accounted for slightly over 9 per cent. of the total Indian casualties from the Mediterranean Expeditionary Force. The mortality has been *nil*, and the type of cases has, generally speaking, been of slight severity. In a considerable number the symptoms have been so mild that cure has rapidly resulted from rest, castor oil, or salines and appropriate diet alone.

It has not been necessary to administer emetine except to the minority. In fifteen cases the disease was severe, and necessitated the invaliding of sufferers to India.

With regard to the use of emetine in the treatment of amœbic dysentery, large doses are not indicated; a dose of $\frac{1}{2}$ gr. twice daily for a period of not more than one week, with $\frac{1}{4}$ gr. once daily for a few days longer, is sufficient and safe. Should the condition of the patient appear to demand the further use of emetine, it may be administered orally. This treatment is combined with a preliminary dose of castor oil and the subsequent use of salines or calomel, preferably the latter. The administration of thymol or calomel—or, better, a combination of both—is the most effective method of assisting in the disappearance of the cysts from the stools and of dealing with amœbic carriers. Quinine injections, of whatever strength, may kill the naked amœbæ, but will not destroy the cysts. Thymol should be given finely powdered and in doses of 30 gr. a day.

With regard to diet, rest to the bowel is best secured by a diet consisting solely of egg albumen water and of water, both given tepid; milk should not be given unless and until the tongue is clean.

A further point is the comparative frequency with which malaria and scurvy are complicating factors with Indian patients. Scurvy is now prevalent amongst Indian patients from the Dardanelles, and of our recent batch of ninety-three dysenterics a certain number were also scorbutic.

Captain Kerr, R.A.M.C.(T.), said, in the hospital with which he is connected, 661 cases of dysentery have been admitted, in addition to some 200 or so other cases of diarrhœa, enteritis or colitis in which the history and clinical evidence in support of a diagnosis of dysentery was not sufficient to justify that name. In those true dysenteries we had twenty-seven deaths, and in twenty of these the evidence of amœbic dysentery was proved *post mortem*. In four the state of the large intestine pointed to that of bacillary dysentery.

The routine treatment in all cases of suspected dysentery, that is, cases with a history of excessive diarrhœa associated with the passage of blood and mucus, is to give a course of emetine, $\frac{1}{2}$ gr., morning and evening for six to ten days, according to the severity of the symptoms and the result obtained. In many cases an initial clearing of the bowel by castor oil or salts is obtained. After a week or ten days, when the blood and mucus have disappeared and the stool is still loose, the emetine is stopped and a bismuth salt given in 1 dr. doses three or four times daily, and this is continued as long as the diarrhœa lasts. The bismuth is frequently combined with tinct. chlorof. et morph. co., and more

recently we have given pulv. ipecac. $\frac{3}{4}$ gr. in addition. At the end of two or four weeks, 2 to 3 more grains of emetine are given, or the powdered ipecacuanha without the bismuth is continued for a week or two.

Rectal flushing has not much in its favour, but for a time at least it does ease those cases in which thick mucus is an urgent symptom. I should like, in those very severe cases which do not yield quickly to treatment, to have an appendicostomy done and the bowel washed out from above downwards.

Lieutenant-Colonel A. H. Lister said: Our treatment has consisted in the administration of emetine and in some cases of antidysenteric serum. Otherwise it has been dietetic and symptomatic.

Every case with dysentery or a recent history of it receives a four days' course of emetine, consisting of the injection of, twice daily, $\frac{1}{3}$ gr. or $\frac{1}{2}$ gr. of emetine. After four days' interval a second similar course is given. If all symptoms of straining or of bleeding have been relieved, the emetine is stopped.

If after two or three days there is no improvement in the condition in spite of emetine treatment, 40 c.c. of antidysenteric serum are given subcutaneously, followed by 20 c.c. next day. This remedy has proved of marked value in a few instances.

In serious cases of vasomotor collapse we have seen good results follow the subcutaneous infusion of saline solutions to the amounts of one to one and a half pints.

As well as giving normal saline infusion we use 10 minims of adrenalin solution (1 in 100) every four hours, injected hypodermically. Some cases are given brandy and champagne, some pituitary extract, some strychnine; but we believe that the adrenalin is the most reliable drug.

Pain is relieved by hypodermic injections of morphia, and atropine; we believe there is no contraindication in this disease to such relief.

Major T. S. Novis said: Emetine in $\frac{1}{2}$ gr. doses by intramuscular injection twice daily has proved to be the most successful method of treating amœbic dysentery. Appendicostomy, though successful for chronic colitis, could scarcely be adopted as a routine practice for acute dysentery.

Captain F. Oppenheimer said: Milk diet was found to be unsatisfactory, as many cases vomited passed large quantities of undigested casein and became very weak. Horlick's milk was used with great success.

Fresh milk, three eggs, two custards, one pint of beef-tea, Bovril or chicken broth, one pint of arrowroot or cornflour, one portion of clotted milk, cocoa for supper and three lemons was the diet for all but exceptional cases; the eggs are taken beaten up in milk, or if the patient is not markedly ill, lightly boiled.

Meat juices or extracts do not appear to aggravate the condition as they so commonly do in diarrhœa due to pathological conditions in the small intestine.

Purgation by sodium sulphate 1 dr. hourly is now abandoned. In certain early bacillary cases this practice is still adhered to, the others having only one dose of salts or an enema as required.

The benefit of enemata seems to be chiefly due to their mechanical effect. When there has been much tenesmus, I usually follow this with a small starch and opium enema. This is chiefly of value at night, and appears to give great relief.

Emetine in $\frac{1}{2}$ gr. doses twice daily for ten days is given, and if amœbæ had not disappeared I increased the course to one of fourteen days (consecutive), at the same time giving one injection of 1 gr. daily instead of two $\frac{1}{2}$ gr. injections. The results were very satisfactory, but later again the course was increased to twenty-one days with the object of preventing hepatitis.

Dover's powders I have given freely at night to produce sleep and to relieve distressing nocturnal diarrhœa. For the griping pains I have relied chiefly on hot fomentations and chlorodyne.

Serum has been given to all but the mildest bacillary cases and to other severe cases which appeared to be bacillary on clinical evidence without waiting for bacteriological confirmation. The results obtained have been good, but not consistently so.

Intravenous hypertonic saline injections were found very good in collapsed cases.

Colonel Tubby said: Appendicostomy as a surgical measure in dysentery is not advisable during an attack of acute dysentery. Should it be attempted in a chronic case? Here again I am against it, for in amœbic dysentery the bowel does not heal so well as a normal bowel. There is danger of peritonitis following, due to the lack of adhesions forming.

In cases of bacillary dysentery, however, we may get favourable results from it, provided other conditions are also favourable.

Lieutenant J. A. Delmege said: All cases in the hospital to which he is attached were treated with emetine intramuscularly $\frac{3}{4}$ gr. first day, then 1 gr. on successive days. Forty per cent. of them were treated till the total dose was 15 gr., and 60 per cent. of them were treated till the total dose was 4 gr.

Morphia ($\frac{1}{4}$ gr. sublingually) has been found most efficacious for relieving abdominal pain.

I have been unable to convince myself that irrigations, except in a few cases, either cut short the more acute stage of the disease or prevent its chronicity.

With regard to diet, cases which were kept on low diet for a comparatively long period improved more rapidly than those whose food was increased more quickly; whole milk is not given till the patient is passing six motions or so a day with very little mucus, and bread and butter and eggs are not added till he is passing three to four motions a day with little or no mucus.

Professor S. Kartulis, after describing the older methods of treatment of dysentery, said: The miraculous effect of emetine in most cases of acute dysentery is well known. But unfortunately emetine is not alone able to cure all cases of dysentery; emetine fails often, and sometimes does not

act at all on the living amœbæ in the intestine, even if used in repeated doses. Perhaps in one-tenth of the cases of dysentery treated in our hospital by emetine the amœbæ remained for a long time alive. Also *post mortem* the parasites were found in the sections of the ulcerated intestine as in untreated cases.

When Sir L. Rogers some years ago recommended for the treatment of liver abscess that quinine be injected in solution into the cavity of the abscess, I tried his method, but the results were not satisfactory. After the injection the amœbæ were found dead, but in the next few days they appeared again in a living condition. After this failure I tried a 0·50 per cent. solution of tannic acid as an injection into the cavity of the abscess, but the results were also negative. My next idea was to get the drug into the general circulation by injecting the same solution of 0·50 per cent. of tannic acid under the skin, and as the results were again unsatisfactory I tried stronger solutions, and found that tannic acid (2 c.c.) in solution of 20 per cent. strength, when injected under the skin, was able to kill the amœbæ in the walls of the liver abscesses.

I applied the above-mentioned tannic acid injections also against amœbic dysentery, and I was glad to see that by this method the symptoms of the disease and the amœbæ in the stools disappeared without any other internal treatment. The results were the same as with the emetine injections.

Further progress for the treatment of dysentery was made when I combined the emetine injections with tannic acid enemata.

I inject at once ½ gr. of emetine into the muscles, if possible twice a day. I order two enemata in twenty-four hours of a tannic iodoform mixture:—

Tannic acid	4·0
Iodoform	3·0
Sodium chloride	6·0
Arrowroot	25·0
Aq. dest.	1,000·0

The enemata must be kept fifteen to twenty minutes in the large intestine. Usually they are well supported by the patients. I do not use purges such as castor oil, calomel, &c., though they are ordered by many practitioners. I only employ them in exceptional cases, because I think that they have not any particular influence on the progress of the disease.

The injections of emetine and the enemata must be continued for three to four days, and should be given twice in twenty-four hours. In most of the cases the severe symptoms disappear altogether on the fourth day and the patients are free from pain, tenesmus and frequent motions with blood and mucus; amœbæ are not to be found. After this I continue for a week to inject the emetine only once in twenty-four hours. Enemata of the tannic iodoform mixture are given also once every day. Two to three injections of emetine a week are given for two further weeks.

Diet: For the first three days only small quantities of diluted milk in weak tea, or, better, slimy soups prepared with fresh butter are allowed. I permit at the same time lemon drinks, two to four in the twenty-four hours. On the fourth day, in addition to the above, I give once or twice in a day macaroni, rice or arrowroot well boiled in water with fresh butter. Light solid food, such as chicken or fish, is allowed after a week, but only when the stools are normal in appearance and free from amœbæ. At the same time jams and marmalades may be given. In the early stages of treatment, when severe pain is present, I order hot linseed poultices to be applied to the abdomen; sometimes I give an injection of morphia.

When diarrhœa complicates the disease, I have used for the last three years, with excellent results, uzara in tabloids or in liquid form.

The whole number of cases of amœbic dysentery treated by the old and new methods in the thirty-two years of my practice among private patients is about 3,000. Only four deaths occurred, and these were treated by the old method.

Lieutenant H. Crean said: I should like to call attention to the possible value of eusol as an injection into the bowel in certain cases of dysentery; eusol saline up to half strength can be given *per rectum* without pain or toxic symptoms.

Colonel Gordon Hall said: With regard to the so-called cases of emetine poisoning, I can see nothing whatever to make one conclude that emetine was the cause of death.

I have never found that injections of emetine caused any pain. If pain is produced, I consider that the technique must be wrong.

Colonel C. W. Healey said: In dealing with emetine we are dealing with a very powerful agent whose dosage has to be carefully considered, and the length of time it is administered carefully regulated. The depressing effects of the drug if given in 1 gr. doses daily for some time become very marked, the more noticeable features of the depression being general lassitude, lowness of spirits, total disinclination to make an effort, rapidity of pulse, loss of appetite, nausea, and in some cases a difficulty of swallowing and a feeling of constriction about the throat and chest.

The symptoms of collapse having arisen three or four days after the cessation of the administration of the drug in the cases under review is worthy of notice.

Major Hall said: The occurrence of three unexpectedly fatal cases after emetine treatment led to the investigation of the circumstances.

Amounts of the drug given in the fatal cases were: 21 gr. in two courses—interval of fourteen days; 12½ gr. over twenty days, with interval of nine days; 17 gr. over thirty-two days, with interval of fifteen days.

In these cases symptoms did not arise until three, four, and four days respectively after the cessation of the drug.

On consideration of these cases, it is necessary to formulate a system of dosage:—

(1) There should be a definite limitation of the drug to, say, a 5 gr. course over seven days.

(2) Second courses should not be undertaken lightly. (3) Patients should be kept in bed during injection, no matter how slight their symptoms. (4) The pulse and cardiac sounds should be carefully watched during and after the course of emetine has ceased.

Dr. C. Ekins, Lieutenant D. Forde, and Lieutenant F. Dunn also contributed valuable notes to the discussion.

Annotation.

Asphyxiating Gases as a Weapon in Warfare.—Dr. George A. Lung, Medical Inspector, U.S. Navy, at the meeting of Military Surgeons of the United States (*New York Med. Journ.*, November 20), stated that the chemical attack, which included asphyxiating gases and flame, made its first appearance about the fifth century B.C. Greek fire was invented in the fourth century and contained pitch, resin, asphaltum or petroleum, sulphur and quicklime, and probably saltpetre. Upon ignition this compound developed benzine and produced explosions. Asafetida, oxide of cacodyl, codol, scatol, and bisulphide of carbon had been tried, but never proved very satisfactory. In 1870, a French chemist prepared a fulminate of picrate of potash to repel the German invaders. When chemists learned how to liquefy gases, new possibilities presented themselves, such as liquid sulphuric acid, chlorine, bromine, nitrous binoxide, and carbon dioxide. Carbon dioxide, nitrogen, and hydrogen excluded a supply of oxygen. Carbon monoxide and cyanogen were so powerful that less than 1 per cent. in the air would cause death. These gases were all intensely irritant to the respiratory mucous membranes and mechanically interfered with respiration. In the campaign in Flanders, last spring, the principal gases were chlorine, bromine, vapour of formol, nitrous vapour, and sulphurous anhydride. Fires lighted in front of the trenches caused the gases to become disengaged and the wind carried the fumes; but often carboys were used, also cylinders and explosive shells which released gases. Chlorine was manufactured cheaply and could be indefinitely preserved. It volatilized quickly with a vapour heavier than air. Bromine was not so useful because of greater expense of production. Sulphur dioxide was not effective enough, although liquid sulphur dioxide was often used in hand grenades. Nitrogen tetroxide had been used, also liquid carbon dioxide. Burning inflammable gas was more formidable at short range, but shelter from it was more easily found. Liquid chlorine gas was brought to the trenches in steel cylinders under seventy-six pounds pressure. There was an outlet pipe which dipped into the gas, and whose other end projected 8½ ft. Upon opening the valve, the liquid gas was ejected by its own pressure and formed a greenish yellow mist. As the liquefaction pressure was low, many cylinders had to be used to produce a large volume of the gas. A mixture of 1 per cent. of chlorine was dangerous, and 5 per cent. fatal. One litre of chlorine rendered 70,000 cubic feet of air unfit to breathe. Chlorine and bromine provoked spasms of the glottis and inflammation of respiratory mucous membrane which might prove rapidly fatal. The irritation caused abundant expectoration tinged with blood. Many died vomiting blood and all passed bloody urine. Eyes watered and the eyelids swelled, the cheeks became violaceous red, and the features drawn. Dyspnœa and coughing set in, often with stitches in the side and painful and jerky speech. Often broncho-pneumonia or gangrene of the lungs set in. Out of 112 patients in the Lille Hospital, two had hæmoglobinuria for several days, while several had persistent albuminuria, and most of the patients passed concentrated high-coloured urine containing much biliary pigment. Often the sputum became rich in microbial flora, especially after gangrene of the lungs set in, when anaerobes became plentiful. In a death from pneumonia, there was found congestion of the entire respiratory tract, injection of the digestive tube, massive degeneration of the liver, spleen, and kidneys, and massive pneumonia of the right lung with gangrene at the base. An English physician said that the outpouring of mucus was so extreme that a patient stood in danger of being drowned in his own secretions. Often death was due to acute bronchitis and its secondary effects. Those who were not killed immediately had a lingering and painful death, while the few who survived were permanently injured and became invalids for life. The effect of the gas was to fill the lungs with a watery frothy matter which gradually increased and rose till it filled up the whole lung and came up to the mouth—it was suffocation and slow drowning. It was the most awful form of scientific torture. The use of gas not only destroyed the enemy, but enabled his position to be occupied. In one instance the full effect of the gas was experienced at a distance of 3,000 yards and could even be smelled three miles away. Mechanical fans were futile, such as aeroplane propellers, &c., and hot-air currents and ammonia were just as likely to be wafted back and increase the damage. The best prophylactic measure yet devised had been the mask combined with a neutralizing chemical. The mask to be effective must have within its meshes either hyposulphite of sodium or common washing soda in moist condition. The formula recommended by the Academy of Medicine in Paris was: Sodium hyposulphite, 1,000 grm.; sodium carbonate, 200 grm.; glycerine, 150 grm.; water, 800 grm. However, there was no specific medicinal remedy. There had always been a cry against every new method of destruction. First it was firearms, then mines and torpedoes, then aerial bombs, poisoned food and wells, although nothing yet had been said against malignant bacteria. The German War Book advised "the fullest, most dangerous, and most massive means of destruction" as obtaining results fastest and therefore the most humane. It is really a case of all was fair in love or war.

Original Communications.

TWO CHRONIC AMŒBIC DYSENTERY CARRIERS TREATED BY EMETINE, WITH SOME REMARKS ON THE TREATMENT OF LAMBLIA, BLASTOCYSTIS AND *E. COLI* INFECTIONS.

By George C. Low, M.A., M.D., C.M.,

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In a recent paper entitled "The Treatment of Amœbic Dysentery," published in the *British Medical Journal*, November 13, 1915, reference was made to the fact that the carrier of amœbic dysentery is the individual who has *Entamœba histolytica* cysts present in his fæces.

Such an individual may not necessarily present any signs of dysentery, the only thing complained of being some looseness of the bowels or slight diarrhœa. From time to time, however, exacerbations of the dysenteric symptoms may appear, and these often draw attention to the real nature of the case.

In other instances, on the other hand, one gets no such help, and the detection of the carrier comes in the ordinary routine examination of the fæces, which should be, though it is not always, carried out on tropical patients.

Chalmers and Archibald [1] have recently referred to these as cryptic infections, and call attention to their great importance. They believe that the only quick and ready means for the diagnosis of latency is a differential leucocyte count.

Though this may be so to experts, I personally believe that routine careful examination of the stools is far easier and much more certain than the more cumbersome task of doing a differential leucocyte count. Besides, the latter is so often complicated by previous malarial and other infections, that in places where malaria and helminthiasis are common, its value necessarily becomes much reduced for such a purpose. Further, in some cases of amœbiasis no large mononuclear increase may be present, the same holding good for eosinophilia.

For example, the following blood analysis of a chronic relapsing dysentery shows this clearly (Mr. B.):—

Reds	4,500,000	
Whites	8,750	
Hæmoglobin ...	95 per cent.	

Differential	Number counted	Per cent.
Polymorphonuclears ...	336	67·2
Large mononuclears ...	19	3·8
Lymphocytes	118	23·6
Eosinophile	23	4·6
Transitional	4	0·8
Mast cells	0	0·0
	500	100·0

No parasites of any kind present; blood, to all intents, normal.

Fæces semi-solid to solid, with blood and mucus. Vegetative forms of *E. histolytica* present. Emetine rapidly cured the condition.

In another case, an Indian native (D. G.), the large mononuclear leucocytes, it is fair to say, were increased, but one cannot, of course, in such a case exclude malaria, even though no parasites were present in his blood.

Reds	3,080,000	
Whites	3,125	
Hæmoglobin ...	70 per cent.	

Differential	Number counted	Per cent.
Polymorphonuclears ...	247	49·4
Large mononuclears ...	52	10·4
Lymphocytes	187	37·4
Eosinophile	6	1·2
Transitional	3	0·6
Mast cells	5	1·0
	500	100·0

No malarial parasites present. The anæmia and low leucocyte count favour malaria.

Fæces.—Pea soup colour and consistence. No blood, shreds of necrosed tissue and mucus. Vegetative forms of *E. histolytica* present.

Emetine rapidly cured the condition.

In a paper entitled "An Interesting Case of Eosinophilia," read before the Society of Tropical Medicine and Hygiene, December, 1915 [2], I pointed out that an increase of eosinophiles independently of any of the well-known recognized causes was not uncommon in people who had resided in the Tropics. Such cases were not amœbic carriers, and I cannot offer any explanation for the presence of this increase.

It is possible that the cases of eosinophilia noted in amœbic dysentery have been of this nature and have nothing to do with the dysentery *per se*. The two blood counts given above show no definite eosinophilia (taking 2 to 4 per cent. as normal for the eosinophiles, Case I is just over the maximum limit, Case II is just under the minimum limit), and I have often noticed this in other cases of dysentery as well.

I see that Noc [3], in a paper on the diagnosis of dysenteries in Indo-China, published in the *Bulletin of the Medico-Chirurgical Society* of that place, has come to similar conclusions. In this paper he states that the presence of alterations in the total and differential leucocyte counts is of value, but that no specific importance can be attached to them. He has also noted many cases of amœbiasis where there was no eosinophilia, this agreeing with my own findings as just given above.

An amœbic dysentery carrier is a dangerous individual, then, and, as he has few or no symptoms, goes about freely. If the conditions in which he lives are insanitary he may easily spread his cysts broadcast and so infect fresh individuals. The generally accepted idea of the route of infection now is that the cysts die if dried, but go on living if they find their way into water or moist earth at

suitable temperatures. When swallowed in contaminated water by man the cyst wall is digested, the four nuclei escape, develop into amœbæ, which invade the tissues of the large bowel, and by dividing up into two in the ordinary way, bring about the requisite multiplication of the parasite.

In England, in towns at least, the disposal of fæces is so good that there is not a great danger perhaps of amœbic dysentery becoming introduced; but it is well to remember that cases have occurred in people who have never been out of the country. In most of these a contact with individuals who have been abroad is usually obtainable. Marshall's case in Scotland [4] is a good example.

Here an agricultural labourer acquired amœbic dysentery while living on a farm near Edinburgh. A soldier from India had recently arrived there and though, as far as could be ascertained, he had no signs of dysentery there is very little doubt that he must have been a carrier in the true sense of the term, and so infected the labourer.

Saundby and Miller have also described a case of liver abscess following amœbic dysentery in a man in Birmingham who had never been out of England [5], and recently, I believe, a similar case has occurred at the London Hospital, in this instance the patient having worked in the docks on board a transport. It is clear, then, that if a great influx of amœbic carriers takes place into England, and that if these people are allowed to spread indiscriminately over the country, especially into agricultural areas, where sanitary arrangements are not so good as in towns, a real danger may be created.

Can anything be done, then, towards the treatment of such cases? Ideas as to the value of emetine in destroying the cystic stages of the *E. histolytica* seem to vary considerably, many authors stating that the drug does not affect these forms at all, nor the *E. minuta* stage, which precedes the cysts, the supposition being that these forms are free in the bowel and so are not reached by the emetine.

On analysing these statements carefully, however, there is often a lack of scientific detail as to the dose of emetine that has been used, the length of time it has been employed, and the number of examinations made of the stools, both before and after the administration of the drug.

Looking at the subject theoretically, the action of emetine on the amœbic cysts would seem to be the same as that of quinine on the crescents of malaria; the latter drug has no direct action on the crescents, but by killing the young forms that produce them the supply of the former is cut off and so they eventually disappear from the blood. Similarly, if emetine kills the vegetative stages of the amœbæ, the *tetragena* stage which invades the intestinal wall and lives in the tissues, then the supply of the *minuta* stage and of the cysts ought to come to an end and the stools should ultimately become free.

Recently I have had a very good opportunity of putting these theoretical data to a practical test. My researches on the subject are not yet completed, but as the matter is one of urgency I think it better to publish results as far as they have gone.

In dealing with such cases one must always remember that cysts in the stools often vary in number, and sometimes almost completely disappear of their own accord. To gauge, then, the action of any drug on these the examinations must be kept up over a prolonged period of time to see whether or not the disappearance is a permanent and real one and not merely a temporary abeyance. The first case I am about to describe has now been under close observation for seven months, and may, I think, be looked upon as satisfying the requirements just indicated.

Case I.—Mr. H. contracted amœbic dysentery in the Sudan—the only place he had ever been to abroad—in April, 1912. He had diarrhœa and bleeding then which lasted for a week. Treatment was by chlorodyne, which relieved the condition and apparently cured it for the time being. Patient returned to England for good on June 20, 1914, and went on with his usual work, though his bowels were never quite right, his stools being soft and too numerous. In 1915 this looseness of the bowels was worse, there being three or four motions a day, and a burning sensation in the stomach was also complained of. At one time a little blood and mucus were noted and the diarrhœa then became much more severe. Patient was not under treatment, nor was he dieted, and he also took alcohol in moderate amounts. There was no temperature, no sweating at nights, and no signs of liver involvement. Dr. Wenyon examined his fæces on June 2, 1915, and found *E. histolytica* cysts, *Lamblia intestinalis* cysts, and *Blastocystis* present. Dr. Balfour kindly asked me to treat the patient, which I did with emetine, the examination of his stools being carried out by myself and Dr. Wenyon. Physically there was little to make out. Patient's heart and lungs were normal, his conjunctiva was a good colour. The liver was not painful on pressure, but its edge could be felt half an inch below the costal margin. There was no pain over the colon. The urine was normal. The stool examinations were very carefully done and have extended over a considerable period of time, the fact of the patient being infected with lamblia and blastocystis as well being very convenient, as the effects of the emetine and other drugs on these could be studied at the same time. The following table shows at a glance the results obtained by the emetine on the *E. histolytica* cysts and by B-naphthol and methylene blue on the lamblia cysts:—

TABLE I.

Date	Dose of emetine by injection	*Entamœba histolytica* cysts	Lamblia cysts	Blastocystis
1915				
June 2 ...	... ...	... +++	... +++	... ++
,, 3 ...	1 grain ...	... +++	... +++	... ++
,, 4 ...	,, ...	... ++	... +++	... ++
,, 5 ...	,,			
,, 7 ...	,, ...	... −	... +++	... +
,, 9 ...	,,			
,, 11 ...	,, ...	... −	... +++	... −
,, 14 ...	,, ...	... −	... +++	... −
,, 16 ...	,,			
,, 18 ...	,, ...	... −	... +++	... −
,, 21 ...	,,			

Date	Dose of emetine by injection	*Entamœba histolytica* cysts	Lamblia cysts *	Blasto-cysts
June 25	... ...	−	++	−
July 3	... ...	−	+++	−
,, 13	... ...	−	+++	−
	Dose of B-naphthol by mouth			
,, 19	9 grains.			
,, 20	,,			
,, 21	,,			
,, 22	,,			
,, 23	... ...	−	+	+
Aug. 6	... ...	−	++	+
,, 9	20 grains.			
,, 10	,,			
,, 11	,,			
,, 12	,,			
,, 13	... ...	−	+	+
,, 27	... ...	−	++	+
Oct. 30	... ...	−	++	+
Dec. 3	... ...	−	+	+
,, 20	... ...	−	+	+
,, 29	... ...	−	+++	+
	Dose of methylene blue by mouth			
,, 30	3 grains t. i. d.			
,, 31	,, ,,			
1916				
Jan. 1	3 grains twice, drug then stopped owing to toxic symptoms having appeared.			
,, 3	... ...	−	−	+++
,, 4	... ...	−	−	+
,, 6	... ...	−	−	+
,, 7	... ...	−	−	+
,, 10	... ...	−	+	+++
,, 12	... ...	−	++	++
,, 13	... .	−	+	+++
,, 21	... ...	−	+	++

* Free-living forms were seen from time to time, but as these are comparatively rare the infection is best estimated by the presence of the cysts.

Abbreviations used: +++, very heavy infection; ++, moderate infection; +, scanty infection; −, nothing found. A blank space with no signs indicates no examination of stool made.

Case II.—Mr. S. History: Went to the Sudan in 1913. From October 23, 1913, to May 13, 1914, enjoyed good health. Then came home to England. Returned to the Sudan December 12, 1914. Left again for England March 12, 1915, having completed his work. Then suffering from fever. This apparently came on insidiously, the first thing noticed being a loss of appetite in January, 1915, and sleeplessness. This was followed by definite fever, which was treated by quinine, and recovery took place. Three weeks after a relapse occurred, and after that frequent bouts of pyrexia were experienced. For example, on his way home to England he spent three days in bed at Port Said, and also was ill most of the way home on the steamer. On his arrival he first went to Jersey and then finally arrived in London on April 21, 1915. Dr. Balfour examined his blood on that date and found many crescents present. After this discovery he very kindly sent him to me for treatment, and by judicious doses of quinine and iron and arsenic the patient soon threw off his malarial condition. In June, 1915, a curious pain was complained of in the epigastrium, this running up through his chest and ending about the jaw, principally on the left side. This attack appeared suddenly and recrudescences appeared once or twice. Nothing definite could be found to account for the condition, his heart being perfectly normal and there was no evidence of arterial disease. The distribution of the pain pointed to a neuritic condition of the vagus or phrenic nerves. In November, 1915, Dr. Wenyon examined his fæces and found *E. histolytica* cysts. This discovery was specially interesting because the patient had only suffered from some abdominal pain with the passage of a little blood and mucus once in March, 1915. This slight attack came on when he was in Port Said and soon passed off of its own accord, no special treatment being given or apparently required. Apart from this he never showed any other signs in any way indicative of dysentery. After this his stools were a little loose, but not diarrhœic; they quickly became normal again, and from that time till the present he has gone on passing normal stools, one a day, or now and again two. When he was being treated with iron and arsenic for his malaria his stools were solid and hard; latterly they have been solid and quite formed, the only thing in any way abnormal being that some days the consistence was a little soft. *E. histolytica* cysts in moderate numbers have been present in his fæces from November, 1915, onwards.

This, from the clinical data, is evidently a case of one or two chronic amœbic ulcers, or even one large ulcer somewhere in the large bowel, probably the cæcum.

Though not, perhaps, specially dangerous to himself, at least unless liver involvement were to follow, he is nevertheless a type of dangerous carrier, and the importance of trying a course of emetine was, of course, at once apparent.

Table II gives the results of the examinations of the patient's stool before and after his treatment with emetine.

The behaviour of the two cases to emetine is thus very interesting. In the first the drug caused a rapid disappearance of the cysts with no return for over seven months, while in the second it seemed to have little or no influence upon them at first. There was, however, it is true, some slight reduction in the numbers, but no complete disappearance until towards the end of the course. Why the first case should have succeeded so quickly while the other resisted so strongly, is not easy to explain, but it shows that one must persist with the drug in large doses. In such a case $\frac{1}{3}$ or $\frac{1}{2}$ gr. doses would probably have had no effect at all. It is too early to say whether the disappearance of the cysts in Mr. S.'s case is a permanent one or not; examinations over long periods alone will show this. In some cases other observers have noted that cysts have reappeared after fair courses of emetine, so the infection is manifestly a very difficult one to get rid of entirely. Still, with one definite success and another apparently so, it is clearly one's duty to give a proper course of emetine in all such cases, the results being carefully controlled by microscopical examinations of the stools.

TABLE II.

Date	Dose of emetine by injection	*Entamœba histolytica* cysts	Remarks
1915			
Nov. ...	...	...	++	... (Wenyon).
Dec. 20 ...	...	...	++	... Stool softish but not diarrhœic.
,, 31 ...	...	...	++	... Stool solid, slightly soft only.
1916			
Jan. 3 ...	1 grain	...	++	... Stool solid, fair consistence.
,, 4 ...	1 ,,	...	+	... Stool solid, slightly soft in consistence.
,, 5 ...	1 ,,	...	++	... Stool solid, slightly soft in consistence.
,, 6 ...	1 ,,	...	+	... Stool solid, slightly soft in consistence.
,, 7 ...	1 ,,	...	−	... Stool solid, harder in consistence.
,, 10 ...	1 ,,	...	+	... Some looseness of bowels on the 8th; to-day stool formed, but softish.
,, 11 ...	1 ,,	...	+	... Stool solid, slightly soft in consistence.
,, 12 ...	1 ,,	...	++	... Stool solid, slightly soft in consistence.
,, 13 ...	1 ,,	...	+	... Stool solid, slightly soft in consistence.
,, 14 ...	1 ,,	...	−	... Stool solid, slightly soft in consistence.
,, 17 ...	1 ,,	...	+	... Stool loose.
,, 18 ...	1 ,,	...	−	... Stool formed, but still very soft.
,, 19 ...	...	...	−	... Stool formed, but still very soft.
,, 20 ...	...	...	−	... Stool formed, harder in consistence.
,, 21 ...	...	...	−	... Stool formed, harder in consistence.
,, 24 ...	...	...	−	... Stool ordinary, tendency to softness
,, 27 ...	...	...	−	... Stool ordinary, tendency to softness

In the case of failures, the only other thing to do is to try emetine or large doses of ipecacuanha by the mouth, or even other drugs, and, failing these, to isolate such carriers strictly.

LAMBLIA INFECTIONS.

The question as to how far *Lamblia intestinalis* can be held responsible for the production of clinical symptoms, such as diarrhœa, has often been discussed. Up till quite recently I was of the opinion that, in many cases at least, little or no inconvenience was caused by the presence of these parasites in the upper part of the small intestine, but after having studied the case just described carefully I am not now quite so sure of this. It would seem that the parasites, especially when a fresh multiplication is taking place, do excite a certain amount of irritation in the bowel, the result of this being a looseness of the fæces or a real diarrhœa, the appearance of the stools often being of a light yellowish colour. Things may then quieten down again and the stools become more or less normal, but damp or getting chilled seems easily to provoke an exacerbation. Mr. H. is perfectly certain of this himself in his own case.

Be this as it may, there is no doubt that the lamblia is a parasite very resistant to treatment. Claims of having stamped out infection by means of B-naphthol are fairly frequent, but here again there seems to be a lack of scientific detail and an absence of records of further stool examinations to determine whether the disappearance of the parasites was a permanent one or not.

A glance at the first table shows at once that emetine has no effect whatsoever on the lamblia, but that B-naphthol, on both of the occasions when it was administered, reduced a quite heavy infection to a scanty one. Here, however, careful search still revealed a few cysts, and further examinations soon showed that the parasites increased again almost up to their previous maximum.

It may, of course, be objected that the doses of the drug were not large enough, and this is possible and is worthy of further consideration.

Another point brought out in the table is a variation in the number of the cysts which appeared spontaneously on December 3 and 20. On the latter date only one or two cysts could be found, but by the 29th again, contemporaneously with an attack of diarrhœa, a very heavy infection was again present.

Such variations must be borne in mind, of course, in estimating the value of any drug treatment, though in other cases I have examined the numbers often have kept very constant, as they did in this case in June and July, 1915.

Castellani, in a recent note in the *British Medical Journal* [6], has advocated the use of methylene blue for the destruction of intestinal flagellates. He does not specifically mention lamblia, but speaks of trichomonata and cercomonata. I therefore tried this drug in the doses he mentions, 3 gr. t.i.d., on Mr. H.

The results of its administration on the lamblia are shown in the first table. Unfortunately, however, the methylene blue upset the patient considerably, toxic symptoms appearing, so it had to be discontinued after a total quantity of 24 gr. in all had been taken.

The symptoms of poisoning presented are of interest. The drug was begun on Thursday, December 30, 1915, three 3 gr. doses being taken on that day. Next day, Friday, a difficulty of passing urine was experienced, but the patient took his three 3 gr. doses as before. By that night a definite retention had appeared, however, and pain was also felt in the region of the bladder. Next day, Saturday, some urine dribbled away, but as the pain was more severe and as spasmodic contractions of the bladder began, patient, after taking two more doses of the drug, stopped it altogether. By this time the urine was bright blue. On the following day, Sunday, urine dribbled away and there was now a difficulty of retaining it. The pain in the bladder was less.

I saw the patient on Monday morning, January 3, 1916, and found the bladder empty; there was still considerable pain on deep palpation over the pubis. The urine had been voided easily and abundantly that morning. A sample passed before me was of a pale greenish colour and contained no albumin. The following day the patient had improved still further and in a few days more all

signs had disappeared and complete recovery took place.

The symptoms, then, were similar to those described by Philipps in a "Discussion on the Therapeutic Value of Recent Synthetic Analgesics, &c.," reported in the *British Medical Journal* in 1898 [7], and it is well to draw special attention to them again as the general use of methylene blue in large doses for the destruction of flagellate protozoa is apparently not entirely free from danger.

The effect of the drug on the lamblia infection was marked. On December 29, the day before treatment was commenced, the infection was + + +, *e.g.*, very heavy. On January 3, 1916, after the administration of the 24 gr., I searched four specimens for over an hour and could not find a single lamblia cyst, this being the first time I had ever made a negative examination in Mr. H. for these parasites. The following day a similar result was obtained and also on two other occasions, but, unfortunately, on January 10 a few cysts made their appearance again, and these have gone on increasing until a fairly heavy infection again exists. It is possible, however, that if the patient could have stood the large doses of methylene blue for some time longer that the infection might have been permanently stamped out, or perhaps a continuance of the drug for a long period of time in smaller doses might have had the desired effect. The patient, however, was averse to this and I did not press it. It is extraordinary how difficult protozoal infections are to get rid of. Even with quinine in malaria, unless the drug is persisted with, relapses are got for years with the presence of parasites in the blood, and the intestinal protozoa seem to form no exception to the rule.

Kerol.—Dr. Newham tried this drug in doses of two 3-minim capsules of the intestinal form three times a day in a case of heavy lamblia infection under the care of Dr. Daniels, in the wards at the London School of Tropical Medicine. There was no apparent effect on the parasites, the numbers of cysts keeping up and showing no signs of diminution.

Blastocystis Infections.

The *Blastocystis hominis* is now usually considered to be of a vegetable nature, though some have considered that it represents the cyst stage of the *Trichomonas intestinalis*. The chief point against this idea is that though the blastocystis is a very common object in stools, free forms of trichomonas are practically never seen in such stools. Mr. H.'s record is a case in point. Here, though having had blastocystis in his stools for months, no trichomonas has ever been detected. The trichomonas is, as a matter of fact, a comparatively rare parasite in stools examined in England, whereas the blastocystis is an extremely common one.

As regards pathogenicity, this has not been worked out. The chief point of interest in the bodies lies in the fact that they may be mistaken by the uninitiated for amœbic cysts. The action of different drugs upon them is seen in Tables I and III. Emetine seemed to kill out the infection in both cases, but the parasites recurred again later, this probably being a genuine relapse and not a re-infection, as the latter would be unlikely in England. B-naphthol and methylene blue had no effect upon them whatever, the largest number seen being after the methylene blue injections.

As far as we know, such parasites cause no special symptoms, but until their life-history and proper nature are worked out one cannot be definitely certain of this. Their persistence in the stools is well brought out in the table, and it would seem to be an infection which is difficult to get rid of either naturally or by drugs.

Entamœba Coli Infections.

It is usually stated that the *Entamœba coli* is a harmless parasite and that it gives rise to no symptoms or pathological lesions. It is supposed to live on the surface of the bowel and not to burrow into the mucous membrane as the *E. histolytica* does. On account of this feature drugs, such as emetine, are not supposed to influence it.

Lately it has gradually been borne upon one that the supposition of the harmlessness of *E. coli* may be more apparent than real, and I think there is a distinct possibility that the parasite may sometimes, and under certain conditions, excite a diarrhœa. Certainly in cases with cysts in their stools it is not uncommon, when a little looseness of the bowels occurs, to find numerous free-living forms present, indicating a multiplication and fresh activity of the parasites. Such a possibility is certainly worth keeping in mind. I recently had a Japanese patient (Case III) suffering from pleurisy and effusion whose stools showed coli cysts, blastocystis, and ascaris and trichocephalus ova. One day, after some looseness of the bowels, a large infection of free-living vegetative forms appeared. These, however, soon disappeared and nothing but

Table III.

Date	Dose of emetine by injection	*Entamœba coli* cysts	Blasto-cystis	Ascaris ova	Tricho-cephalus ova
1915					
Dec. 13 ...	...	−	+	+	+
,, 21 ...	...	+ +	+	−	+
,, 23 ...	...	+	+ +	−	−
,, 29 ...	...	+ +	+	+ +	+ +
1916					
Jan. 3 ...	...	E. c. c. + E. c. f. + + + *	+	+	+
,, 6 ...	1 grain	E. c. c. + +	+ +	+	+
,, 7 ...	,, ...	+			
,, 8 ...	,,				
,, 9 ...	,,				
,, 10 ...	,, ...	−	+	+	+
,, 11 ...	,, ...	−		+	+
,, 12 ...	,, ...	−		+ +	+
,, 13 ...	,, ...	−	−	+ + +	+
,, 15 ...	...	−	−	+ +	+ +
,, 17 ...	...	−	−	+	+ +
,, 20 ...	...	+	−	+ +	+
,, 24 ...	...	−	+	+ +	+ +
,, 27 ...	...	+	+	+ +	+ +

* E. c. c = *Entamœba coli* cysts.
E. c. f. = ,, ,, free forms.

the cysts were again seen. The effect of 1 gr. injections of emetine on the infection was then tried. Contrary to expectation, these caused a complete disappearance of all the cysts and living forms for at least six days. Seven days, however, after the last injection cysts reappeared, so the infection has not been killed off. This result is interesting and also important in showing that examinations must be carried out for considerable periods after treatment. If this had not been done in the present instance a cure might have been reported. The blastocystis also disappeared, as in Mr. H.'s case, but returned again later.

Table III gives the particulars of the treatment and examinations.

I propose to treat some further cases of *E. coli* infection with a combination of emetine injections and saline purges.

These shall be reported upon later.

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[6] "Treatment of 'Flagellate-Diarrhœa' and of Kala-azar," by A. Castellani, *Brit. Med. Journ.*, November 27, 1915.

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DUCKS AND MOSQUITOES.

THE *Colonial Journal* mentions an experiment carried out to prove that ducks are among the greatest enemies of mosquitoes, and consequently of yellow fever and malaria. Two pools of equal area were made in a stream. Ducks were placed in one and fish in the other. The first was speedily cleared of mosquitoes, while the second continued to maintain the insects in all stages of development. Wild ducks were then introduced, and found to prefer the insects to all other foods. At the end of twenty-four hours no pupæ were found in the pond, and after two days all the larvæ had been destroyed. These experiments confirm the observations of William Lockwood, who found that the duck was particularly adapted to devouring the larvæ on the surface of water, and of McAtee, who found mosquitoes in the gizzard of a wild duck.

EMETINE IN PYORRHŒA.

EMETINE is being largely used for pyorrhœa. Dentists state they have to inject it into the gums or palate as their patients cannot understand how a medicine injected into the arm or elsewhere can possibly affect the teeth.

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THE JOURNAL OF

Tropical Medicine and Hygiene

FEBRUARY 1, 1916.

INSTITUTE FOR MEDICAL RESEARCH, KUALA LUMPUR, FEDERATED MALAY STATES.

ANNUAL REPORT.

THE recent issue of the Report for 1914 of this Institute deals with several subjects of interest and contains many scientific observations which enhance the high reputation of the staff of the Institute, where much good work has been done ever since it was founded.

Beriberi is especially worthy of note, as it deals with "The Rice Theory and Recent Criticisms" on the etiology of beriberi.

LONDON SCHOOL OF TROPICAL MEDICINE.

49th Session. October—December, 1915.

Back Row.—Robert (*Laboratory Assistant*), W. M. Wadi- (*House Surgeon*), V. A. Goonetilleke, K. Sakagami, E. J. Rowbotham.

Middle Row.—Louise (*Laboratory Girl*), R. J. Tata, F. G. Cummings, T. Ryan, G. Warren (*Laboratory Assistant*), M. de Costa, J. C. Fra[illegible] Jane (*Laboratory Girl*).

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Absent.—H. de Mel, R. T. Leiper (*Helminthologist*), J. G. Thomson (*Protozoologist*).

LONDON SCHOOL OF TROPICAL MEDICINE

(UNIVERSITY OF LONDON),

Under the Auspices of His Majesty's Government,

CONNAUGHT ROAD, ALBERT DOCKS, E.

In connection with the Albert Dock Hospital of the SEAMEN'S HOSPITAL SOCIETY.

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LECTURES AND DEMONSTRATIONS DAILY BY MEMBERS OF THE STAFF.

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It would appear that the final opinion as to polished rice being the cause of beriberi is not yet settled but that the "deficiency" theory, of which polished rice is the chief expression, is holding the field there can be no doubt.

It is possible, nay probable, that the advocacy of polished rice being the cause of the disease, and rice alone, has clouded the wider view which, fortunately, is taken by Drs. Fraser and Stanton, when they state: "Those who claim to have observed cases of beriberi among people who consumed no rice or rice only in small amount have overlooked the possibility that the diets consumed by their patients may have been deficient in a manner similar to that of a diet mainly composed of polished rice."

The contention is that beriberi is due to a deficiency of some substance in rice, and perhaps in other foods, which, when long absent from the diet, may, and often does, engender beriberi. It has been the endeavour of the staff of the Malay Institute to discover this substance, and it is well known that their classical researches in this direction are sustained with acumen and general acceptancy.

In reviewing the criticism of the rice theory and the etiology of the disease, the hypothesis of beriberi being a "place" disease is disposed of. For a disease to be a "place" infection it would mean that the germ toxin or virus was endemic in the area and existed in the soil, in animals, or in men as "carriers" to reappear from time to time. This aspect of this disease, at one time entertained, has but few now to uphold it.

In the report experiments are mentioned of beriberi-free coolies living on virgin soil, amongst whom beriberi developed; an unpolished rice diet, when introduced, caused the disease to disappear. Subsequently men suffering from beriberi were introduced into this community, but on the unpolished rice diet being continued the disease disappeared from amongst the infected, and none of the resident coolies contracted the disease from the infected incomers.

A specific organism in beriberi has not been proved. Several organisms have been described, but it would seem that the disease is not communicable from man to man. In reference to this matter an occurrence observed by the writer and mentioned in Sir Patrick Manson's text-book is worthy of note. In a ward in the Alice Memorial Hospital, Hong Kong, of which I had charge during Sir Patrick's absence, I noted that certain cases developed beriberi whilst others escaped. There were two cases of beriberi in the ward, one the wet, the other the dry variety, so-called. Several—in fact, five in all—cases within a few days of each other became beriberic, and I observed that they were all surgical cases, that is, patients with open wounds. I drew Sir Patrick's attention to the circumstance on his return to duty, and the fact is recorded in his text-book.

Beriberi as a disease of protozoal or other origin, transmitted by an intermediate host, such as bugs, lice, or fleas, &c., is dealt with in the Report fairly fully. The conclusion, however, seems to be justifiable, viz., that "this hypothesis consorts with modern views in tropical pathology, but on analysis seems to possess no other merit." There are many, some of them keen and not to be lightly set aside, who contend that beriberi has no direct relation to food, but infective through body vermin.

Drs. Stanley and Noel Davis, of the Health Department in Shanghai, have brought forward some observations in support of the transmission of the disease by vermin, and this point has been duly considered by Dr. Fraser and the staff of the Institute for Medical Research in the Federated Malay States. The observation was made as follows:—

"Patients in early and later stages of the disease were transferred with their sleeping mats, clothes, &c., to quarters inhabited by coolies on unpolished rice. Healthy coolies on unpolished rice volunteered as the subject of experiment. The clothes and sleeping mats of the beriberics became the property of the healthy coolie and measures were taken which resulted in the transference of pediculi, bugs, &c., to a new host. These experiments and others of a kindred nature were entirely negative in their result.

"The work of Lovelace in Brazil makes it clear that there is a class of cases which clinically are closely related to beriberi but which are not related etiologically to a diet of polished rice or apparently to the deprivation of any dietary constituent.

"Lovelace holds that 'considering the multiplicity and diverse characters of the agents that are known to cause multiple neuritis, it is highly probable that the term beriberi is one that has been used to cover not a single disease but a group of diseases more or less indistinguishable from one another clinically.' In view of what has been learned of the natural history of other diseases, such as fevers and dysentery, this is indeed probable.

"We would ask those of our fellow workers who as physicians have to deal with outbreaks of beriberi and whose experience is opposed to the view that the disease arises through a defect in diet, to consider that beriberi is after all only one form of polyneuritis, a condition which may be induced by a variety of causes, and that their observations do not necessarily invalidate the conclusions arrived at in regard to the origin of the disease elsewhere. Facts rather than surmises are now necessary if they would combat effectively a theory whose application in practice has been attended by widespread and beneficial results among the rice-eating peoples of the Orient."

In conclusion, may we add that the interpretation of beriberi upon a deficiency basis as its cause will be well received everywhere, for the many observations of indisputable reliance that beriberi occurs amongst communities in which rice in any form constitutes at most a negligible quantity cannot be lightly set aside.

Lately on board a British man-of-war over thirty of the crew, including two officers, developed beri-

beri. The vessel sailed from the Persian Gulf to the East Coast of Africa and thence round the Cape, and whilst crossing the Atlantic the disease broke out. The officers declare they never touched rice in any form. This statement is easily explained on "the deficiency in any food theory," but one by which "the deficiency in rice alone" is refuted.

The pendulum of belief in these non-parasitic ailments swings now in favour of this theory and now of that. Pellagra shared the same fate; maize held the field, then the parasitic theory had the ascendancy, and to-day maize is in favour again as the cause of the disease. So it will be until the physiological chemist reaches a position corresponding to that now held by the parasitologist, and can show how toxins are conveyed from man to man or from insects to man and thus raise their department to a position of practical utility in the investigation of disease. J. C.

Annotations.

Vaccine Treatment of Gonorrhœa (Lieutenant W. G. Brett, *Brit. Med. Journ.*, August, 1915).—The author states that thirty-three cases admitted into hospital and suffering from acute gonorrhœa were treated with gonococcus vaccine and were discharged cured after an average detention of 13·5 days. In no case was the patient discharged until there had been an interval of four or five consecutive days since the appearance of the last sign of discharge. This works out an average of about nine days during which there were manifestations of active gonorrhœa. One cubic centimetre of gonococcus vaccine (Burroughs Wellcome), 200 million cocci, was given, and the urethra washed out three or four times a day with weak permanganate. Two days after the first injection of vaccine a second dose was given of 1,000 million cocci, and unless the discharge showed symptoms of diminution in two or three days a third injection of 1,000 million cocci was given. The author thinks that failures with the vaccine treatment are chiefly due to insufficient dosage.

Thymo-benzol in Bilharziasis.—C. M. Ekins, in the *Trans. Soc. Trop. Med. and Hyg.*, vol. viii, No. 7, p. 212, gives the results of the treatment of four cases of bilharziasis with thymol dissolved in benzol (Robertson's treatment). No benefit ensued; the *Bilharzia miracidia* were present after the treatment in all the cases. Severe intoxicant effects were produced by the drug.

Serbian Honours for Tropical Experts.—For appreciation of medical services rendered in 1915 to the Serbian nation in combating epidemic diseases, H.M. the King of Serbia has bestowed the Grand Cross of the Royal Order of St. Sava on Dr. R. Strong, and has made Dr. T. W. Jackson and Dr. Aldo Castellani Companions of the same Order, the latter receiving also the Royal Red Cross decoration (1st Class) and an honorary commission in the Serbian Army.

Abstracts.

AN AMŒBA IN SUPPURATIVE AND HYPERPLASTIC OSTEOPERIOSTITIS OF INFERIOR MAXILLA.[1]

By K. M. Lynch.

In 1986 Flexner[2] reported an amœba found in artificially obtained pus from an abscess on the floor of the oral cavity. Doflein, in 1901, observed a similar amœba in an abscess with fistulous opening on the right lower jaw. The latter case resembled, somewhat, the following, although there are certain differences in the two parasites observed:—

History.—E. W., a negro woman, aged 23, servant, admitted to hospital April 20, 1915, beginning about one year before had frequent attacks of toothache. The lower jaw on the left side began to swell about a month previous to admission, when she exhibited a hard, non-movable tumour the size of a hen's egg attached to the inferior maxilla. Nothing abnormal was noted in the mouth or throat. The cervical lymph nodes were palpable. The temperature, normal in the morning, went up to 99° and 100° F. in the evening.

A diagnosis of osteo-sarcoma was made, and the left half of the mandible resected and sent to my laboratory.

Examination of Specimen.—From articulation to canine tooth the bone was thick, with rough surface, into which ran small, clean-cut sinuses containing thick white granular pus. The thickening was most prominent about the middle of the body of the bone, where it was of tumorous appearance. Over this prominent portion on the outside was a hard fibrous mass attached to the bone and to the surrounding muscles. In this were several larger sinuses leading into the bone. Saw cut revealed the bone to be of a compact cancellous nature, like new growing bone, honeycombed with small pus sinuses. The first molar tooth was missing, and the third was represented by a decayed root, level with the soft tissues of the gum.

Microscopically, the composition of the tumour mass was of newly formed and forming bone trabeculæ, fibrous tissue, mainly old, encroaching on surrounding muscle, lymphocytic infiltration, largely in localized foci, and small areas of necrosis and pus in which were rounded hyaline non-nucleated bodies somewhat larger than leucocytes. The appearance was that of inflammatory overgrowth of bone and connective tissue of a progressive nature, showing areas of necrosis and pus formation corresponding to the previously mentioned sinuses.

Microscopic examination of the pus revealed no recognizable bacteria; nor did animal inoculation give any results. It contained, in addition to

[1] Abstracted from the *Journal of the American Medical Association.*

[2] Flexner: *Bull. Johns Hopkins Hosp.*, 1892, No. 25.

granular materials, neutrophilic leucocytes and a goodly number of eosinophiles, some recognizable tissue cells, and numerous amœboid cells. These, when rounded, were about 40 microns in diameter, with a distinct clear ectoplasm and coarsely granular endoplasm of refractile bodies. No nucleus was recognizable. These cells were amœboid, throwing out slowly large, broad, single pseudopodia, which were seen to engulf red blood cells and leucocytes. The cell moved from place to place by projecting one of these pseudopods into which the endoplasm flowed, it then becoming the body.

Stained with Leishman's fluid, the cytoplasm was very faint, vacuolated, and contained red blood cells and fragments of leucocytes. No nucleus was observed. Unfortunately, these specimens were destroyed before I had completed my study of them or had opportunity to use other stains.

That this amœba was not of those commonly found in the mouth was plain to me because of its size, activity, character of endoplasm, and staining properties. It differed from Doflein's parasite in that it was sluggish in action and exhibited single large blunt pseudopodia and a distinct differentiation of ectoplasm from endoplasm, while the latter was more active than those of amœbic dysentery, and developed long finger-like pseudopodia of apparently the same appearance as the protoplasm in general.

Doflein conjectures that both his and Flexner's parasites were dysenteric amœbæ, although there was no history of dysentery in either case. Neither was there history of dysentery in the present instance, and the variance in morphology of the amœba connected with the history disputes such an opinion in this case.

That the amœba was the etiologic factor here cannot, of course, be said; but the absence of any other recognizable factor, the nature of the growth, the history of onset, and the decayed tooth as a possible port of entry, lend the suggestion.

AMŒBIC MOUTH INFECTIONS.[1]

By Anna W. Williams et al.

Hypotheses in regard to Action of Amœbæ in Human Mouths.

(1) Amœbæ are accidental invaders; they produce no pathogenic or other reaction in the mouth.

(2) Amœbæ in the mouth have a beneficent action as scavengers.

(3) Amœbæ may be sometimes pathogenic, producing or helping to produce certain cases of pyorrhœa alveolaris, certain abscesses, and certain other mouth infections.

(4) Amœbæ are the specific cause of pyorrhœa alveolaris.

(5) Amœbæ may be pathogenic only in connection with certain other micro-organisms.

In favour of the first hypothesis—that is, that amœbæ are accidental, non-pathogenic invaders—are the facts that amœbæ have been reported so frequently in apparently normal mouths, and that when found in diseased conditions they are always accompanied by other micro-organisms of pathogenic types, which might be sufficient to produce the disease. Against it is the fact that they are found so much more frequently and in so much larger numbers in the lesions.

As for the second hypothesis, that amœbæ are beneficent scavengers, there is no question but that amœbæ are scavengers both of other micro-organisms and of tissue host cells—at least, of leucocytes, red blood cells, and broken-down epithelial cells. But they probably take up as many harmless as well as harmful germs, and leave enough of the latter to exert their full power in harming the tissues of the host. Then, too, since certain amœbæ will live on brain, liver, and kiduey cells of human beings, there is no *a priori* reason to suppose that the mouth amœbæ will not help in destroying the fixed tissue cells in the mouth, especially after a certain amount of injury has been done them by other micro-organisms. The evidence, then, is against this second hypothesis.

As regards the third hypothesis, that amœbæ are sometimes pathogenic, we can only say that the large number of amœbæ in most cases of pyorrhœa and in some abscesses of the jaw, and their infrequent presence in absolutely healthy mouths, make this a tenable hypothesis.

Concerning the fourth hypothesis, that is, that amœbæ are the specific cause of pyorrhœa alveolaris, whether or not they are the specific cause of this condition can only be determined after further study. Some facts brought forward in this paper bring new evidence on this point.

In regard to the last hypothesis, that is, that amœbæ may be pathogenic only in connection with certain other micro-organisms, we must remember that if amœbæ absorb and digest fixed tissues as well as leucocytes, blood cells, and other wandering cells, they may help decidedly in keeping up a lesion bacteria have started. This fifth hypothesis is also tenable.

Original Work.

In order to help determine which, if any, of these hypotheses is correct, we have been trying to find out, first, how many children are infected and at what age the amœbæ begin to appear in their mouths, as well as to study the condition of the mouths showing the amœbæ. Second, what types of amœbæ, if more than one, are present. Third, the relation, if any, of these amœbæ to the diseased condition of the children's mouths, and fourth, the necessity and worth of preventive measures.

Soon after our observations on adults were begun, we found that all patients presented to us by the several dentists who are collaborating with us already had pus pockets formed in the jaw alveoli—that is, they were well-established cases—and when we began to inquire for beginning cases we learned that the diagnosis of pyorrhœa alveolaris is made

[1] Abstracted from *Journal of the American Medical Association*, December 11, 1915.

by most dentists only after pus pockets can be demonstrated, so this added interest to our decision to hunt for beginnings in school children.

So far 1,678 children between the ages of 5 and 15 years have had a preliminary examination, and from 995 representative ones stained smears have been made and examined for amœbæ. The 1,678 children have been divided roughly into those having healthy gums and those with receding or spongy and bleeding gums. The healthy looking gums are further divided into those with one or more decayed teeth, and those with apparently sound teeth. Needless to say, we found very few of the latter; that is, of those with apparently healthy gums and sound teeth, and about one half of all showed unhealthy gums.

From many cases two smears were taken. The smears were made as follows: In the bad cases the teeth and gums were cleaned with a cotton swab dipped in 50 per cent. alcohol; then with the flat end of a hard wood sterile toothpick material was scraped from the margin of the gums (there were no pus pockets in these children, so we did not need a scaler) and stroked lightly over a clean glass slide, three or four streaks being made. The smear was then fixed while still moist by dropping methyl alcohol on it, and it was ready to send to the laboratory. This was called the superficial smear. A second toothpick was used to get material from beneath the margin of the gums, from which another smear was made and fixed. This was called the deep smear. In the cases with clean teeth and tight healthy looking gums, the first smear was made before the cleaning with alcohol. All of these smears were stained with Giemsa's stain and examined for amœbæ. Other stains have also been used in the more minute study of types of amœbæ. In regard to the identification of amœbæ by stained films, we would say that they are more certainly and easily identified by this method than by warm living preparations, though, of course, both methods should be used in studying all of the characteristics of these micro-organisms. In hunting for amœbæ in these smears, we have found that most of them seem to be between the superficial bacterial layer and the deep leucocytic layer, so one may find them only in large numbers in one small part of a smear, especially in a smear taken in a routine way.

Stained by Giemsa, the delicately but definitely reticulated cytoplasm of the amœba stains a clear blue, while the small nucleus shows as a delicate rounded or irregular mass of red granules and threads, with often a central light blue staining karysome, which sometimes contains a vacuole-like body. This nucleus no doubt corresponds to that most frequently described for *Endamœba histolytica-tetragena*. There has been found no marked variation from this type of nucleus.

Amœbæ are so notoriously variable in their entire morphology, according to their stage of development, and to the conditions of growth, that no definite opinion should be expressed as to the species of the forms found in these mouths until much further study has been made. We may say, however, that there seem to be at least two morphologic types of amœbæ present: one small, with more or less rounded, dense nucleus, with a few or no inclusions or vacuoles, found in the majority of healthy mouths, and the other large, with more irregular nucleus with many large vacuoles and containing many red blood cells, leucocytes, and other dense masses formed by undigested material. The latter type is found in the majority of unhealthy mouths. Its appearance agrees with that of the type most frequently seen in the well-developed cases of pyorrhœa alveolaris. We have seen no cysts. We have seen evidence of budding and of more equal division.

NUMBER AND PERCENTAGE OF AMŒBÆ FOUND IN EACH GROUP OF CHILDREN.

Condition of mouth	Between 5 and 16 years		Between 5 and 7 years	
	Total	Amœbæ present	Total	Amœbæ present
Healthy gums	(+ 38) / (− 92) = 29 per cent.		(+ 3) / (− 31) = 9 per cent.	
Healthy gums, decayed teeth	(+109) / (−183) = 37 per cent.		(+ 32) / (−105) = 23 per cent.	
Tartar and receding gums	(+182) / (− 96) = 65 per cent.		(+ 19) / (− 17) = 53 per cent.	
Spongy, bleeding gums	(+268) / (− 28) = 91 per cent.		(+ 34) / (− 5) = 70 per cent.	

We have found that amœbæ begin to appear at a very early age, 35 per cent. of children between 5 and 7 years of age being infected. The numbers of those infected with amœbæ increase in frequency with age. Between 5 and 15 years, 60 per cent. show these protozoa on their gum margins. In apparently normal mouths, only 29 per cent. show amœbæ. Taking the percentages by groups, as in the accompanying table, the results are more significant.

Finding the amœbæ so often in apparently healthy mouths and in such young children does not agree with the statement of Bass and Barrett that they are not found in healthy mouths. Whether or not one or more varieties are taken from adult pyorrhœa patients and are simply waiting their opportunity to exert a pathogenic action, we cannot yet say. But the evidence seems to point towards the establishment of either the first or the fifth hypothesis already given.

These results, however, as they stand, are very striking, especially when we must add that most of the cases of spongy and bleeding gums show more amœbæ in the films than the other cases. If we could only rule out other micro-organisms, the evidence for the pathogenic action of the amœbæ would be stronger.

We have, in these school children carriers of amœbæ, a marked opportunity to test the prophylactic effect of ipecac. or its emetine alkaloid on mouth amœbæ.

We have divided the cases showing amœbæ into three groups, one to be watched without treatment, and others to be treated in different ways, one with emetine, and the other by ordinary cleanliness. We have a tooth-wash made up containing a dilution of emetine, and have the washing of the teeth done morning and afternoon in the school clinic under the supervision of the school nurse.

The first examinations, one week after the beginning of this treatment, gave marked results, in that

every child but one, receiving emetine, showed no amœbæ, while many of the others showed them. In the later examinations, however, amœbæ were found in a few of the emetine-treated which were negative before, while a few more of the controls showed none.

The following points have been brought out so far by these examinations:—

Amœbæ are demonstrated irregularly in all mouths once showing them, most constantly and in largest numbers in mouths showing gingivitis, least so in healthy mouths.

With ordinary teeth-cleansing methods, the number of mouths showing amœbæ is reduced one half. With emetine in the tooth-wash, the number showing amœbæ is greatly reduced, only about 10 per cent. showing them. The second set of controls —those doing their cleaning *at home* by ordinary methods—continue to show amœbæ in about 75 per cent. of the cases.

The question as to the amount of emetine to be used has not yet been settled. We began with a 1:200 solution, then reduced it to a 1:400 strength. Probably a much smaller amount would be sufficient to keep down the development of the amœbæ.

TYPHOID FEVER DUE TO MELONS.[1]

On July 12, 1915, a group of children, eight or ten in number, all from one block near the Upper Narrows of New York Bay, went to the beach and noticed a large number of water-melons in the water. All the melons were either damaged along one end or split along the body, and the portion near the damaged end could not be eaten because of its salty taste. The children carried home what they could and distributed pieces to other members of the family. In from one to three days after the ingestion of the melon the children and a few adults, who had eaten of the melons, with but few exceptions, suffered from an acute attack of gastro-enteritis, characterized by nausea, vomiting, severe abdominal cramps, diarrhœa, and, in some instances, marked prostration. They all recovered, and, after a perfectly well interval, some of the children became ill. On July 24, twelve days after the melon party, appeared what was reported to be the first case of typhoid fever in a child 8 years of age. Then in rapid succession twelve cases developed within about two weeks. No secondary cases developed. The clinical data in these cases did not differ from the average type of the disease. The evidence that this outbreak had its source in the water-melons was based upon (1) the period of incubation, which averaged eighteen days (the average given in the literature of a large series of cases); (2) the Widal test, which was requested in only five cases, three being positive, one doubtful, and one negative; (3) the Diazo reaction, positive in all seven cases examined; (4) examination of fæces, done in eight cases, in five of which two examinations were made, with the result that typhoid bacilli were found; in three cases in which only a single examination was made the bacillus was isolated in one instance; (5) the duration of the disease, twenty-five 7/10 days, which agrees with the average of 500 cases in which the duration was twenty-nine days. Investigation of the milk and water supply gave absolutely negative results, and a detailed investigation failed to produce any evidence in the food supply of that immediate vicinity that could be interpreted as a possible cause. The conclusive evidence pointed to the water-melons as containing the organism of this disease. The melons were picked up in the upper bay, immediately above the Narrows, where within a mile of each other two large sewers emptied, one of them draining the Bay Ridge section of Brooklyn, where at the time an epidemic of 100 cases of typhoid fever was raging.

[1] Read before the Section of Medicine, New York Academy of Medicine: abstracted from the *Medical Record*, December 11.

THE WORLD'S SUPPLY OF CINCHONA BARK.

The cinchona tree is indigenous to South America, and within the lifetime of persons yet living the American continent has ceased to be a considerable factor in the world's supply of cinchona. This fact is brought home to us to-day by the present high price of quinine.

There are many species of cinchona, a number of which yield varying amounts of alkaloids, while others are of little or no value. Commercial cinchona bark to-day, however, consists chiefly of red cinchona, yielded by *Cinchona succirubra*, and yellow cinchona or Calisaya bark, yielded by *C. calisaya* and *C. ledgeriana*.

All the species of cinchona are natives of the Andean regions of South America between latitude 19 south and 10 north. They have never been found native elsewhere. The world would probably have been suffering long since from a quinine famine if it had not been for the cultivation of cinchona outside of South America. In 1853 the Dutch Government commissioned the botanist Hasskarl to collect cinchona plants and seeds for use in starting plantations in Java. In 1866 the Dutch obtained from Charles Ledger, an Englishman long resident in South America, half of his collection of seeds of the valuable species since called after him *Cinchona ledgeriana*. Collections for the cinchona plantations in India were made in 1860, while half of Ledger's collection was purchased in 1866 by an Indian planter. Both in India and in Java the cultivation of cinchona has proved a success, and the richness of the bark in alkaloids has been increased under cultivation and by selection of stock. The requirement of the British Pharmacopœia is for not less than 5—6 per cent. of total alkaloids, but good bark may yield a much higher percentage. The effort of growers in late years has been to raise the quinine content rather than that of total alkaloids.

India consumes all or practically all the cinchona raised in that country. The bulk of the world's supply of cinchona now comes from Java, though a comparatively small amount is still imported from

South America, and some is now produced in Ceylon and Africa. The South American plantations are said to have proved unsuccessful commercially, largely because the expense of transportation (on the backs of men over the mountains) makes competition with Eastern cinchona impossible. The cinchona planter of Java inclines to take advantage of the market, which he now practically controls, and the rise in the price of quinine, which began before the present war, may be due in some degree to this circumstance.

INCOMPATIBILITY OF QUININE WITH ASPIRIN AND OTHER ORGANIC ACIDS.[1]

It has been known for a number of years that, by long-continued heating with glacial acetic acid or by fusion of the alkaloidal salts, some of the cinchona alkaloids may be converted into isomeric products which possess extremely poisonous properties. Experiments have also shown that, by acting as catalysers, slightly dissociated acids, such as acetylsalicylic (aspirin), citric, malic, acetic or tartaric acid, under the influence of heat may convert quinine into its poisonous isomer, quinotoxin, and cinchonin into cinchotoxin. At the temperatures of from 98° to 102° C. (208·4° to 215·6° F.) the conversion is practically quantitative; at 37° C. (98·6° F.—normal body temperature) the reaction goes on much more slowly, amounting to about 2 per cent. in forty-eight hours. The danger of poisoning through conversion of quinine into quinotoxin in the body cannot be great, but it is well to keep the possibility in mind. The formation of a dangerous amount of the poisonous product would probably be greatly favoured if the mixture—quinine and aspirin, for instance—had been made up for some time. Suspensions of the alkaloid in flavoured syrups, with organic acids, &c., might be regarded with suspicion; likewise elixirs such as iron, quinine and strychnine, which usually contain citrates or tartrates. The foregoing applies especially to the alkaloid and to such salts as quinine tannate. Since conversion into the toxic isomer does not take place appreciably with an excess of strong mineral acid, there could be but little danger from the administration of the mineral acid alkaloidal salts, such as quinine sulphate.

The subject has not been studied sufficiently to make it possible to decide, in each case of supposed quinine poisoning, whether the toxic symptoms were due to overdose, to idiosyncrasy or to formation of quinotoxin or cinchotoxin in mixtures administered.

Notes and News.

CASEIN FROM INDIA.

The *Indian Textile Journal* gives an account of the manufacture of casein in India. By conversion into casein, a dry, non-decaying substance that may be packed in boxes or bags, it may be carried with ease, and it finds a ready sale for use as a substitute for celluloid, over which it has the advantage of not being inflammable. The process resembles the manufacture of cheese. The skimmed milk is coagulated by rennet, precipitated by hydrochloric acid, and separated in a centrifugal filter. The result is a whitish or yellowish mass which, after drying, is the casein of commerce. There are several ways of separating it, one of the most recent being a current of electricity, which is said to be the cheapest where current from water or wind power is available.

Casein has also been extracted on a large scale from the soya bean after the oil has been removed by pressing. One of the most important uses of casein is the production of galalith, which is used to imitate ivory, tortoiseshell, and celluloid. It is cheaper than the last-named substance. Galalith is made from casein by pressure, which forms it into cakes that are then compressed to the desired thickness. It is translucent, and can be given any colour. It has no bad odour, and will take a high polish. When heated to 150° C. in a bath of oil, it can be moulded by pressure. It is already used for a great variety of low-priced articles, including waterproofs, that do not soften and stick together like rubber goods in a tropical climate. It is made into plates, rods, and tubes, like ebonite. Galalith factories are increasing in number in Europe. In 1910, at Lurgère (France), 440,000 lb. of casein were converted into galalith—the produce of thirty-five dairies that sent their milk to the factory. It takes 15·85 gallons of milk to produce 2·20 lb. of galalith.

Milk casein is also used for sizing paper which is waterproof and resembles parchment. Silks, artificial textiles, leather, films, and plastic substances are prepared with the aid of casein, and in printing calico a solution of vegetable casein and borax is sometimes used as a thickening agent, which adds brilliancy to the colour and gives a silky appearance.

Drugs and Appliances.

COMPOUND MENTHOL SNUFF.

New Export Packing.

This well-known snuff, introduced by Messrs. Burroughs Wellcome and Co., for the treatment of common colds, hay fever, and other nasal conditions, has hitherto been put up in enamelled metal boxes and provided with an inner cardboard container. For use in temperate climates this packing has been found perfectly satisfactory; but in tropical countries the cardboard is apt to deteriorate through the influences of heat and humidity, while the metal box is apt to become unsightly through damp attacking the metal. In future, therefore, the product will be issued for tropical use without the cardboard packing, and enclosed in a watch-shaped bottle, securely corked, waxed, and fitted with a screw cap cover. This will be found a convenient size and shape for the waistcoat pocket, and securely guards the contents against all risk of deterioration.

[1] *Journal of the American Medical Association*, December 11 1915.

To illustrate "Note on Dermatitis cupoliformis," by ALDO CASTELLANI, M.D., M.R.C.P.

Original Communications.

NOTE ON DERMATITIS CUPOLIFORMIS.

By Aldo Castellani, M.D.

I have noted in Ceylon for several years a peculiar nodulo-ulcerative condition of the skin affecting mostly Europeans, which I have called dermatitis cupoliformis, or "tropical ecthyma."

The disease begins with several superficial dusky red, not raised, slightly itching spots, which are generally follicular and perifollicular; they are, as a rule, situated on the feet and legs. The patient usually takes these spots for mosquito bites. Some of the spots disappear, while others become slowly larger, raised, hard and infiltrated, without showing signs of vesication or pustulation, and very often, especially on the feet, somewhat cupoliform; they reach the size of a pea to that of a small cherry; there is no pustulation. After a time the centre of the nodule breaks down and an ulcer forms with reddish fundus and often undermined edges.

These ulcerative lesions are somewhat painful and extremely slow to heal, complete spontaneous cure seldom taking place in less than ten to twelve months; on healing, patches of hyper-pigmentation often remain. The condition is fairly common in young, strongly built, European planters.

Etiology.—If the initial dusky red, follicular, not elevated spots are pricked and a droplet of blood collected and films made, one only sees numerous red blood cells with few leucocytes, and here and there a few cocci arranged in pairs. If agar tubes are inoculated a streptococcus-like germ grows in pure culture from the non-ulcerated lesions, while from the ulcerated lesions staphylococci and other germs may be grown, in addition to the streptococcus. This streptococcus is biologically different from all other streptococci I have so far isolated in Ceylon from skin affections and systemic diseases of streptococcus origin. I named it *Streptococcus tropicalis* (1914). It is Gram-positive, does not liquefy gelatine, does not produce indol. I give in the following table its principal sugar reactions:—

Streptococcus tropicalis.

Motility	O	Adonite	O
Litmus milk	A	Inulin	A
Lactose	A	Sorbite	O
Saccharose	A	Galactose	A
Dulcite	O	Lævulose	A
Mannite	O	Inosite	O
Glucose	A	Salicin	A
Maltose	A	Amygdalin	O
Dextrose	A	Isoduleite	O
Raffinose	O	Erythrite	C
Arabinose	A		

A, acid; O, no production of acid or gas.

The malady may be experimentally reproduced by inoculating pure cultures of the germ into the hair follicles or around them by means of a very fine needle, provided a recently isolated strain be used.

Diagnosis.—The affection, which runs a very long course, when well developed, is recognized by the presence of raised, hard, rather large cupoliform nodules, some of which present a central ulcer with undermined edges. These nodules on superficial examination are most often mistaken for Oriental sore, but the absence of Leishmania distinguishes the affection at once from Oriental sore. Though etiologically closely allied to ordinary ecthyma, the appearance of the lesions is quite different from what one sees in the usual type of ecthyma, which, especially in children, is as common in the Tropics as in temperate climates. In ecthyma the initial lesions are pustular, there being generally discrete flat pustules; when these rupture a brownish crust is formed beneath which suppuration goes on. In cachectic children the so-called "ecthyma gangrænosum" is occasionally met with, especially during convalescence from varicella and other exanthemata, but in this type, too, the lesions are at first vesicular or pustular, and no infiltrated nodules are present. The affection must also be distinguished from pyosis tropica, purulent folliculitis, Barkoo rot, ulcus infantum, blastomycosis, ulcers of syphilitic origin, and veldt sore. In pyosis tropica the ulcers do not show undermined margins, and pustular lesions are present. The absence microscopically and culturally of fungi separates the condition from blastomycosis, apart from different clinical signs. The microscopical examination and the utter uselessness of mercury, potassium iodide, and salvarsan distinguish the affection from syphilitic lesions.

In Barkoo rot the crust covering the ulcer is very hard and difficult to remove. In ulcus infantum a diphtheria-like germ is found. In veldt sore the ulcerative lesions are generally very superficial, the edges of the lesions are not undermined and the exudation dries into a thin crusty mass. In purulent folliculitis of the legs there are no ulcers, but numerous pustules are present, each pierced by a hair.

Treatment.—Treatment with antiseptic lotions (hydr. perch., hydr. perox., &c.), followed by a balsam of Peru ointment, is of some slight use, but very slow in its effects, the condition remaining practically unaffected for many months. The best treatment by far is the use of an autogenous vaccine. Cases which have shown no improvement to ordinary treatment for a long time may get completely cured from two to three weeks after starting the vaccine treatment.

Reference.

Castellani. *Journal of the Ceylon Branch of the British Medical Association*, 1914.

ARNETH COUNTS IN YELLOW FEVER.

By J. W. Scott Macfie, D.Sc., M.B.

(*West African Medical Staff.*)

Introduction.

In a former paper (1915) I gave a preliminary account of the examination of the polymorpho-

nuclear leucocytes by the method of Arneth in a number of blood-films collected by Dr. J. M. O'Brien from cases of yellow fever which he had studied at Guayaquil, Ecuador. I concluded that "in yellow fever there is a great shift to the left of the Arneth count," and some evidence was brought forward to show that this phenomenon might prove of value in the diagnosis of early and suspicious cases. At the time this preliminary account was written I was not in possession of the clinical details of the cases from which the blood-films were obtained, and I therefore limited myself to a consideration of the films taken on the first day of observation in each case. The examinations showed such a profound shift to the left of the Arneth count that it seemed advisable to record the results at once, although it was recognized that the films had probably been taken at various stages of the disease, and that perhaps they included specimens from cases in which the diagnosis had been doubtful. Recently Dr. O'Brien (1915) has published a full account of the cases of yellow fever he examined at Guayaquil, and thanks to his courtesy I am able to give a more detailed record of the changes observed in the neutrophile leucocytes in this disease.

Arneth Counts in Cases that occurred at Guayaquil.

Arneth counts were made on blood-films obtained from sixteen of the cases recorded by O'Brien (see Table I). Six of the cases proved fatal, five recovered after a typical attack, and three after a mild attack of the disease, and in two (Nos. 45 and 46 in O'Brien's Report) the diagnosis was doubtful.

Table I.—Arneth Counts in Yellow Fever: Guayaquil Cases.

Old No.*	Report No.†	Day of the illness	Arneth classification per cent.					Arneth index	Remarks, &c.
			I	II	III	IV	V		
15	15	7th	49·0	41·0	10·0	—	—	90·0	Died on the 8th day, in the afternoon.
		8th	69·0	27·5	3·0	0·5	—	96·5	
8	17	5th	58·5	36·5	5·0	—	—	95·0	Recovered; discharged on the 15th day.
		6th	52·5	39·0	8·0	0·5	—	91·5	
		8th	37·5	46·0	14·5	2·0	—	83·5	
6	21	8th	40·0	40·0	19·0	1·0	—	80·0	Died on the 10th day. Complicated by pregnancy.
4	22	5th	69·0	30·0	1·0	—	—	99·0	Recovered; discharged on the 10th day.
		8th	23·0	50·0	23·0	4·0	—	73·0	
13	26	8th	55·5	34·0	8·5	2·0	—	89·5	Died on the 9th day.
3	29	4th	67·5	30·0	2·0	0·5	—	97·5	Recovered; discharged on the 8th day. Considered to have been a mild case of yellow fever
14	31	5th	59·5	36·5	4·0	—	—	96·0	Died on the 8th day.
		6th	62·0	35·0	3·0	—	—	97·0	
5	32	5th	82·0	17·0	1·0	—	—	99·0	Died on the 6th day.
10	34	7th	62·0	35·0	3·0	—	—	97·0	Recovered; discharged on the 14th day.
1	37	6th	43·0	41·0	15·5	0·5	—	84·0	Recovered; discharged on the 9th day. A mild case.
11	39	6th	53·0	43·0	4·0	—	—	96·0	Recovered. Considered to be a mild case of yellow fever by Dr. O'Brien.
17	40	5th	60·0	37·5	2·0	0·5	—	97·5	Recovered; discharged on the 11th day.
2	45	6th	48·0	40·5	9·5	2·0	—	88·5	Recovered; discharged on the 15th day. The diagnosis was "doubtful." The temperature, after falling to 100 4° F. on the 7th day, rose to 102·8° F. on the 9th and 10th days.
		7th	39·5	39·0	20·0	1·5	—	78·5	
		9th	36·0	47·5	16·0	0·5	—	83·5	
		10th	44·5	41·5	13·0	1·0	—	86·0	
		11th	39·0	46·0	15·0	—	—	85·0	
		12th	45·0	40·0	14·0	1·0	—	85·0	
12	46	11th	20·0	52·5	22·0	5·0	0·5	72·5	Recovered; discharged on the 16th day. Some pigmented leucocytes were found in the blood. N.B.—The earliest film examined was taken on the 11th day.
		12th	25·5	45·0	24·5	5·0	—	70·5	
		13th	30·5	51·5	16·5	1·5	—	82·0	
		14th	22·0	43·0	29·0	5·0	1·0	65·0	
7	47	6th	49·0	44·0	7·0	—	—	93·0	Recovered; convalescent on the 14th day.
		8th	14·5	50·0	29·0	6·5	—	64·5	
		9th	7·0	50·5	37·5	5·0	—	57·5	
		10th	5·0	38·0	41·5	13·5	2·0	43·0	
9	50	5th	75·0	24·0	1·0	—	—	99·0	Died on the 7th day.
		6th	53·5	41·5	5·0	—	—	95·0	

* *Ann. Trop. Med. and Paras.*, vol. ix, p. 435.
† *Yellow Fever Bureau Bulletin*, Supplement, vol. i, pp. 317-352.

The two latter cases should not therefore have been included in my original description. The results of the Arneth counts are given in Table I, together with a brief note of the nature of each case, but for further details the reader must be referred to O'Brien's "Report on a Visit to Guayaquil," published in the Supplement, vol. i, of the *Yellow Fever Bulletin*, 1915. In the table the day of the illness, as stated by O'Brien, is inserted opposite each Arneth count. It should be taken into consideration, however, that it is often difficult to determine the exact date of the onset of the illness; and in these Guayaquil cases it is perhaps remark-

able that none was seen before what was regarded as the fourth day.

Excluding the two cases in which the diagnosis was doubtful, the first day of examination was in one case the fourth day, in six the fifth day, in three the sixth day, in two the seventh day, and in two the eighth day (see Table II). The average Arneth index on these first days was 93·5. In only three cases (Nos. 21, 26, and 37) was the index below 90 on the day on which the first examination was made, and in one of these (No. 26) it was 89·5. Case No. 21 was not examined before the eighth day, and at this stage the temperature was 98·4° F., and the pulse 88. On the following day the temperature was 96° F., and the pulse uncountable. The condition of the patient was also complicated by pregnancy. Case No. 37 was also atypical, was mild in nature, and was not examined before the sixth day. From these examinations it would appear, therefore, that in yellow fever there is a profound shift to the left of the Arneth count at the time when the cases usually come under observation, and that at this period the Arneth index is, as a rule, not less than 90·0.

Unfortunately the blood-films collected by O'Brien, and which he very kindly permitted me to use in this investigation, did not include any long series of specimens taken on successive days of the illness from the same case. In only one instance, No. 47, were there as many as four films, and these had been taken on the sixth, eighth, ninth, and tenth days. On the second and third days of the illness the temperature of this patient was 104° F., on the fourth day it fell to 101·6° F., and on the fifth day it was normal, and did not again rise above 99·4° F. (see Chart 1). On the sixth day the Arneth index was 93·0, on the eighth day it was 64·5, on the ninth day 57·5, and on the tenth day it was practically normal, namely, 43·0. In this case, therefore, the recovery of the patient was accompanied by a rapid return of the Arneth count to normal percentages.

Arneth Counts in Cases that occurred at Lagos.

In 1913 a number of cases of yellow fever occurred at Lagos, in Nigeria, and at the time I received daily from most of them blood-films for examination. As a good many of these specimens had been preserved I thought it might be of interest to re-examine them, and to make Arneth counts where possible. Unfortunately some of the films, which had been prepared for a special purpose, were unsuitable; others had faded, and could not be satisfactorily restrained; and yet more had to be rejected because malaria complicated the cases from which they had been obtained. In a few of the blood-films that remained it was impossible to find sufficient polymorphonuclear leucocytes on which to base an Arneth count, because the leucopenia that is often conspicuous in the early stages of yellow fever was so pronounced. Finally, satisfactory counts were made in five cases, but in only two of these was it possible to obtain a series of estimations taken at regular intervals during the course of the illness (see Table III). In the table the cases are numbered and lettered according to the system adopted by the Yellow Fever Commission (West Africa), and a full account of each will be found in the Report by Dr. T. M. Russell Leonard, published in the *Yellow Fever Bureau Bulletin*, 1915, Supplement, vol. i.

The first two cases, Nos. L. 38 and L. 39, were in Syrians, and each was examined on what appeared to be the second day of the disease. The Arneth indexes in these two cases were 93·0 and 95·5. The first case ended fatally on the fifth day, and the diagnosis was confirmed at the autopsy.

The other three cases were in negroes; the first two, Nos. L. 51 and L. 52, being very mild attacks, and the third, No. L. 56, a rather more severe one. In each case there was a profound shift to the left of the Arneth count at the commencement of the illness, and a rapid return to the normal as convalescence was established. This relationship is perhaps brought out most clearly in Charts 2, 3, and 4, in which the successive Arneth indexes are

Table II.—Arneth Indexes in Yellow Fever (Guayaquil Cases), arranged according to the Days of the Illness on which the Examinations were made.

Old No.	Report No.	Result	Day of Illness									
			1	2	3	4	5	6	7	8	9	10
15	15	Death	—	—	—	—	—	—	90·0	96·5 D.	—	—
8	17	Recovery	—	—	—	—	95·0	91·5	—	83·5	—	—
6	21	Death	—	—	—	—	—	—	—	80·0	—	D.
4	22	Recovery	—	—	—	—	99·0	—	—	73·0	—	—
13	26	Death	—	—	—	—	—	—	—	89·5	D.	—
3	29	Recovery	—	—	—	97·5	—	—	—	—	—	—
14	31	Death	—	—	—	—	96·0	97·0	—	D.	—	—
5	32	Death	—	—	—	—	99·0	D.	—	—	—	—
10	34	Recovery	—	—	—	—	—	—	97·0	—	—	—
1	37	Recovery	—	—	—	—	—	84·0	—	—	—	—
11	39	Recovery	—	—	—	—	—	96·0	—	—	—	—
17	40	Recovery	—	—	—	—	97·5	—	—	—	—	—
7	47	Recovery	—	—	—	—	—	93·0	—	64·5	57·5	43·0
9	50	Death	—	—	—	—	99·0	95·0	D.	—	—	—

TABLE III.—ARNETH COUNTS IN YELLOW FEVER. LAGOS CASES.

Case No.	Commission No.	Race	Result	Day of illness	ARNETH CLASSIFICATION PER CENT.					Arneth index
					I	II	III	IV	V	
8	L. 38	Syrian	Death	2nd	57·5	35·5	7·0	—	—	93·0
9	L. 39	Syrian	Recovery	2nd	49·5	46·0	4·0	0·5	—	95·5
18	L. 51	Negro	Recovery	3rd	55·0	35·0	8·5	1·5	—	90·0
				5th	45·0	41·5	13·5	—	—	86·5
				7th	31·0	53·0	15·0	1·0	—	84·0
				9th	16·0	49·5	30·5	4·0	—	65·5
				11th	9·0	44·0	41·0	5·5	0·5	53·0
19	L. 52	Negro	Recovery	3rd	45·0	42·0	12·0	1·0	—	87·0
				4th	44·0	51·0	5·0	—	—	95·0
				5th	44·5	46·0	9·0	0·5	—	90·5
				7th	35·5	50·0	13·5	1·0	—	85·5
				9th	12·5	48·0	34·5	5·0	—	60·5
				12th	9·5	44·0	40·5	5·5	0·5	53·5
22	L. 56	Negro	Recovery	4th	42·0	51·0	7·0	—	—	93·0
				8th	10·0	62·0	26·0	2·0	—	72·0
				15th	7·5	37·0	39·0	15·0	1·5	44·5

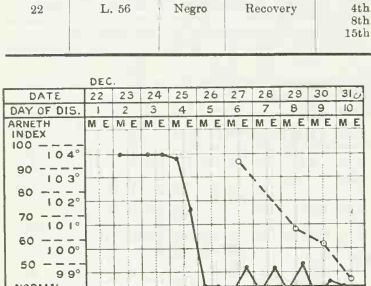

CHART 1.—YELLOW FEVER CASE, GUAYAQUIL, No. 47.
Continuous line, temperatures; broken line, Arneth indexes.

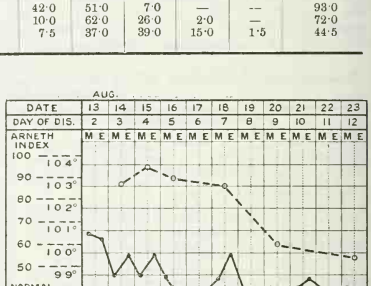

CHART 3.—YELLOW FEVER CASE, LAGOS, L. 52.
Continuous line, temperatures; broken line, Arneth indexes.

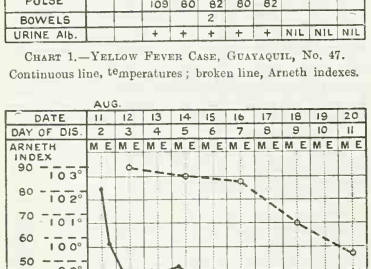

CHART 2.—YELLOW FEVER CASE, LAGOS, L. 51.
Continuous line, temperatures; broken line, Arneth indexes.

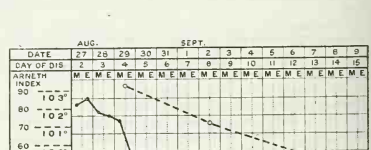

CHART 4.—YELLOW FEVER CASE, LAGOS, L. 56.
Continuous line, temperatures; broken line, Arneth indexes.

plotted as a curve above the same normal base line as the temperatures.

In my previous paper I expressed the opinion that the occurrence of a very high Arneth index in any suspicious case of fever in West Africa in which no malaria parasites could be found, and in which there was not presumptive evidence of malaria, would be strongly in favour of a diagnosis of yellow fever. It is interesting, therefore, to find that even in the very mild cases of this disease that occur in West Africa there is such a marked shift in the Arneth count. The importance of this phenomenon lies, of course, in the fact that these mild cases, which are often extremely difficult to diagnose by the ordinary methods, are just as serious a menace to the health of the non-immune population as are the severe cases which are readily recognized.

The Changes observed in the Arneth Count during an attack of Yellow Fever.

The Arneth counts collected in this paper are too few in number to furnish a complete history of the changes that take place in the polymorphonuclear leucocytes in yellow fever, but they will serve, I think, to indicate their nature and duration.

Already at the earliest phase of the disease there was found to be a very marked shift to the left of the Arneth count, the majority of the polymorphonuclear leucocytes being of the types included in Arneth's Class I. In one case (see Table III, No. L. 52) the index, which was 87·0 on what was recorded as the third day of the illness, rose to 95·0 on the fourth day, and was still as high as 90·5 on the fifth day. Unfortunately no data are available to show the effect on the Arneth count of the remission of the temperature which usually takes place on the third day.

In fatal cases, so far as can be judged from the materials examined, the Arneth index either remains very high, or mounts still higher as the disease progresses.

In cases that recover, on the other hand, the index, after remaining high until about the seventh day, begins to fall rapidly and reaches a figure approximating to the normal about the tenth to the fifteenth day. In this respect yellow fever appears to differ from malaria (*P. falciparum* fever), for in the latter disease, in the few cases that have been examined on a number of successive days, the deflexion of the Arneth count has been observed to persist somewhat longer.

It is probable that there is nothing actually specific about the changes in yellow fever, and it may perhaps be anticipated that a similar profound shift to the left of the Arneth count will be found to be present in the early stages of other acute conditions accompanied by high fever and profound toxæmia, such, for instance, as plague, &c. In the majority of such diseases, however, even in the early stages, there will be other signs and symptoms to aid the diagnosis; but in yellow fever in the mild attacks, and in the initial stages of the more typical forms of the disease, these are, unfortunately, often absent or of a negative character, and it is in such cases that the Arneth count may be of assistance in determining the nature of the infection.

It is well known that leucopenia is often a marked feature of the blood condition in the early stages of yellow fever. It may be that this is due, in part at any rate, to the destruction of the older polymorphonuclear cells, namely, those with three or more nuclear fragments, by the toxæmia developed during the onset of the disease, and that in this manner the profound shift to the left of the Arneth count very early in the illness is accounted for. This hypothesis receives support from the observations of O'Brien (1914), who has described an acute degeneration of the polymorphonuclear leucocytes in yellow fever. It may be questioned whether the toxins would select the cells belonging to the higher classes in this way; but as there seems to be no doubt that the cells of these classes are the older individuals, it would seem probable that they are relatively less resistant. It has recently been shown by Taylor (1915) that, judged by their phagocytic power towards *Staphylococcus pyogenes aureus*, the cells of Class II are the most efficient—an observation that would also indicate that the cells of Classes III to V were past their prime.

Although this explanation might account for the initial shift to the left of the Arneth count, it will not serve to explain the persistence of the phenomenon. After the first day or two the leucopenia disappears and leucocytes are again abundant in the blood. Some observers, indeed, have recorded a decided leucocytosis brought about by a great increase in the number of polymorphonuclear cells. As the shift continues to be most pronounced this can, I think, only be accounted for by supposing that, as a result of an unusual degree of activity of the leucopoietic system, a large number of young polymorphonuclear leucocytes (Class I) are being poured out into the blood-stream.

As convalescence is established the increased activity of the leucopoietic system apparently ceases, for there is observed to be a rapid fall in the percentage of the cells belonging to Class I. The percentage of cells belonging to Class II is also reduced, but less rapidly than is the case with Class I, and the percentages of cells belonging to the higher classes gradually increase. The changes are, in fact, such as might be expected to result from the maturation of a large number of polymorphonuclear leucocytes thrown into the circulation during a brief period of exceptional activity of the tissues that produce these cells.

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THE JOURNAL OF

Tropical Medicine and Hygiene

FEBRUARY 15, 1916.

"NEEDLING" PAINFUL SPOTS OF THE BODY AS A MODE OF TREATMENT AS PRACTISED BY THE CHINESE, WITH THE WRITER'S EXPERIENCES.

FROM time immemorial the Chinese have practised "needling" the body for the relief of pain, of swellings, of stiffness, and the treatment of many ailments. The practice has become with them an art—an exact science, in fact, if the term science can be applied to such a proceeding.

The model of the human body in brass, with its many indicated puncture points, is a well-known feature of wonder to the northern Chinese, and the pictures of the model are met with throughout the Empire.

To each one of the hundreds of puncture points indicated in the model a curative effect is attached, and the modern student of surface anatomy may well stand aghast when asked to interpret the several structures any particular puncture might traverse when pushed deeply; and the clinician will be puzzled to explain the possible or probable effect likely to be produced thereby. We may and do say: "There is something in it"; but we seldom if ever venture to practise it, except occasionally in an experimental and tentative fashion, as, for instance, by placing an electric needle in the sciatic nerve.

Is the idea one of counter-irritation merely, or is it practised with the idea of puncturing circumscribed effusions which, owing to their presence, distend the tissues and thereby engender localized pains? It is scarcely possible to suggest any other reason for the employment of "needling," but either the one or the other is sufficient to justify its use if it can be proved that good results obtain.

The Chinese have other and less severe methods of counter-irritation. Nothing is more common than to see the skin of persons in China suffering from fever and many other ailments covered with circumscribed contusions produced by "nipping" the skin between coins (cash). This procedure is more easy of accomplishment and less technical than needling, and as a counter-irritation more potent. It would appear, therefore, that the puncturing of fasciæ is the reason for the practice, and the only possible way in which "needling" can claim to be a rational treatment. It may be asked, Is the puncturing of fasciæ to relieve tension so frequently required as a means of treatment? The fact is, we know little of such a pathological condition; for instance, what do we know of the real pathological state in lumbago? Our treatment is empirical because our knowledge of the ailment is limited—it might be said non-existent. Is it an effusion into the mass of lumbar muscles? If so, then is the mystery explainable and the puncture of the thick fascia covering the muscles justified as a rational therapeutic agent. This is evidently the reason for the Chinese practice of "needling," which undoubtedly relieves pain and shortens the duration of the ailment. Relieving tension when an organ is inflamed is a sound and long-practised method of treatment in scientific medicine. It is chiefly confined, however, to a few organs only; at one time free incisions for orchitis were in vogue, but beyond that and subcutaneous inflammation the procedure is seldom carried. Were it extended to inflammations of the liver, the lung, glands, and other organs, good might and, theoretically, should ensue.

Anyone acquainted with puncturing the liver by a needle in search of liver pus knows well that, after, say, half a dozen to a dozen unsuccessful punctures, the temperature often falls, the enlarged liver diminishes, and a rapid cure of the hepatitis occurs. By this procedure the severe tension of the

liver capsule is relieved, blood escapes into the cavity of the peritoneum from the punctured points, and the condition is ameliorated or the ailment cured. Were lobar pneumonia treated similarly, equally good results might be anticipated, but the procedure is not included amongst the methods of treatment to-day; yet during search for liver pus we often traverse the lower part of the right lung, which in all cases of hepatitis is deeply congested, with great benefit to the lung itself. That this frequently occurs has been brought home to the writer, as the patient coughs up some blood as the result of the lung puncture, a result which acts beneficially in every instance this has occurred.

So impressed has the writer become that he has adopted "needling" for many ailments, amongst which are the following:—

(1) So-called rheumatic pains in the gluteal region and in the neighbourhood of the hip-joint when pain is not relieved in any other way.

(2) For pains passing down the back of the thigh, frequently associated with neuralgic pains over or in the sciatic nerve, and forming part and parcel of a general tenderness in hip, hip-joint, and thigh.

(3) To dispel swelling and pain around the shoulder-joint in which a "rheumatic" type of pains and conditions following an injury to the shoulder has set in.

(4) For "lumbago" due to (*a*) injury, or to (*b*) "rheumatism" ascribed to chill, when either are of long standing and other remedies fail.

(5) To dispel the stiffness and swelling so apt to follow a sprained ankle.

(6) When after a fracture of the leg or other parts the tissues become so bound together that the muscles are hampered in their action and ordinary massage fails to improve matters.

(7) Over the sacrum and adjacent area of the pelvis, in which pains in women, ascribable to pelvic trouble, are so frequently complained of.

The most frequent necessity for treatment arises, however, in the region of the hip, where one has to deal with those indefinite pains in both men and women usually styled sciatica.

Dr. Wm. Bruce, of Strathpeffer, taught us that much of the sciatica diagnosis so frequently made is not due, at any rate primarily, to the sciatic nerve at all, but to changes in and around the hip-joint, and that the chief tender spot in connection with these changes is in the post-gluteal region, just above or behind the sciatic notch.

The writer has followed Dr. Bruce's teaching, and is so convinced of the truth of his statements that, not content with mere massage, he has "needled" the surroundings of the hip-joint above and behind, and punctured at times even the capsule of the joint itself.

In another type of hip ailment the writer has used "needling" with benefit. To give an example. A man playing tennis "did something" to his hip which "lamed" him for a time. Rest, fomentations, electricity, massage, &c., were applied, and still the trouble remained for many months. In the course of some two years he never was rid of a "crippling" pain, especially after he had sat still for some time. Thinking to hasten matters, he tried exercise again, and when playing tennis was again seized by "sciatic" pains, which necessitated resting for a time. The trouble continued and rather increased in severity. On examining him when he came home on leave from abroad a definitely tender area was found in the gluteal region, above and behind the great trochanter, leading up to the crest of the ilium, just about the spot where the last dorsal nerve crosses the ilium. Defying all known treatment, the writer, under an anæsthetic, on two occasions punctured the area of the hip deeply, most of the punctures reaching down to the bone. The punctures were made down the thigh along the tract of the sciatic nerve, down to the back of the knee. The needles were also made to puncture the capsule of the hip-joint at three places. The method of manipulation consisted of holding a hare-lip pin in either hand and rapidly thrusting each deeply into the tissues, over a hundred punctures being made in the space of two or three minutes.

The benefit of this treatment was apparent, and its repetition still further continued to do good.

This short account of "needling" may serve to bring up for discussion a practice which has tradition—that is, experience—for its justification; and there can be no doubt that as a rational treatment it has much to recommend it.

J. Cantlie.

Annotations.

Case of Boric Acid Poisoning (P. Wilson, *Medical Annals*, No. 5, 1915).—A baby seven weeks and six days old in the afternoon was given about 3 oz. of a saturated solution of boric acid instead of boiled water. Shortly after the baby was nursed, but vomited during the nursing, so that this was discontinued, and 3 oz. more of the boric acid solution were given. In the evening the baby had many copious movements, which soon became nothing but clear, jelly-like mucus. The vomiting and purging continued for about thirty-six hours, gradually decreasing in severity. The day following the administration of the poison there was a little blood in the movements and once a considerable stain in the vomit. The baby refused to nurse and rapidly lost weight. There was no fever. So far the picture was one of an acute gastro-enteritis of moderate severity from a chemical irritant. Two days after the first ingestion there appeared a slight miliary eruption on the neck, chest and back. The disease ran its course rapidly, and the peeling was completed in about ten days. The baby quickly regained a normal condition.

Galactose Test of Liver Functioning.—Pari's further experience has confirmed the fluctuations in the response to the galactose test in the same person at different times. Hence a single test has comparatively little significance. He reports in detail three cases of cirrhosis of the liver tested repeatedly

for alimentary galactosuria. The response demonstrated that the liver was able to do its work better at some times than at others, its functioning fluctuating contemporaneously with the amounts of ascitic fluid produced but in the inverse direction.

Ethylhydrocupreine Hydrochloride in the Treatment of External Eye Diseases.—J. S. Wyler (*Lancet-Clinic*, December 25, 1915) reports the results obtained with instillations of this quinine derivative in external eye affections other than pneumococcic corneal ulcers, in which its efficacy has already been established. The drug is of value in acute and mild subacute infections of the lacrymal sac. In two cases, with long standing itching and redness of the eye, favourable results were obtained. In the first much stringy mucus was being secreted, and treatment with various recognized drugs had given no benefit, epinephrine and novocain alone bringing temporary relief. Instillation of 1 per cent. ethylhydrocupreine hydrochloride solution, every two hours, brought absolute comfort, which persisted throughout the summer under continued use of the drug. In the second case a 1 per cent. solution, used three times daily, also brought complete relief. In three cases of trachoma a considerable improvement took place under the influence of the same drug. Two of these cases showed pannus formation and the third a central corneal ulcer. Instillation of a 2 per cent. solution of the drug, every three hours, reduced the pannus, and brought relief from pain, gradual diminution of the ulcer, and improvement of vision. Three cases of phlyctenular inflammation in children were most favourably influenced by treatment with a 10 per cent. solution of the drug in the office and a 1 per cent. solution at home. Two of these cases had corneal involvement. In all a rapid disappearance of the photophobia was noted. Results from the use of the drug in parenchymatous keratitis were unfavourable and in gonococcal ophthalmia doubtful.

MEDICAL NOTES.

Chloroform continues to be the anæsthetic best fitted for use in tropical countries, both in general and obstetric practice.

Crotalin, a name given to the dried venom of the Crotalina (rattle-snake), is recommended for epilepsy. Introduced some six years ago by Spangler, but it does not seem to have advanced in reputation. Small as the dose recommended is, namely, 1/400 of a grain, untoward results have been recorded. The rationale of the use of crotalin is that epileptic attacks are associated with certain changes in the blood which are advantageously dealt with by the use of the venom. It is plain that as both the condition of the blood in epilepsy has yet to be established, and the potency of the venom for good or evil is an unknown quantity, the use of crotalin remains purely an empirical remedy. That, however, does not wholly condemn its use.

Abstracts.

FOOD POISONING BY THE *BACILLUS PARATYPHOSUS* B.[1]

By H. S. Bernstein and Ezra S. Fish, M.D.

During July, 1915, an epidemic of food poisoning occurred at Westerly, R.I., and in an adjacent town. The epidemic was characterized by symptoms of an acute gastro-enteritis. The symptoms followed the eating of pie, which was obtained at a restaurant in Westerly. It is estimated that sixty persons were made seriously ill, four of whom died.

Many ate pie purchased from the restaurant and yet remained unaffected. It was, nevertheless, firmly established that all those who were affected traced their symptoms to the pie. The dough was mixed Friday, July 2, and a batch of pies was made on the following day for Sunday and Monday. This batch consisted of coconut-custard, custard, squash, lemon, chocolate, berry, and apple pies. The preparation of these food products differed in no way from that employed for many years previously.

The symptoms appeared from twelve to nineteen hours after eating. In some cases the symptoms appeared as early as four and a half hours. They were characterized by epigastric pain, a burning sensation from fauces to stomach, extreme thirst, and spasmodic contractions of the calves of the legs. Vomiting was a constant symptom and was of about six days' duration. The vomitus was green. Diarrhœa was also present and was associated with tetanus. The stools were of a pea-soup consistency, greenish, and extremely foul smelling. The green colour of the stools persisted for many days. The number of the dejections varied from ten to twenty daily. The temperature was elevated, reaching 103 in some cases. The pulse was normal. Two of the patients had a herpetic eruption around the mouth, and in one other a generalized erythema appeared for twenty-four hours. One child of 8 was rendered unconscious for two or three days, and presented a marked rigidity of the neck. In one of the fatal cases, there was a suppression of urine. Most striking of all was the mental depression. Convalescence was protracted.

Two men and one woman died within four days after the onset of symptoms. The fourth person, a man, died three weeks later. The persons who died were all beyond middle age. The first fatal case was that of a man aged 49. Symptoms of marked severity came on seven hours after eating and proved fatal in thirty-six hours. Two other members of the family, who had eaten pie at the evening dinner, became ill, whereas four other members, who had not had any pie, were unaffected.

There was no unusual taste or odour to the pies to excite suspicion; and the symptoms followed

[1] Abstracted from *Journal of the American Medical Association*, January 15, 1916.

the eating of all the different kinds of pie of which this particular batch consisted. The gradual increasing number of cases of poisoning gave rise to much alarm. Laboratory investigations were conducted after the acute stage of the epidemic had passed. No field work, which might have enhanced the value of this epidemiologic study, was rendered possible.

The small amount of material precluded any attempt to isolate a ptomaine by chemical means. Accordingly, the bacterial content of the specimens merited inquiry.

The twenty-four hours' growth on the Endo plates, which were seeded with an emulsion of the pie, contained a mixture of red and of transparent, colourless colonies. The latter were transplanted on slant-agar. They yielded a profuse growth of Gram-negative bacilli. These bacilli in subsequent cultures showed a slight tendency to pleomorphism. They possessed motility and showed the following cultural characteristics: Litmus milk at first became slightly acid, the acidity giving way to a permanent alkalinity. Gelatin was not liquefied, but gas was produced therein. With Hiss carbohydrates serum-water mediums, dextrose, lactose, galactose, mannite and maltose showed acid and gas formation; lactose, saccharose, dextrine and salicin were unchanged.

An eighteen-hour bouillon culture of the organism thus isolated from the pie mixture, and termed for convenience " Strain 4," was employed in the determination of its pathogenicity. Three animals were each inoculated with 1 c.c.: one rabbit subcutaneously, one guinea-pig subcutaneously, and one other guinea-pig intraperitoneally. The two guinea-pigs died overnight. A diffuse peritonitis was present in each animal. The organism recovered from the heart's blood and peritoneal cavity possessed the same cultural characteristics as the one injected. It was a Gram-negative, motile coccobacillus, producing colourless transparent colonies on Endo plates and a permanent alkalinity in litmus milk. The rabbit died seventy-two hours after injection. Cultures taken from the heart's blood and peritoneal cavity, twenty-four hours *post mortem*, were in turn transplanted on Endo plates. Colourless colonies were obtained identical in character with Strain 4.

Feeding experiments were also performed. A kitten was fed with portions of the pie and suffered no ill-effects. Another kitten was fed on sterile milk, which had previously been inoculated with Strain 4. A mild enteritis resulted.

A specimen of blood was received from a patient, aged 20, who " had quite severe symptoms after eating pie." The blood was collected twenty-four days after the onset of symptoms. It is particularly noteworthy that this patient gives no history of any illness of over two or three days' duration prior to the attack of food poisoning. The blood serum from this patient agglutinated the typhoid bacillus, the paratyphoid bacillus B and Strain 4 in the dilutions of 1:10, 1:40, 1:80, 1:100, and 1:200 (the latter dilution showed partial clumping). The paratyphoid bacillus A was agglutinated only in dilution of 1:10. The patient's serum also agglutinated the organism recovered from the hearts' blood of the guinea-pigs and of the rabbit which had been inoculated with Strain 4. Moreover, Strain 4 was agglutinated by an antityphoid serum.

Ten dried specimens of blood were received from individuals who similarly had suffered ill-effects from eating the pie in question. The specimens were collected one month after the onset of symptoms. Five of the specimens caused complete agglutination of Strain 4, three produced partial clumping, and two were negative. The question whether the organism isolated was capable of producing a soluble toxin invited solution. Accordingly a forty-eight-hour bouillon culture of Strain 4 was filtered through a Berkefeld filter. Two guinea-pigs and one rabbit were each inoculated with 1 c.c. of the bacteria-free filtrate. The animals developed no symptoms. Two animals were used as control, one guinea-pig was injected with sterile bouillon, and one other guinea-pig with the bouillon containing the growth of Strain 4. The latter died overnight. All other observations were similarly controlled and repeated. In each instance, the observations found corroboration.

It is to be recalled that of the mixed cultures made from the ingredients of the pie the bouillon inoculated with the dough proved fatal to a guinea-pig, as did the mixed culture from pie. The animals died either from the toxins in the food products or from the organisms present. It may well be assumed that Strain 4, if present, may have been overgrown by the streptococcus and the *Bacillus coli communis*. Since Strain 4 has been isolated only from the pie, the presumptive evidence is that the dough, also, contained the organism.

Thus the organism isolated from the pie mixture possesses the morphologic, cultural, pathogenic and immunologic characteristics of the Salmonella group. This group is composed of the *Bacillus paratyphosus* B, the *B. suipestifer* and the *B. enteritidis* Gaertner.

Rabbits were accordingly immunized against Strain 4, the *B. paratyphosus* B, and the *B. suipestifer*. Three intravenous injections of a twenty-hour bouillon culture of each of the three organisms were administered to rabbits at fifteen-day intervals. The animals were bled approximately one week after the last inoculation. The first injection consisted of 0·001 c.c. of the living culture, the remaining two of 0·01 c.c. Rabbits injected with Strain 4 succumbed shortly before the second injection became due. The organism was recovered from the heart's blood and stools. Fortunately it was possible to obtain blood from one rabbit after it had survived a second injection of Strain 4. At that time the animal had a paralysis of the lower limbs and of the urinary bladder. This may account for the relatively low titre in the agglutinating properties of the serum.

The similarity of the serum reactions between Strain 4 and the *B. paratyphosus* B establishes definitely the identity of the former. The *B. enteritidis Gaertner* was not agglutinated by any one of the immune serums.

Strain 4 did not remove all the agglutinins for the *B. paratyphosus* B from a paratyphoid B serum. Repetition of the test yielded constant results. A similar anomalous reaction is recorded by Hutchens and Tulloch[1] in a strain of the *B. paratyphosus* B isolated from yeast in a brewery. This yeast had been used as food for farmyard animals and produced symptoms of an acute enteritis.

The agencies whereby the *B. paratyphosus* B gained access to the pie must of necessity remain a matter of conjecture. The cases of poisoning were limited to persons who purchased the food-product at this restaurant. If we accept the view of Bainbridge, the infection originated from a human source, possibly a paratyphoid carrier.

The distribution of the *B. paratyphosus* B in nature has given rise to much discussion. Bacilli of the paratyphoid group have been isolated from milk, from water, from sausage, and from goose. Moreover, the organism has been obtained from the intestinal contents of healthy pigs.[2] It was noted by Conradi that food containing these organisms could be eaten by human beings without the production of untoward symptoms. Negative results were obtained in the examination of pigs' fæces.

Bainbridge[3] is disposed to regard "the human alimentary canal (including the bile passages) as the normal habitat of *B. paratyphosus* B, while admitting that paratyphoid 'carriers' may cause infection not only directly but also by contaminating sound food, just as is the case with typhoid carriers. Under these circumstances it is to be expected that the bacilli may occasionally be found in food polluted by a carrier, although they have not met with such an instance." Moreover, the presence of the *B. paratyphosus* B in healthy human beings is unknown in England. In this connection the findings of Bonhoff are of unusual interest. In the bacteriologic examination of the heart's blood in 6,476 cases at necropsy, he isolated the *B. paratyphosus* B from twenty-nine cases. Five of the twenty-nine cases fall into a group which the author classifies as bacteriæmia as a coincident finding. This group comprised one case each of senility, pulmonary tuberculosis and chronic alcoholism, and two cases of inoperable carcinoma.[4]

The importance of carriers of paratyphoid bacilli has been further emphasized by epidemics which owe their origin to them. Thus an epidemic of paratyphoid fever occurred affecting forty-four children in a surgical ward. A young girl, recently admitted to undergo treatment for rachitis, was held responsible because of the presence of the organisms in her stools. A similar outbreak of paratyphoid B fever, verified bacteriologically, involved sixteen surgical cases at a hospital in Roanoke, Va.[5] A coloured boy who was employed as a helper in the kitchen was the probable source of the infection, "which was spread by finger conveyance from case to case in the wards." The first outbreak in England of an acute gastro-enteritis due to the *B. paratyphosus* B is recorded by Bainbridge. The symptoms were identical with those described in the westerly epidemic. Fourteen persons in four households became seriously ill. The organisms were isolated from two specimens of stools, and their identity determined by absorption tests. No food was held responsible, as the dates of onset varied. The exchange of visits between the households at the time of the epidemic suggests strongly the intervention of a carrier.[6]

In addition to the infections by contact mentioned above, there are epidemics recorded in which food material proved to be the vehicle of infection, because of contamination by paratyphoid carriers. Sacquépée and Bellot describe an epidemic of paratyphoid fever affecting nineteen in a French army corps of 250. The cook in camp had recovered a short time previously from an attack of paratyphoid fever. His blood agglutinated the *B. paratyphosus* B, which persisted in his stools. Similar epidemics of paratyphoid fever occurred in various Japanese camps on the island of Waiawa. A native who brought vegetables to these camps proved to have the bacilli in his stools, although he gave no history of any illness during the two previous years.[7] Of forty-five individuals who were taken sick after drinking some German beer, thirty-three agglutinated the *B. paratyphosus* B; and in the stools in eight cases the organism was present. It is supposed that the brewer had infected the product, which was of domestic manufacture. Pastry was productive of acute symptoms in thirteen cases. The baker of the pastry was a recent convalescent from an attack of paratyphoid fever, which he had contracted from his son. The organisms were found in the urine of the baker. The food itself was not available for bacteriologic examination. A fatal case, that of a private in the German army, yielded the *B. paratyphosus* B in cultures from the intestinal contents, urine and spleen. The clinical symptoms were most acute in character. At the same time there were among the civil population twenty cases of food poisoning due to the ingestion of sausages. From the stools of one of the victims, the *B. paratyphosus* B was isolated.

It may not be amiss to cite two other epidemics of food poisoning in which the organisms were recovered from the food product. Fried eel was responsible for symptoms in a family of six. Paratyphoid bacilli were obtained from specimens of the

[1] Hutchens, H. J., and Tulloch, W. J.: "An Anomalous Strain of *B. Paratyphosus* B," *Journ. Path. and Bacteriol.*, 1913-14, xviii, 431.

[2] Bainbridge, F. A., and O'Brien, R. A.: "On the Paratyphoid Group of Bacilli," *Journ. Hyg.*, 1911, xi, 68.

[3] Bainbridge, F. A.: "The Etiology and Epidemiology of Paratyphoid Fever and Food Poisoning," *Proc Roy. Soc. Med.* (Epid. Sec.), London, 1910-11, iv, p. 51.

[4] Bonhoff, F.: "Ueber Paratyphusbazillenbefunde an der Leiche," *Virchows Arch. f. path. Anat.*, 1914, ccxvi, 321.

[5] Lumsden, L. L., Freeman, A. W., and Foster, W. B.: "Paratyphoid Fever: Report of an Outbreak in a Hospital at Roanoke, Va.," *Pub. Health. Rep.*, 1913, xxviii, 1041.

[6] Bainbridge, F. A.: "An Outbreak of Gastro-enteritis due to *B. paratyphoid* B, *Brit. Med. Journ.*, 1910, ii, 1515.

[7] Sinclair, A. N.: "An Epidemic of Paratyphoid Fever, Origination from a Carrier and Dissemination by Vegetables," *Am. Journ. Trop. Dis. and Prev. Med.*, 1914, i, 612.

eel. The organisms were more numerous, however, in the centre of the fried portions. Most noteworthy of all is the food infection which occurred at Wrexham, England, in August, 1910. Many of the features of this epidemic were strikingly similar to ours at Westerly.[1] One hundred and seven persons in fifty-six families became seriously ill as the result of eating pork pies. Of this number five died. The symptoms were those of an acute gastro-enteritis, associated with herpes and mental depression. The pork pies originated from the same bakeshop. The *B. paratyphosus* B was found in two specimens of suspected pork pies and agglutinins for the organism in five persons who had eaten the pie in question.[2] The organism was also found in the stools of the head cook. She gave no history of ever passing through any typhoid-like illness and to the best of her belief she had never before caused a similar outbreak.

SUMMARY.

The purport of this communication is:—

(1) To record an outbreak of food poisoning due to the *B. paratyphosus* B which affected sixty individuals, of whom four died.

(2) To indicate that the vehicle of infection was pie, from which the organism was isolated.

(3) To emphasize the necessity of protecting public food supplies from "disease carriers."

THE DOG AS A CARRIER OF DISEASE.

Pediatrics, December, 1915, remarks that in the case of foot-and-mouth disease the dog acts as a mechanical carrier of infection. The dog which runs across an infected farm easily may carry in the dirt on his feet the virus of the most contagious of animal diseases to other farms and thus spread the disease to the neighbouring herds.

There are, however, many other maladies in the spread of which the dog takes an active part: Rabies, hydatid, ringworm, favus, tapeworm, roundworm, and tongue-worm are often conveyed to human beings in this way. It occasionally happens also that the dog carries fleas and ticks, transmitting bubonic plague or the deadly spotted fever in this way. Hydatid disease is caused by the presence in the liver, kidneys, brain, lungs, and other organs, of a bladder-worm or larval tapeworm. A dog which is allowed to feed on carrion or the raw viscera of slaughtered animals may eat a bladder-worm containing numerous tapeworm heads. These tapeworm heads develop into small segmented tapeworms in the intestines of the dog. The tapeworms in turn deposit eggs which are passed out in the excrement of the dog, and spread broadcast on grass and in drinking water where animals can eat them and thus become infected. The hog is particularly liable to this disease because of its rooting habits.

Of the external parasites which dogs may carry to animals, fleas and the various kinds of ticks are both troublesome and dangerous. The remedy is clear. The owner must keep his dog clean, not merely for the comfort and happiness of the dog, but to prevent it from becoming a carrier of disagreeable and dangerous vermin. These reasonable measures, important to the stock farm, have a direct connection with the health of the family. Where ringworm or other skin diseases break out among the children, or the worm parasites develop, it is well to determine whether a dirty or uncared for dog may not be carrying infection on his skin or his hair, or conveying disease from carrion.

[1] Williams, D. L.: "Food Infection at Wrexham," *Journ. Roy. Inst. Pub. Health*, London, 1910, xviii, 725.

[2] Trommsdorff, R., Rajchman, L., and Porter, Agnes E.: "A Severe Outbreak of Food Infection Caused by a Paratyphoid Carrier," *Journ. Hyg.*, 1911, ii, 89.

THE PRESENT HIGH COST OF DRUGS IN AMERICA.

THE high cost of living has been a common topic of discussion for some time past, but the high cost of being kept from dying bids fair to exceed it. The present high prices of drugs and chemicals have never been equalled even in the times of the Civil War. The following list, prepared by the Pennsylvania Pharmaceutical Association, shows some of the more remarkable jumps in price, comparing the prices of July, 1914, at the time of the outbreak of the European War, with the high point reached since then:—

	Increased per cent.		Increased per cent.
Acetanilide	400	Antipyrin	400
Belladonna	700	Carbolic acid	1,000
Caffeine	250	Calomel	200
Wool fat	500	Naphthalene	500
Phenolphthalein ...	700	Phenacetin	1,800
Potassium bromide ...	1,500	Potassium permanganate	700
Quinine	1,200	Saccharin	600
Sage	500	Salicylic acid	900
Salol	800	Thymol	600

In some of these instances, as in the case of belladonna, the rise in price is due to the fact that this drug is largely cultivated in and exported from Germany and Austria. In the case of the coal-tar products the reason is found in the use of many of the basic substances in the manufacture of explosives, thus, carbolic acid is largely used in making the explosive known as picric acid, sometimes called lyddite, and all available stocks are being diverted to that use so far as possible. Quinine is high in price because so much is used in the treatment of febrile conditions arising in troops exposed in the trenches.

Every time a pharmacist refills an old prescription at its original price, the chances are he is losing money. There is no class of substances in which the rise in price has been so little felt by the consumer and largely equalized by the taking of smaller profits as in the case of drugs. This condition, however, cannot continue indefinitely, and drugs and medicines are bound to rise much higher in price if the War continues.

Notes and News.

HEALTH OF THE UNITED STATES ARMY.

THE report for 1914 refers to a mean enlisted strength of 87,228. The admission rate was 660 per 1,000, being 665·83 in America; 1,080 in China; 955 in Panama; in Alaska 422. For the entire Army the constantly non-effective rate was 23·78, and rate for discharges for disability was 12·99; the death-rate 4·40. The percentage of the total number of discharges for disease were: Mental alienation, 23·35; tuberculosis, 16·37; flat foot, 9·07; venereal disease, 6·80; epilepsy, 6·55; and organic disease of the heart, 5·16. From typhoid fever, including the Philippine Scouts and Porto Rican troops, a total of 98,649, only 7 cases occurred. Five of these had not received complete vaccination, 4 were enlisted in the prodromal stage of the disease, 2 were hospital orderlies, the seventh was a re-enlisted man vaccinated forty-nine months before. Typhoid fever is present at army posts among civilians who have not been vaccinated against it. Among all the troops on the Mexican border and in the large camps in Texas, not a single case of typhoid fever has occurred in an inoculated man since June 4, 1912.

TYPHOID VACCINATION FOR SAILORS.

THE Health Commissioner of Hoboken, New Jersey, has administered anti-typhoid serum to the 2,500 sailors on the German steamers interned there.

TYPHUS IN MEXICO.

OFFICIAL records in Mexico City and suburbs show 3,241 typhus cases in December, with total deaths in the city proper of 305. In November the total number of cases was 2,199 with 400 deaths.

A PROSPECTUS of the new edition of Reference Handbook of the Medical Sciences, by various writers, edited by T. L. Stedman, A.M., M.D., consisting of eight Imperial octavo volumes, and illustrated by chrom-lithographic and upwards of 6,000 engravings in the text, is issued by Wm. Wood and Company, New York, U.S.A.

WE hear that the Berkefeld Filter Co., Ltd., of 121, Oxford Street, London, W., have received a large order for filters for the Egyptian State Railways. This may be regarded as proof of the efficiency of these well-known filters.

THE Antaimoro is a tribe of dwellers on the south-east coast of Madagascar; little is known about them, but they are believed to be Arabs, and the inhabitants themselves claim to come from Mecca and to be descendants of Abraham. This is partly confirmed by the fact that the medicine-men amongst them write in Arabic characters. In one of the Antaimoro villages there stands the stone figure of an elephant; this is a phenomenon of interest, for the elephant is an unknown animal to the Malagasy. It is probable, judging from the customs and religious forms of the tribe, that they came to Madagascar before the Mohammedan era. Perhaps some of our readers can help to elucidate further the history of this ancient sect?

Review.

AN INDEX OF TREATMENT. By various writers. Edited by Robert Hutchison, M.D., F.R.C.P., and James Sherren, F.R.C.S. Seventh edition. Revised and enlarged. Bristol: John Wright and Sons. 1915. Price 21s. net.

The appearance of seven editions since 1907 is sufficient evidence of the success of this eminently practical work. Accepting the invitation in the preface for suggestions, and considering the general tendency rather than special articles, more emphasis might be laid on the lines of treatment which are on trial with indication for and against their promise of good results in the future; especially is this required in dealing with acute diseases. In regard to chronic diseases and recovery in acute diseases, too much space is occupied with the account of methods of treatment which are untried or are generally considered to have failed. The work is indispensable to those who desire to be acquainted with modern practical treatment.

Personal Notes.

COLONIAL MEDICAL SERVICES.

West African Medical Staff.

Transfers and Promotions.—T. E. Rice, L.S.A.Lond., D.P.H.Ireland, Principal Medical Officer, Sierra Leone, to be Principal Medical Officer, Gold Coast. E. H. Tweedy, L.R.C.S., L.R.C.P.Ireland, Deputy Principal Medical Officer, Gold Coast, to be Principal Medical Officer Sierra Leone. C. F. Watson, M.R.C.S.Eng., L.R.C.P.Lond., D.P.H.Ireland, Provincial Medical Officer, Nigeria (Northern Provinces), to be Deputy Principal Medical Officer, Gold Coast. G. B. Norman, M.B., B.C.Cantab., Medical Officer, Nigeria (Northern Provinces), to be Senior Medical Officer.

Retirements.—F. G. Hopkins, M.D., B Ch.Dublin, Principal Medical Officer, Gold Coast, retired on pension. C. R. Patton, M.B., Ch.B.Ediu., Medical Officer, Gold Coast, retired with a gratuity.

Return to Staff.—D. T. Birt, M.B., B.S.Durham, has returned to the Staff from temporary employment as Lieutenant in the Royal Army Medical Corps. M. B. Hay, M.R.C.S.Eng., L.R.C.P.Lond., D.P.H.Lond., and J. C. Watt, M.B., Ch.B.Glas., have returned to the Staff from temporary employment as Surgeons in the Royal Navy. W. A. Trumper, M.R.C.S.Eng., L.R.C.P.Lond., and J. Lindsay, M.B., Ch.B.Edin., who were taken prisoners by the Germans at Garua, Northern Cameroons, on August 29, 1914, were released by a British Force on January 8, 1916.

Transfers.—R. H. Miller, M.R.C.S.Eng., L.R.C.P.Lond., M.R.C.V.S.Edin., Medical Officer, Gambia, has been seconded for service as Medical Officer in Somaliland.

Other Colonies and Protectorates.—N. P. Jewell, M.B., B.Ch., B.A.O.Dublin, lately Assistant Medical Officer, Seychelles, to be Medical Officer, East Africa Protectorate. A. L. Murison, M.R.C.S.Eng., L.R.C.P.Lond., to be District Medical Officer, Cyprus. Lieutenant-Colonel R. H. Whitwell, M.B., M.Ch.Edin., B.Sc., F.H.Edin., I.M.S.(retired), to be District Medical Officer, Cyprus.

Original Communications.

PERIPHERAL NEURITIS IN JAMAICA.

By C. R. Edwards, Lieutenant, R.A.M.C.

District Medical Officer, Jamaica Medical Service.

There is in Jamaica a disease known as Peripheral Neuritis, which is very common amongst the native population, and which is responsible for a large amount of the pauperism all over the colony, more especially in the capital (Kingston) and its surrounding suburbs. It is more frequent in the coast towns and villages than in the hills, and is almost exclusively seen in the poorest classes, whose diet is irregular and generally inadequate in nitrogen.

The medical reports for the last forty years show that the disease has been noticed by the district medical officers, some of whom have likened it to beriberi; others have held the belief that it was one and the same thing as beriberi; and others, again, have believed it to be the effect of malarial fever. The treatment suggested in these reports has been generally the same as that for malarial fever, but the success attending such treatment has not been great. I think it has been generally admitted that the treatment of patients in their own homes has been disappointing.

Age.—It is never seen in children, but is most frequently observed in young adults between 18 and 25 years of age, attacking males and females in almost equal proportions, possibly a little more frequent in females. It is of slow progress, terminating fatally in some cases in about twelve years, while in others it lasts till old age. In all stages the patients are unable to earn their living and become a burden to the State.

Symptoms.—These may be divided into two classes: (*a*) Those in which a patient wakes up in the morning to find that he has lost the use of both legs, and (*b*) where the symptoms come on gradually. At first there is a difficulty in walking, which increases, then sticks have to be used in walking, and finally the patient becomes bedridden. In both classes the sight and hearing are greatly affected, the optic nerve is seen to be degenerated, and the deafness may increase till there is total loss of the sense of hearing. At the same time severe girdling and lightning pains are noticed, togcther with shooting pains in the extremities, and a burning sensation in the hands and feet. There appears to be loss of power in certain muscles and loss of co-ordination of muscles. The pupils react to light, but on closing the eyes patients will fall unless held up. The patella reflex is not lost. There is considerable wasting, especially of the fat. There is no glandular enlargement. There is a certain dryness of the skin, which eventually becomes like parchment. The girdling pains are universal and form a distressing part of the disease, which is popularly known as "cramp pain." They occur frequently by day and night. The gait in walking is very remarkable: it is identical with the gait of locomotor ataxy, and the lightning pains and the inability to staud on closing the eyes would tend to strengthen this view, but the pupils will be found to contract to light; the patella reflex will be present, the deafuess and partial blindness will all help to decide.

Beriberi.—The resemblance to this is, I think, only partial. There is no œdema and no dyspnœa in neuritis, and the duration of neuritis, and its possible cure in some cases and its improvement in others tend to show that it is only a resemblance. Agaiu, Hindus in Jamaica are not affected by neuritis, whilst beriberi is common in them in their own country.

The Skin.—In addition to the dryness mentioned above, it is not infrequently seen that there is on some part of the skin a horny pigmentation occuring chiefly on the extremities. Pellagra is also noticed in a certain proportion of cases of those brought in in a very emaciated and weak condition. Ulcers are not usually seen in people suffering from this disease.

Treatment.—The treatment consists mainly in building up the nutrition of the body, taking care at first not to overtax the digestion. Drugs, such as iodide of potash, arsenic, and quiniue have been used, but patients have not improved under their use more rapidly than when treated with good food and no medicines. It is necessary to do something for the pain, which is often severe—keeping patients awake during the night—and most relief is obtained by rubbing the muscles with liniments. For the impairment of vision and hearing nothing does any good.

The effect of the above treatment varies with the age of the patient and the stage of the disease. It is much more hopeful in the case of a young patient of 20 years, even though she may have completely lost the use of her lower limbs, than it is in a person of 50 or 60 who has not suffered to the same extent. I have many times seen a young person brought in unable to sit or stand, recover in three months sufficiently to be able to walk with a stick, and in six months recover sufficiently to be discharged. In neglected cases—those in which, for instance, the friends have kept a paralysed boy bedridden in his hut for months or years—the prospect of successful treatment is quite hopeless. Such a case will become more wasted, and eventually die from terminal diarrhœa.

The difficulty about those who are sufficiently cured or relieved to be discharged from hospital is that they return to the same conditions of life—indolence, sloth, overcrowding, and poverty. It seems certain also that these patieuts are naturally slow in their movements, in thinking, and understanding, causes which make it difficult for them to obtain work, or to do it if they obtain it. As a result they will return to hospital later with a second attack, and then it is more difficult to get good results. Eventually the case becomes chronic and hopeless.

Cause.—Certain efforts have been made to tracc

the cause. The drinking water has been tested for impurities, the rum commonly used by the poorest people tested, the villages visited, and a house-to-house inspection made, with no results except it was clear that all their conditions of life were bad, and their food was often scanty and for the most part deficient in nitrogen. What was observed was that they frequently passed several days with a very small quantity of food, and although this may have contained nitrogenous elements, the quantity consumed was not enough for their requirements.

Post-mortem Appearances and Bacteriological Tests.—The *post-mortem* appearances taken from three subjects are as follows: Skin hard with horny pigmented eruption in some parts of the extremities, considerable wasting of muscles and absence of fat. Internal organs show no signs of disease, but are all pale, shrunken, and below natural weight. The blood tested bacteriologically by the Wassermann test with negative results in two cases; the third was not so tested. The brain, cerebellum, and spinal cord, as well as some of the large nerves and their roots, were examined microscopically, with the following results:—

Degeneration cells were found in the posterior and, to a less extent, in the lateral columns of the cord, in some isolated patches in the cerebellum, in the roots of the optic and auditory nerves.

The position in the cord occupied by these cells appeared to be identical with that affected in locomotor, and thus accounts for the similarity of symptoms in the two diseases.

No malarial parasites were found in the blood.

It would be premature to form any definite views about the cause of this disease until more facts are available, but it may be reasonable to infer—

(1) That there is no connection with syphilis, tubercle, or malaria.

(2) That the disease is not in the peripheral nerve endings.

(3) That it originates in the nerve centres and nerve roots.

(4) That the parts attacked are the centres and roots in all cases, as there is little variation in the symptoms.

(5) That, although this points to selection, still no micro-organism has yet been found.

(6) That it may probably prove to be a food disease.

I have to acknowledge my indebtedness to the late Colonel Harrison, R.A.M.C., who did all the bacteriological and microscopic work connected with this paper, and who visited the villages with me, and inspected the natives and their houses and ways of living.

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PATHOGENIC "FÆCALIS" STREPTOCOCCI IN THE ANGLO-EGYPTIAN SUDAN.

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AND

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CONTENTS.— *Introductory—Historical—Khartoum Cases—Generic Classification—Group Classification—Fæcalis Group—Summary—Acknowledgments—References.*

Introductory.—This is the third of a series of short notes upon the streptococci met with in the Anglo-Egyptian Sudan. The first paper dealt with *Streptococcus equinus scpticæmia*, while the second considered the subject of *Streptococcal puerperal fever.*

In the present paper we deal with some pathogenic streptococci belonging to the Fæcalis Group which we hope will be of interest to tropical practitioners, as we believe they have not so far been described in the Tropics.

Historical.—Streptococcus fæcalis was first differentiated by Andrewes and Horder in 1906, when they described it as follows:—

> There is a group of streptococci so characteristic of the human intestine that the term *Streptococcus fæcalis* may justly be applied to it. It is mostly short-chained, rendering broth uniformly turbid, but, in disease at least, forms with long to medium chains occur. It grows readily on gelatine at 20° C. with rare exceptions, and is distinguished by its great chemical activity. It forms H_2S in broth cultures, but is totally devoid, so far as our experiments go, of hæmolytic power. Its chemical powers are rapidly manifested, and the typical intestinal form reacts positively to Gordon's tests in all cases save raffinose and inulin; even these may be added. A mannite reaction is constant but the variants are very numerous. There are records of twenty-nine. *Even gelatine may be liquefied by some varieties of the typical form.* The species possesses a very great resistance to desiccation far greater than that of the long-chained throat forms. It is not pathogenic for rodents. This form is not found according to Gordon in normal saliva. He never once found a streptococcus fermenting mannite in the 300 colonies which he tested. The mannite test is probably not an absolute one, and he found types resembling *Streptococcus fæcalis* in all except this. Nevertheless, it seems justifiable to assert that the mannite reaction is characteristic of a large number of intestinal as opposed to salivary streptococci. We have found this type on thirteen occasions in disease processes, notably in cystitis, and we regard it as a facultative parasite.

It must not, however, be thought that this was the first description of streptococci occurring in human fæces, as *S. erysipelatos*, or, as it is more commonly called, *S. pyogenes*, was considered for long to be a normal denizen of human saliva and fæces until Andrewes and Horder separated this type under the name of *S. mitis*, from the very pathogenic *S. erysipelatos*, which in its typical form does not occur in the mouth or intestine.

But long before 1906 other observers had described streptococci in human fæces which they looked upon as distinct from *S. erysipelatos*, and

these may be classified into two series, according as to whether they did or did not liquefy gelatine.

If now the reader turns to the provisional diagnostic table given below, it will be noted that gelatine liquefiers are gathered together into Group IV, which is called the Gracilis Group, which may be defined as follows:—

> *Streptococci* parasitic in animals, facultative anaerobes growing in broth, on agar, and on blood serum without pigment formation and on gelatine which is actively liquefied and fermenting glucose, lactose, saccharose, salicin, and often raffinose and mannitol.

The type species is *S. gracilis* Escherich 1886, which has been recognized as a good species by Neumann and Lehmann and by the Winslows. Its synonyms include: *S. coli gracilis* Escherich 1886, *S. coli brevis* Escherich 1886, *S. enteritidis* Escherich 1887, *S. rugosus* Rovsing 1890, *S. trifoliatus* Rovsing 1890, *S. urex* Rovsing 1890, *S. albus* Macé 1892, *S. bonvicini* Chester 1901, *S. fischeli* Chester 1901, *S. carnis* Chester 1901 (misspelt in Chester's book and called *S. eanis*, which is an obvious printer's error).

The group also includes Houston's liquefying streptococci: *S. zymogenes* MacCallum and Hastings 1899, and perhaps *S. brightii* Mannaberg 1885.

The liquefying forms of *S. fæcalis* are obviously *S. gracilis* and should therefore be removed from any description of the former organism.

With reference to the non-liquefying type of *S. fæcalis* it will be noticed that, as far as the descriptions go, it closely resembles those given for *S. enteritis* Hirsh 1897, with its synonym *S. enteritis varietas libmanni* Chester 1901, and it may be the same as *S. giganteus* Lustgarten 1887, but the description of these organisms is so imperfect that the name *S. fæcalis* should be retained and the others considered as only probable synonyms.

On the other hand, it closely resembles the milk streptococcus, which is known as *S. lactis* (Leichmann 1896), with synonyms *Bacterium lactis* Lister 1874 (a *nomen nudum*); Günther and Thierfelder's organism 1895, Kozai's No. 1, 1899, Scherbeck's organism 1901, *S. lacticus* Kruse 1903, Utz's No. 2, 1904, *B. acidi lactici* Connester and Stocking 1906, but it is not known whether this organism does or does not ferment mannitol, which is an important point, and therefore, at all events for the time, *S. fæcalis* remains unsupplanted by any other name.

Therefore the non-liquefying varieties alone of Andrewes and Horder's species should be named *S. fæcalis*.

In 1905 Houston's results of examination of 300 gelatine non-liquefying strains of streptococci obtained from nineteen normal stools of healthy persons were published.

He recognized the difference between streptococci which liquefied gelatine and those which did not. Of the former he described seven strains, all of which would come under the Gracilis Group of the Provisional Diagnostic Table already referred to above.

Among his 300 gelatine non-liquefying strains the following require to be noted:—

I. Fermenting *saccharose*, *lactose*, *salicin* and *mannitol*, producing acid and clot in milk, and reducing neutral red and present in 13 per cent. of the strains.

XIV. Fermenting *lactose*, *salicin* and *mannitol*, producing acid and clot in milk, and reducing neutral red and present in 2 per cent. of the strains.

XX. Fermenting *saccharose*, *lactose*, *salicin* and *mannitol*, and reducing neutral red and present in 1·34 per cent. of the strains.

XXVII. Fermenting *lactose*, *salicin* and *mannitol*, and producing acid and clot in milk and present in 0·67 per cent.

These groups represent Andrewes and Horder's gelatine non-liquefying *S. fæcalis*. The variation of neutral red is, we believe, unimportant and we know that milk can vary in the same organisms cultivated in the same laboratory and therefore we are inclined to look upon all these strains as *S. fæcalis* and note that they form 17 per cent. of the 300 strains examined.

He however has another *S. fæcalis* type which ferments *raffinose*, and this is exemplified by the following groups:—

XXIV. Saccharose, lactose, *raffinose*, salicin and mannitol, fermented with acid and clot in milk, forming 1 per cent. of the total series.

XXXIII. Saccharose, lactose, *raffinose*, salicin, mannitol and inulin fermented with acid and clot in milk, forming 0·34 per cent.

XXXV. Saccharose, lactose, *raffinose*, salicin, mannitol fermented, forming 0·34 per cent.

XXXVI. Saccharose, lactose, *raffinose*, salicin, mannitol fermented with reduction of neutral red and acid and clot in milk, forming 0·34 per cent.

XXXIX. Saccharose, lactose, *raffinose*, salicin, and mannitol fermented with reduction of neutral red, forming 0·34 per cent.

Thus the raffinose fermenters of the Fæcalis Group form 2·36 per cent. of the whole series, and their proportion to the non-raffinose fermenters of the same group is approximately 1 to 8, but we shall see that other investigators have found the Fæcalis Group present in normal human fæces in a larger proportion than 19 per cent. of the streptococcal fæcal strains, therefore these figures are probably lower than the usual average.

It will thus be seen that as regards the Fæcalis Group Houston's researches divide it into:—

A.	Gelatine liquefiers ..	*Gracilis group.*
B.	Gelatine non-liquefiers:—	
	a. Non-raffinose fermenters	*S. fæcalis.*
	b. Raffinose fermenters ..	*Unnamed.*

In 1907 Cumpston investigated the types of streptococci found in scarlatina with a view to determine whether there was any uniformity in type. His 101 strains were obtained from abscesses, from nasal discharge, and from the tonsils during the fever.

None of these liquefied gelatine at 22° C., though they all grew on this medium, nor reduced neutral red under anaerobic conditions at 37° C. and three days' growth.

Nineteen strains from abscesses showed one Fæcalis type characterized by fermenting saccharose,

lactose, salicin, and mannitol, and producing acidity without clot in milk.

The only strain from nasal discharge fermented saccharose, lactose, salicin, and mannitol, and produced acidity, but no clot in milk, and was of the Fæcalis type.

Of the eighty streptococci from the throats, thirteen fermented saccharose, lactose, salicin, and mannitol, with only acidity in milk, and one resembled these, but failed to ferment saccharose, while one fermented, in addition to the above sugars, raffinose and inulin, and produced acid and clot in milk. Thus fifteen out of the eighty belonged to the Fæcalis Group.

One strain was obtained from the spleen at a *post-mortem* of a toxic type of the disease. It fermented saccharose, lactose, salicin, and mannitol, but did not clot milk nor reduce neutral red, but was pathogenic to a mouse.

Thus sixteen out of 101 strains belonged to the Fæcalis type and one of these showed raffinose fermentation, *i.e.*, a proportion of 1 to 15.

In 1908 the Winslows distinguished between the gelatine fermenting types which they placed under *S. gracilis* and the non-fermenting varieties to which they restricted the name *S. fæcalis*, but they did not recognize the subdivision of this type by raffinose fermentation or non-fermentation.

In 1909 Horder described 150 cases of infective endocarditis, in thirty-two of which he performed blood cultures during life and obtained forty positive results, among which streptococci were found to be present twenty-six times, *i.e.*, 65 per cent., while in another case they were found to be present by *post-mortem* examination.

The streptococci obtained in twenty-six cases during life were classifiable into :—

S. pyogenes (*S. erysipelatos*)	3
S. salivarius	9
S. anginosus	6
S. fæcalis	8

Thus *S. fæcalis* obtained the second place in frequency as a producer of cardiac disease.

In 1910 Winslow and Palmer investigated the intestinal streptococci of the horse, the cow, and man by quantitative fermentation methods and found glucose, lactose, and mannitol to be fermented in 23 per cent. of the human and 2 per cent. of the cow fæcal streptococci, but to be absent in the horse, and they found glucose, lactose, raffinose, and mannitol to be fermented in 3 per cent. of the cow and 1 per cent. of the horse fæcal streptococci, but to be absent in the human strains. They however did not test their streptococci on gelatine.

In 1911 Gordon dealt with the subject of the differentiation of the streptococci and stated that *S. fæcalis* formed smooth grey colonies which were often confluent when grown on agar at 37° C., while it grew particularly well on gelatine at 22° C., and he notes that one variety liquefies this medium. He also notes that it makes broth turbid and grows therein in short chains. He adds the fermentation of glycerol, rhamnose, and sorbitol to the positive tests given above by Andrewes and Horder and observes that although generally harmless to mice and rabbits, still, according to Horder, it can cause malignant endocarditis when injected intravenously into rabbits. He represents the typical *S. fæcalis* as not fermenting raffinose.

In 1912 Lewis contributed a paper upon the micro-organisms present in suppuration of the accessory sinuses of the nose, in which he described *S. pyogenes* (*S. erysipelatos*), *S. anginosus*, and *S. salivarius*.

He met with two mannitol fermenters, viz., Strain 1, which fermented glucose, saccharose, lactose, raffinose, and mannitol, but did not clot milk, though it grew on gelatine at 20° C. and was experimentally pathogenic, while Strain 5 fermented glucose, saccharose, lactose, and mannitol, clotted milk, grew on gelatine, and was pathogenic.

He also reports finding *S. fæcalis* with presumably raffinose fermenting powers, because he says that it differed from *S. salivarius* only in its action on mannitol, three times from teeth streptococci. Therefore he found the *fæcalis* non-fermenters of raffinose present in the proportion of 1 to 4 of the *fæcalis* fermenters of that sugar.

In the same year Beattie and Yates wrote a paper upon the differentiation of streptococci derived from cases of human disease.

Those with which we are concerned are :—

Nos. 1, 2, 48, *c*, *o*, *p*, which fermented saccharose, lactose, salicin, and mannitol, and clotted milk, are therefore typical *S. fæcalis*, while two variants are mentioned, one (30) which failed to ferment saccharose and gave a slight reaction with inulin, and another (1) which failed to ferment salicin.

> Strains (1) and (2) were from arthrites of the knee-joint, and the latter also caused septicæmia ; strain (48) was a septic throat, as was (*c*), while strains (*o*) and (*p*) were also from arthrites hut of the acute rheumatism type.
>
> Strain (30) was from a knee-joint in a case of bronchopneumonia, while strain (1) was also from the knee in a case of acute rheumatism. When tested on animals strain (2) was recovered unchanged, but strain (3) acquired the power of fermenting inulin as tested from a rabbit's wrist and as tested from its heart blood, failed to ferment anything but salicin, and produced merely acidity in milk. That they were the same organism seems probable from a subsequent inoculatiou.

In the same year Broadhurst found the raffinose inulin fermenting variant four times, the inulin fermenting variant twelve times, the raffinose fermenting variant once, and the type eight times, with the suppression of saccharose twice, in twenty-seven examples of the group in 100 strains of milk streptococci. She found the coagulation of milk incubated at 37° C. for three days to be unsatisfactory as a diagnostic character.

In 85 per cent. of her strains neutral red at 37° C. for three days under anaerobic conditions gave no reduction, and therefore, as Houston has rejected it, she does not discuss it further.

> We have been unable to refer to Bergey's work published in this year upon ninety-two cultures from all sources, but from Stowell, Hilliard and Schlesinger's remarks we understand that he did not meet with *S. fæcalis*, and therefore did not deal with the subject we have in hand.

In 1913 Fuller and Armstrong considered the differentiation of fæcal streptococci and found *S. fæcalis* to be present in 65 per cent. of human, 2 per cent. of cow, and 1 per cent. of horse fæces, while the Raffinose type was absent in human and horse fæces, but present in 3 per cent. of cow dung streptococci.

In 1914 Hopkins and Lang studied the classification of pathogenic streptococci when they recognized a Fæcalis type, characterized by fermenting saccharose, lactose, salicin, and mannitol.

> In the same year Lyall studied the pathogenic streptococci, but we regret that we have been unable to see this paper.

In 1915, Kligler, by a correlation of the agglutination and fermentation reactions, defined *S. fæcalis* as follows:—

> Mannite fermenters generally ferment salicin, rarely ferment raffinose, and are variable in their reaction to blood and in their pathogenicity.

Thus we see that wherever streptococci have been carefully studied the gelatine-non-liquefiers which ferment mannite have been recognized as *S. fæcalis*, while a variant fermenting raffinose has been observed by all workers. We will now leave the subject at this point and turn to our own cases.

Khartoum Cases.—We have met with four cases of infection in which we have found a streptococcus of the Fæcalis Group, and these may be divided into two series by the fermentation or non-fermentation of raffinose.

Series A.—In these two cases raffinose was not fermented:—

Case 1.—We are indebted to Dr. Atiyah, the Medical Officer in charge of the Civil Hospital, Omdurman, for the following notes:—

> The patient, an Arab, was stabbed on September 16, 1915, by a knife which produced a wound beginning about one inch to the left of the left nipple and passing downwards penetrated the chest wall below the eighth rib, and was believed, judging by the symptoms, to have injured the diaphragm.
>
> For some days after this the patient did well, although his temperature varied during the first three days from 100·8° to 101·6°, and though fluid was observed to be present in the pleural cavity on the third day. His temperature gradually declined, reaching normal on the 21st, i.e., five days after the injury. The next day, however, fever again set in, the temperature rising to 101° F., and a quantity of bloody fluid was removed from the chest by an aspirator. This fluid was without offensive odour. After this the patient was slightly better and the temperature did not rise higher than 99·9° F. until the 24th, when it rose to 102° F., and again fluid was aspirated from the pleural cavity, but this time its odour was offensive, and when examined it was observed to contain numerous streptococci mixed with bacilli, but the former were easily obtained in pure culture, and will be described below.
>
> On the 26th resection of a portion of a rib took place and 20 c.c. of polyvalent antistreptococcal serum were injected, and this was repeated on the next day, but the temperature kept at 102·6° F., and the patient became very weak and died on the 28th, i.e., on the 12th day after the injury. No *post-mortem* could be performed.

The streptococcus isolated from this case showed the following characters:—

Morphological Characters.—The organism is a coccus measuring 1·2 microns in transverse diameter and present as single or double cocci, or as short chains. It does not possess a capsule and is non-motile, and not acid-fast as tested by the Ziehl-Neelson method, but it was Gram-positive.

Biological Characters.—It grows well aerobically at 22° C., and also at 30° C., 37° C., and 40° C., but not at 60° C., while it is a facultative anaerobe.

Cultural Characters.—It grows well on agar, producing the typical streptococcal form of growth, but it gives rise to no pigment on agar, gelatine, or blood serum. It produces a good growth on gelatine at 22° C. without liquefying the medium. In broth it forms a general turbidity and on glucose-serum-agar a cloudiness of the medium, but there is no visible growth on potato.

Biochemical Characters.—It produces acid without gas in the following carbohydrate, glucoside, and alcoholic media:—

Monosaccharides.—Hexoses: Glucose, fructose, and galactose.

Disaccharides.—Maltose, lactose, and saccharose.

Polysaccharide.—Dextrin.

Glucosides.—Amygdalin and salicin.

Alcohol.—Hexahydric: Mannitol.

It produced neither acid nor gas in:—

Monosaccharides.—Pentose: Rhamnose.

Trisaccharide.—Raffinose.

Polysaccharides.—Inulin and amylum.

Alcohols.—Tetrahydric: Erythrol. *Pentahydric:* Adonitol. *Hexahydric:* Dulcitol and sorbitol.

Phenol.—Hexahydric: Inosite.

It did not reduce the *Eurodine* neutral red in anaerobic culture.

Milk was acidified and clotted, but indol was not produced nor were nitrates reduced.

It did not undergo lysis in bile salts nor in salt solutions, nor was it hæmolytic.

The quantitative determinations of sugars gave the following figures:—

Glucose	5·0
Saccharose	4·0
Lactose	3·6
Raffinose	0·5
Salicin	3·1
Mannitol	1·4
Dextrin	1·3
Inulin	0·0

These and all subsequent figures represent the number of cubic centimetres of $\frac{N}{20}$ KOH required to neutralize 5 c.c. of the culture after deducting the amount required for the same purpose by an equal quantity of an uninoculated control.

Pathogenicity.—It was non-pathogenic for rabbits when injected intravenously.

Classification.—The characters whereby it is believed that this organism is a streptococcus will be given under the heading Generic Classification, while the group to which it belongs can be determined from the Provisional Diagnostic Table, and as it is parasitic in an animal and a facultative anaerobe not producing pigment, not liquefying gelatine, and not forming gas while it ferments

glucose, saccharose, lactose, and mannitol, indicates that it belongs to IX, the Fæcalis Group, the details concerning which we will consider later.

Case 2.—For the notes on this case we are indebted to Dr. Bousfield, Medical Officer of Health, Khartoum and Omdurman.

> The patient, an Arab lad aged 18, who, according to the history, became ill on September 11, suffering from pain in the right hypochondriac and iliac regions associated with fever which was believed to be due to a mild form of appendicitis.
>
> On admission into the Khartoum Civil Hospital he had a temperature of 102·4° F. and considerable abdominal pain, mainly in the right epigastrium. On examination no abdominal signs were found, but some dulness and crepitations were discovered at the base of the right lung associated with a slight pleural rub. At first the heart was clear, but five days later a very distinct systolic murmur was heard, and hence a septicæmia was suspected and 1 c.c. of blood was added to a nutrient broth flask which after incubation at 37° C. for 24 hours showed a pure streptococcal growth. Antistreptococcal serum was administered, and the patient eventually improved considerably, but the heart was not normal when he insisted upon leaving the hospital.

The organism isolated from this case exhibited the following features:—

Morphological Characters.—It is a streptococcus which is present in short chains, or as single or double cocci, but without motility or a capsule. Its size is 1·2 microns, and it is Gram-positive, but not acid-fast.

Biological Characters.—It grows well aerobically at 22° C., 30° C., 37° C., and 40° C., but not at 60° C., and is also a facultative anaerobe.

Cultural Characters.—It produced the usual typical streptococcal growths on agar and a good growth at 22° C. on gelatine, which was not liquefied, while a general turbidity was produced in broth but no visible growth on potato, and it produced no pigment on blood serum or any other medium.

Biochemical Characters.—It produced acid but no gas in:—

Monosaccharides.—Hexoses: Glucose, fructose, and galactose. *Pentose:* Arabinose.

Disaccharides.—Saccharose, lactose, maltose.

Polysaccharide.—Dextrin.

Glucosides.—Salicin and amygdalin.

Alcohol.—Hexahydric: Mannitol.

It did not acidify the following:—

Monosaccharide.—Pentose: Rhamnose.

Trisaccharide.—Raffinose.

Polysaccharides.—Inulin, starch.

Alcohols. — Trihydric: Glycerol. *Tetrahydric:* Erythrol. *Pentahydric:* Adonitol. *Hexahydric:* Dulcitol and sorbitol.

Phenol.—Hexahydric: Inosite.

It did not produce fluorescence in the *Eurodine* neutral red when grown anaerobically.

It formed acid in and clotted milk, but it did not produce indol nor reduce nitrates. It failed to produce hæmolysis, nor was there any plasmolysis in bile salts nor autolysis in salt solutions, but it formed a cloudiness in glucose agar serum. No sulphretted hydrogen was produced in lead acetate broth.

Its quantitative sugar reactions were:—

Glucose	...	..	...	...	5·3
Saccharose	...	...	...	...	3·6
Lactose	...	...	...	...	3·1
Raffinose	...	...	...	...	0·2
Salicin	...	...	...	...	3·0
Mannitol	...	...	...	...	2·1
Dextrin	...	...	...	...	1·8
Inulin	...	...	...	...	0·2

Pathogenicity.—It was non-pathogenic for rabbits when inoculated intravenously, but it produced a septicæmia in man associated with signs of endocarditis, as well as of pulmonary and pleuritic symptoms and a history of mild appendicitis.

Classification.—For the same reasons as that given for the first organism we believe that this streptococcus belongs to the Fæcalis Group.

Remarks.—The method of entry of the streptococcus in this case is unknown, but the researches of Rosenow have shown that the tonsils and the teeth are important portals where the organisms cannot merely gain an entrance to the blood-stream, but may acquire the varying affinities necessary to infect different and distant organs. This, of course, implies a hæmatogenous infection, which was present in this case and was connected with the pleural and the cardiac symptoms.

As the boy only gave a history of mild appendicitis of which all symptoms had disappeared when he entered the hospital, it is not possible to be certain whether this had or had not been present.

Series B.—The raffinose fermenters include Cases III and IV.

Case III.—This is a mild case of puerperal fever following a perfectly normal labour during which there were no intra-vaginal examinations and everything was quite normal until one week after the labour.

The organism we found in the uterine discharge from this case exhibited the following reactions:—

Morphological Characters.—It is a Gram-positive, non-motile, non-encapsulated coccus measuring about 1·2 microns in transverse diameter and generally found in short chains. It is not acid-fast.

Biological Characters.—It was a facultative anaerobe growing well at 22° C., 30° C., 37° C., and 40° C., but not at all at 60° C.

Cultural Characters.—It produced the usual typical growth on agar-agar, and a good growth on gelatine, but without producing liquefaction. It also showed a general turbidity in broth, but no visible growth on potato. It gave rise to no pigment formation on blood-serum or any other medium.

Biochemical Reactions.—It produced acid without gas formation on:—

Monosaccharides.—Hexoses: Glucose, fructose, and galactose. *Pentoses:* Arabinose and rhamnose.

Disaccharides.—Saccharose, lactose, and maltose.

Trisaccharide.—Raffinose.

Polysaccharide.—Dextrin.

Glucoside.—Salicin.

Alcohol.—Hexahydric: Mannitol.

It produced neither acid nor gas in :—

Polysaccharides.—Inulin and amylum.

Glucoside.—Amygdalin.

Alcohols. — Trihydric: Glycerol. *Tetrahydric:* Erythrol. *Pentahydric:* Adonitol. *Hexahydric:* Dulcitol and sorbitol.

Phenol.—Hexahydric: Inosite.

And it does not produce a green fluorescence in the *Eurodine* neutral red when grown anaerobically.

It forms acid and clot in milk but produces neither indol nor reduction in nitrates, nor is it hæmolytic, nor does it produce plasmolysis with bile salts, nor autolysis with salt solutions, while it does form a cloudiness in glucose-serum-agar.

The following quantitative sugar reactions were determined :—

Glucose	...	...	...	...	5·1
Saccharose	...	...	...	...	4·0
Lactose	...	...	...	...	3·0
Raffinose	...	...	...	...	3·5
Salicin	...	...	...	...	3·4
Mannitol	...	...	...	...	2·1
Dextrin	...	...	...	...	2·0
Inulin	...	...	...	...	0·1

Pathogenicity.—It was non-pathogenic in rabbits but was apparently the causal agent in a case of puerperal fever producing a metritis but no septicæmia, as a blood culture was sterile.

Classification.—For the reasons already given above it can be classified under the Fæcalis Group, but is atypical in that it ferments raffinose, which is a point to which we shall return later.

Remarks.—As far as the literature at our disposal shows, we believe that this is the first time that a member of the Fæcalis Group has been found as a causal agent of puerperal fever.

Although it ferments raffinose, still it is a very different organism from those described by Chalmers and Atiyah as causing a number of cases of puerperal fever in Khartoum and Omdurman.

The main points of difference are as follows :—

No.	Reaction	Case III organism	*S. salivarius*	*S. bovis*
1	Gelatine at 22° C.	Good growth	Little or no growth	Slight growth
2	Mannitol	Fermented	No change	No change
3	Salicin	Fermented	No change	Fermented
4	Quantitative estimation of acid from salicin	3·4	0·0	2·3
5	Quantitative estimation of acid from glucose	5·1	3·1	2·3

This large increase of acid production in glucose is of importance and points to a human source for the streptococci of Case III, and not to a bovine source, for it must be remembered that *S. salivarius* and *S. bovis* are essentially bovine streptococci, sometimes residing in the human body. In support of our contention that 5·1 indicates a human origin for the streptococcus of Case III, we quote Winslow and Palmer, who state :—

> The presence of streptococci forming over 3·5 per cent. of acid in dextrose broth would seem in general to be characteristic of human stools.

Our figures refer to 5·1 c.c. of $\frac{N}{20}$ KOH and are comparable with Winslow and Palmer's figures, but the expression used by these authors in their tables of figures, viz., " Percentage of acid formed," is apt to be misleading, and we take it that the figures are obtained as explained on page 5 of the journal in question.

Moreover, it seems to us possible that salicin fermentation follows on the same lines, and indeed the literature of the subjects tends to show that the whole Fæcalis Group ferments salicin with peculiar ease.

Case IV.—This was an ordinary case of tonsillitis from which the organism with the following characters was easily isolated.

Morphological Characters.—It is a coccus growing in short chains and measuring 1·2 microns in transverse diameter, but non-motile and without a capsule. It coloured with the usual laboratory stains and was Gram-positive, but not acid-fast, as tested by the Ziehl-Neelson method.

Biological Characters.—It grew well at 22° C., 30° C., 37° C., and 40° C., but not at all at 60° C., and it was a facultative anaerobe.

Cultural Characters.—It grows typically on agar-agar, but neither on this medium, on blood serum, nor on any other medium did it produce pigment.

It grew quite well on gelatine, which it did not liquefy, but produced no visible growth on potato, while broth was rendered uniformly turbid.

Biochemical Characters.—It produced acidity but no gas in :—

Monosaccharides.—Hexoses: Glucose, fructose, and galactose. *Pentose:* Arabinose.

Disaccharides.—Saccharose, lactose, and maltose.

Trisaccharide.—Raffinose.

Polysaccharide.—Dextrin.

Glucoside.—Salicin.

Alcohol.—Hexahydric: Mannitol.

There was no acidity or gas production in :—

Monosaccharide.—Pentose: Rhamnose.

Polysaccharides.—Inulin and amylum.

Glucoside.—Amygdalin.

Alcohols. — Trihydric: Glycerol. *Tetrahydric:* Erythrol. *Pentahydric:* Adonitol. *Hexahydric:* Dulcitol and sorbitol.

Phenol.—Hexahydric: Inosite.

The *Eurodine* neutral red is not altered by its anaerobic growth, nor does it produce indol or reduce nitrates.

It forms acid and clot in milk, but it is not hæmolytic, nor does it show any lysis in bile salts or in common salt solutions, but it does produce cloudiness in glucose-serum-agar.

The following quantitative determinations were made :—

Glucose	...	...	...	...	5·1
Saccharose	...	...	...	...	4·1
Lactose	...	...	...	...	2·5
Raffinose	...	...	...	...	2·9
Salicin	...	...	...	...	3·5
Mannitol	...	...	...	...	2·2
Dextrin	...	...	...	...	1·6
Inulin	...	...	...	...	0·0

Pathogenicity.—It was non-pathogenic to rabbits but was present in the tonsils in a case of human tonsillitis.

Classification.—From the remarks given above it is obvious that this organism belongs to the Fæcalis Group and that it is in the same series as the preceding organism, being a raffinose fermenter.

Generic Classification.—All the four organisms may be classified under Billroth's genus *Streptococcus* because they are cocci usually found in short chains and producing small discrete translucent colonies or an effused translucent growth on agar-agar at 22° C. and 37° C., as well as a cloudiness in serum-glucose-agar.

They ferment certain carbohydrates, glucosides and alcohols, but typically not inulin, nor do they reduce nitrates, nor undergo lysis in bile salts or in common salt solutions, and they are essentially parasites.

Group Classification.—If the Provisional Diagnostic Table of Streptococcal Groups given below be consulted it is seen that all the four organisms belong to (B), because they are parasitic in man, and to (G) because they are facultative anaerobes which do not produce pigment (N), or actively liquefy gelatine (S), or produce gas (II), while they come under (*b*) because they ferment glucose, and under (3) because they also ferment saccharose, lactose, salacin, and mannitol, and sometimes raffinose, and therefore they belong to the Fæcalis Group.

This Provisional Diagnostic Table has been slightly altered from those given in the former papers in that the old Section 2, Sub-section *b*, is converted into a separate Section 3, and the fact that certain members of the Fæcalis Group can ferment raffinose is clearly recognized, while the old Section 3, or bovine raffinose fermenters, is converted into Section 4.

PROVISIONAL DIAGNOSTIC TABLE OF STREPTOCOCCAL GROUPS.

A. Parasitic on plants. Grow in broth but not on agar or gelatine		*I. Sphagni group.*
B. Parasitic in animals. Grow in broth and on agar and usually on gelatine :—		
F. Obligatory anaerobes ...		*II. Fœtidus group.*
G. Aerobes, facultative anaerobes :—		
M. Pigment present ...		*III. Sanguineus group.*
N. Pigment absent :—		
R. Gelatine actively liquefied		*IV. Gracilis group.*
S. Gelatine usually not or rarely slightly liquefied. Inulin usually not fermented :—		
I. Gas produced ...		*V. Mastitidis group.*
II. Gas not produced :—		
Non-fermenters	(a) Glucose and other sugars media not fermented ...	*VI. S. H. & S. (I) group.*
Monosaccharide fermenters	(b) Glucose usually and other sugars generally fermented :—	
Equine fæcal type	1. *Glucose* alone or with *saccharose* and *salicin*, but not with lactose, *fermented* ...	*VII. Equinus group.*
Disaccharide fermenters	2. *Lactose, glucose, saccharose and salicin*, but not mannitol, *fermented*	*VIII. Erysipelatos group.*
Human fæcal type	3. *Lactose, glucose, saccharose, salicin, mannitol, and sometimes raffinose fermented* ...	*IX. Fæcolis group.*
Trisaccharide fermenters.	4. *Raffinose, lactose, saccharose, usually glucose, sometimes salicin and rarely inulin*, but not mannitol *fermented* ...	*X. Salivarius group.*
Bovine fæcal type		

The Fæcalis Group.—The Fæcalis Group may be defined as follows:—

"*Streptococci* parasitic in man, facultative anaerobes, growing in broth and upon agar and blood serum without the formation of pigment, and well upon gelatine at 22° C. without producing liquefaction and fermenting glucose, saccharose, lactose, mannitol, and salicin, and sometimes raffinose, but typically not inulin, and generally, but not always, clotting milk, and variable as regards neutral red reduction and sulphuretted hydrogen formation, and usually producing relatively large amount of acidity in glucose media tested quantitatively."

When the four organisms just described above are consideerd it will be seen that as regards the fermentation of sugars they fall into two series, as already stated, viz., Series A, in which raffinose was not fermented, and Series B, in which this sugar was acidified.

The two organisms included in Series A closely agree with the non-liquefying varieties of Andrewes and Horder's *S. fæcalis*, as can be seen in the following comparison:—

No.	Reaction	*S. fecalis*	Case I	Class II
1	Gelatine at 22° C.	Good growth	Same	Same
2	Saccharose	Acid	,,	,,
3	Lactose	,,	,,	,,
4	Raffinose	No change	,,	,,
5	Salicin	Acid	,,	,,
6	Mannitol	,,	,,	,,
7	Milk	Acid and clot	,,	,,
8	Neutral red	Usually reduced	Not reduced	Not reduced
9	Hæmolysis	Absent	Same	Same
10	Sulphurretted hydrogen	Typically produced	Absent	Absent
11	Pathogenicity laboratory animals	Nil	Nil	Nil

The organisms of Cases I and II differ from the type in the non-reduction of neutral red, which we

do not believe to be a reliable diagnostic test and in the non-formation of sulphuretted hydrogen, and these variations need not be regarded as important, as Andrewes and Horder report a considerable number of variants from their type.

They also agree with Kligler's definition of *Streptococcus fæcalis*, which really should be for the group and not for a species, and which has been given above.

If therefore we restrict the term *S. fæcalis* Andrewes and Horder 1906 to non-fermenters of raffinose, we have a close similarity between it and the organisms of Cases I and II, and we conclude that all three are one and the same organism.

The two organisms forming Series B differ from *S. fæcalis* in the fermentation of *raffinose*, and this appears to us to be of importance because every observer, as a study of the historical section of this paper shows, who has worked with the various members of the group has met with raffinose fermenters, and as this has now taken place in England, America, and Africa, it shows that this type is worthy of a distinguishing name.

We had already given it an appellation, and this paper was about to be despatched when we received the *Journal of Infectious Diseases* for September, 1915, from America containing a paper by Broadhurst entitled, "Environmental Studies of Streptococci," where we find that she has met with an organism fermenting saccharose, lactose, salicin, raffinose, and mannitol, occurring in 34 per cent. of the streptococci in the canine throat, 29 per cent. in equine fæces, 16 per cent. in bovine fæces, 14 per cent. in the canine alimentary canal, 14 per cent. in blood, 11 per cent. in milk, 5 per cent. in the feline alimentary canal, 5 per cent. in the feline throat.

To this organism, which is apparently the same as that which we are considering, she has given the name *Streptococcus versatilis*.

We define *S. versatilis* Broadhurst 1915 as follows:—

"*Streptococcus* capable of growing in broth as short non-encapsulated chains and producing a good growth at 22° C. on gelatine, which it does not liquefy, without pigment or gas formation and capable of producing a considerable amount of acidity in glucose, saccharose, lactose, raffinose, salicin, and mannitol, but not capable of hæmolysing blood, and usually acidifying and clotting milk and capable of causing disease in man if it enters the tissues. Habitat: The intestinal tract of man, canines, felines, equines, and bovines."

We are now in a position to consider the classification of the Fæcalis Group, which we give as follows:—

DIAGNOSTIC TABLE OF THE FÆCALIS GROUP.

A. Glucose, saccharose, lactose, salicin and mannitol fermented:—

	Typical sub-group
I. Raffinose not fermented ...	*S. fæcalis* Andrews and Horder, 1906.
II. Raffinose fermented ...	*S. versatilis* Broadhurst, 1915.

B. Suppression of one of the characters of the typical sub-group or with the addition of the fermentation of inulin:—

	Atypical sub-group.
I. Raffinose not fermented ...	Variants of *S. fæcalis*.
II. Raffinose fermented ...	Variants of *S. versatilis*.

Summary.—Four cases of disease are described in which streptococci belonging to the Fæcalis Group were found, and which belong to two distinct species, separated by the fermentation or non-fermentation of the trisaccharide raffinose, which must be a more difficult sugar to decompose than a monosaccharide or disaccharide, and which therefore affords an important distinction.

The two organisms are:—

(1) *Streptococcus fæcalis* Andrewes and Horder 1906, which we believe is now described for the first time as the causal agent in disease in the Tropics, being found in a case of septicæmia associated with endocarditis, and being also present in a traumatic pleural effusion, which may be illustrations of the peculiar way in which streptococci are attracted from their usual portals of entry to distant organs.

(2) *Streptococcus versatilis* Broadhurst 1915, which has just recently been named, is now defined, for although its reactions have been noted by several workers in Europe and America, it had never been separated from *S. fæcalis* or from the members of the Salivarius Group until Broadhurst's paper appeared in September of this year.

This organism we found in a case of puerperal fever and in one of tonsillitis.

The list of streptococci known to cause puerperal fever will therefore now include the following:—

(1) *S. erysipelatos* Fehleisen 1883.
(2) *S. fœtidus* Veillon 1893.
(3) *S. anaerobius* Lewkowicz 1901.
(4) *S. mitior* Schottmüller 1903.
(5) *S. salivarius* Andrewes and Horder 1906.
(6) *S. puerperalis* Furneaux-Jordan and Mackay 1912.
(7) *S. bovis* Chalmers and Atiyah 1915 (*S. bovinus* Broadhurst 1915).
(8) *S. versatilis* Broadhurst 1915.

We would also draw attention to the fact that streptococci may gain entrance to the circulation and may cause a subacute form of septicæmia and heart disease in the Tropics, as in temperate climates, though this happens much more rarely, as far as we know, in the former, which may be due to the influence of climate and especially of atmospheric temperature.

Acknowledgments.—We have much pleasure in acknowledging the kind help given by Dr. Bousfield with regard to Cases II, III, and IV, and by Dr. Atiyah with regard to Case I.

Addendum.—On reading Broadhurst's paper mentioned above, which has only just come to hand, we find that she gives the name *Streptococcus bovinus* to an organism found in 46 per cent. of the streptococci in bovine fæces, 16 per cent. in the human throat, 11 per cent. in equine fæces, 5 per cent. in the canine alimentary canal, and 4 per cent.

in the feline alimentary canal, and which fermented saccharose, lactose, raffinose, and salicin. This organism is probably the same as one of the species found in cases of puerperal fever in Khartoum by Chalmers and Atiyah, in their paper on "Streptococcal Puerperal Fever," and named by them *Streptococcus bovis*. As this paper left Khartoum some weeks before Broadhurst's publication was received all that can be done is to point out that Broadhurst's name of *S. bovinus* has priority and must stand for the organism of which *S. bovis* Chalmers and Atiyah 1915 now becomes a synonym.

Khartoum,
October 12, 1915.

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COYOTES SPREAD RABIES.

THE United States Public Health Service, on December 20, appointed an executive officer to lead a campaign against rabies originating in coyotes and now said to be a menace to people and stock in California, Oregon, Nevada, and Idaho. Thirty persons supposed to have contracted rabies by the bites of coyotes have recently been treated at Reno, Nevada.

RAT EXTERMINATION.

AN example of a mutually satisfactory contract is furnished from Aalborg, the fourth largest town in Denmark, with 37,000 inhabitants. Out of 2,300 buildings 1,289 were found to be rat-infested. In December, 1913, a contract was made, the bacterial culture Ratin was applied, supplemented where found necessary with the more intensive culture, Ratinin. In six months rats were only found on 137 properties. The contract was to exterminate the rats on 95 per cent. of the properties in the town. When treatment was concluded, November 25, 1915, rats were only found in seventy properties, about 3 per cent. The Town Council, in their testimonial, state: "The Ratin Company, by its work in the town, has demonstrated very considerable ability, energy and zeal, and it is consequently a pleasure to give the said company our best recommendation for the manner in which the work has been carried out and the results accruing therefrom.

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THE JOURNAL OF

Tropical Medicine and Hygiene

MARCH 1, 1916.

THE QUESTION OF THE LIMITATION OF SUGAR.

IN several countries in Europe the question of controlling the food supply has become acute, the most recent material to be put under the *régime* of limitation by the authorities in Britain being sugar.

The question whether it is because sugar is scarce, whether there are insufficient ships to carry on the import at the normal rates, or whether it is to teach the people economy by cutting down what the Government regards as a luxury, we have little to do with. The fact remains, however, that the

limitation is promulgated as a necessity in view of War requirements, be the reasons what they may. It is from the national health and hygiene point of view that medical men have to consider the question, but the physiological problem is so huge that it can be but touched upon here.

To go back to earlier times, sugar, as we know it, was unknown. In the Bible sugar is not once mentioned, and the only sweetening agent referred to is honey. The fact is, sugar and syrup are recent introductions in the world-history of dietary, and it may well be asked, Is it a necessity? We are familiar again with the young lady's super-civilized refinement of "no sugar" with this and that for reasons associated with obesity, of which she stands in dread after critically surveying her mother. But between the time of absence of sugar from the world's dietary and that of the maiden of to-day there is a gap to be dealt with of enormous proportions.

It may be argued, seeing that the world got along very well without sugar for thousands of years, that its use to-day is merely wanton extravagance. Here, again, we are pulled up by physiological and economic reasons which are far from simple in their elucidation.

To begin at the root of matters, it may be accepted as an axiom that glucose (*i.e.*, sugar) in some fashion is a bodily requirement for mankind —let us add to be safe—as we know it to-day. For at an earlier day still, in the pre-vegetable age, even the pre-fruit age of man, animal food was the only sustenance, for to kill animals for food was a far more easy and primitive method of getting food than the raising of crops, which entailed forethought, considerable intelligence and knowledge of preparing and cooking food.

Glucose is the condition the starchy elements of food are (or ought to be) reduced to before they leave the mouth, and by a process of hepatic digestion the glucose is converted into carbonic acid and alcohol. Instead of this elaborate process of conversion of starch into sugar, modern man prefers that the sugar should be previously prepared; and when consumed in this state the process of salivary digestion is practically usurped and its necessity curtailed. The question of whether this is advantageous physiologically on the one hand, or financially on the other, must be left to physiologists and to students of economic problems. Whether the body should prepare its own sugar or depend upon the sugar grower and the manufacturer is the question. There can be no doubt that the consumption of manufactured sugar plays its part physiologically much more rapidly than when starchy foods are taken and, after elaborate digestive processes, become saccharine.

There is incontrovertible evidence to prove that sugar when consumed shows its effects physiologically much more rapidly than when it is obtained by the elaborate process of digestion whilst it is being converted into glucose. There is, apparently, also evidence to show that cane-sugar is more quickly and easily broken up into its ultimate elements, and therefore that carbonic acid and alcohol are more readily produced, than the glucose, in which form it reaches the stomach and liver from the mouth. The well-known fact that manufactured sugar (including sugar from cane, beet, &c.) overcomes fatigue more rapidly and potently than does the glucose of digestion would seem to explain many things in our economic life. The desire of children for sweets, the crowding of our sweet-shops by young women, the especial craving of the soldier in the field for sweets in every form, all point in this direction. No doubt the limitation of alcohol in great measure provides the explanation of this desire; for the alcoholic men and women never care for sweet things in any form, the alcohol they consume doing away with the necessity of obtaining it by the more indirect process of digestion. That this is advantageous at times of fatigue there can be no doubt; that, however, it is advantageous under all circumstances is another matter; for as converted starchy foods stand to sugar, so does manufactured sugar stand to alcohol. The alcohol supplied by the distiller can be taken in excess of the wants of the body without (short of drunkenness) immediate evidence of detriment to the individual, although ultimate detriment is positive; whereas excess of sugar produces "biliousness" to a degree which involuntarily limits its consumption. It is therefore a question whether the direct consumption of sugar is physiologically as sound as obtaining saccharine substances and finally alcohol from the more elaborate process of salivary conversion of starch into glucose. Sugar is really a substitute for the natural process of obtaining it from starches, as alcohol taken directly is a substitute for that obtainable by the conversion of cane-sugar.

It is a question of rapidity of action between these elements; alcohol acts at once on the system, cane-sugar speedily but less immediately, and starch (and its product glucose) is the slowest method of the three. Each has its benefits according to requirements in health and disease, but the slowest process is Nature's method, and any departure from that must be viewed with concern and suspicion.

J. C.

RECENT APPEARANCE OF MALARIA AT GALVESTON, BAHRENBERG.

(*Public Health Reports, December* 17, 1915.)

In Galveston malaria has before been extremely rare, if, indeed, cases of local origin had occurred at all within recent years.

Prior to a storm of August 16 and 17 1915, only imported cases were seen and no anophelinæ. As the wind during the storm blew toward the city, it appears probable that infected mosquitoes were blown there. Since August a noteworthy number of cases of severe malarial infection have been met with, which in many cases were of pernicious type and in persons who had not been on the mainland. One physician saw twenty-five cases during October and November, 1915, shown by microscopical examination to be due to the æstivo-autumnal parasite.

Annotations.

Prophylaxis of Malaria.—De Blasi (*Gazzetta degli Ospedalli*, No. 79, 1915) emphasizes the importance of rainy seasons and mild winters as favouring the spread of malaria and rendering the type graver. Too much reliance should not be placed on quinine in prophylaxis, but all other preventive measures should be given due importance, the sick isolated, and rooms they have used disinfected before the non-malarial are allowed to occupy them. In the cases rebellious to quinine, methylene blue is often effectual. The alleged cyclic recrudescence of malaria is due exclusively to climatic conditions.

Creeping Eruption of the Skin (Frank Crozer Knowles, *Journ. Amer. Med. Assoc.*, January 15).—This rare disease usually involves the exposed surfaces of the body, though it may occur elsewhere, particularly near the genitalia. The eruption usually begins with itching and a creeping red line from 1 to 4 mm. wide, and 0·5 mm. elevation above the surface is soon apparent, though the earliest sign may be only a red spot, from which, however, the line soon shoots out. The line does not branch, but is often crooked. The case reported in the present study occurred in a girl infant twenty months old, and the regions involved were excised intact and subjected to study by serial section. By this means the causative parasite was actually discovered *in situ*. The exact nature of the parasite is uncertain, but is probably a gastrophilus. Full references are given to previous cases.

Experimental Syphilis in the Rabbit produced by the Brain Substance of the Living Paretic.—U. J. Wile (*Journal of Experimental Medicine*, February, 1916) quotes the successful demonstration of *Spirochæta pallida* in the living brain of patients suffering from general paralysis, and successful inoculation of brain substance obtained at autopsy.

The author in five out of six cases demonstrated spirochætes; in one case they were extremely numerous. Then the major part of the material was injected into the testes of a rabbit, later transmitting the disease to others.

The conclusions arrived at are: Spirochætes from the living paretic brain easily infect rabbits with experimental syphilis. They constitute a virulent strain with a shorter period of incubation than exists with other strains.

Beriberi.—R. R. Williams and J. A. Johnston (*Philippine Journal of Science*, vol x, Section B, No. 5), in the course of preliminary notes on an investigation, confirm the belief that beriberi is predisposed to by heat and physical exercise.

They formulate the hypothesis that in beriberi there exists a toxic substance which produces the symptoms of the disease. If produced rapidly or in great quantities this toxic substance brings about a condition similar to anaphylactic shock, resulting in acute beriberi. If gradually developed there results chronic beriberi with progressive nerve lesions. This toxic substance may be produced by a hypothetical organism or, as may perhaps seem more probable, may be the product of normal or slightly disturbed metabolism. Vitamines are then necessary antidotes for the poison and are, therefore, to be regarded as therapeutic agents rather than foods.

Pseudo-typhoid Fever.—Under this heading Schüffner (*Philippine Journal of Science*, vol. x, Section B, No. 5) states he has seen a number of cases of Japanese river fever in Sumatra with a mortality of 3 per cent., transmitted, according to the histories given by patients, by ticks or mites, one a larval form of a *Trombidium*, as in Japan, the other the larval form of a *Cheyletus*. The species are undetermined as the adults are unknown.

The Dermal Necrosis.—In 39 per cent. of cases the original point of infection is discoverable; in Europeans in all cases. The lesion begins as a flat vesicle, 3 to 4 mm. in diameter, surrounded by a dull-red areola. This soon bursts, and beneath it there appears a small, dark area of blackish necrosis some 4 mm. in diameter; five to eight days later a slough is cast off, leaving a small, round or oval ulcer with steep edges, and the floor covered with mucopus. The edge is little raised, the red areola extends only a slight distance. The ulcer has little discharge, small tendency to heal. The typical features of the initial ulcer are its slight depth and clean-cut edge. Lymphangitis is not observed, the neighbouring glands are tender and enlarged, sometimes markedly so, even as large as a pigeon's egg; they aid in discovery of the small ulcer.

The Rash is seen in 70 per cent. of cases, is present in all Europeans. In some cases it consists of a few reddish spots, or may be so pronounced as to resemble a measles rash. It appears on the second or third day, is fully developed on the sixth to eighth. It then is a roseola, with spots in size from a hemp seed to a threepenny-piece, resembling a secondary syphilitic roseola; it persists from eight to ten days longer, then becomes a brownish colour and slowly fades, and in one case there were hæmorrhagic spots on the abdomen; in this case only was there desquamation.

The temperature curve corresponds in all respects to that seen in enteric fever. Restlessness and mental disturbance are marked, and may persist until the afebrile period. The blood is not infectious to monkeys. *Post-mortem* changes only indicate pyrexia. The author makes no suggestion of a causative agent.

Original Communications.

THE METEOROLOGY OF MALARIA.

Disappearance of Malaria from England.

By Matthew D. O'Connell, M.D.

Below I give the hourly meteorological conditions at Kew, in Surrey, for a complete period of forty-eight hours in the month of August, 1911, extracted from the hourly values from autographic records which are issued by the Meteorological Office at South Kensington. For comparison I have, as far as possible, placed in line with each hourly record at Kew the nearest atmospheric conditions which were found to raise body temperature above normal in the spinning and weaving sheds in Lancashire and in Ireland.

Comparing the atmospheric conditions at each hour at Kew with those which raised body temperature above normal in the spinning and weaving sheds, it can be seen that the atmospheric conditions at Kew for the whole forty-eight hours given presented much less impediment to loss of heat from the body than the conditions in the spinning and weaving sheds did. For while the dry bulb temperature of the air is practically the same in both atmospheres, the drying power of the air at Kew is from 6·9 to 42 gr. per 10 cubic feet of air greater than the drying power of the air in the spinning and weaving sheds. Hence loss of heat from the body by evaporation was greater at all

Kew, 1911	Hourly atmospheric cooditioos at Kew: Temperature of air, F. Dry	Wet	Drying power of air per 10 c. ft. Grains	Relative humidity per cent.	Velocity of wind per hour Miles	Atmospheric cooditioos which raised body temperature in the spiooing aod weaviog sheds: Temperature of air, F. Dry	Wet	Drying power of air per 10 c. ft. Grains	Velocity of wind per hour Miles	Degree to which body temperature was raised in the spinning aod weaving sheds: Temperature of mouth, F.	Pulse	Respirations
August 12, 6 o'c. p.m.	82·7	63·6	77·4	37	6·7	83·0	74·0	47·0		99·8	104	21
,, 7 ,,	80·3	64·2	66·8	40	5·4	80·5	73·0	38·5		99·6	92	20
,, 8 ,,	76·8	63·9	52·2	49	4·8	76·0	70·0	29·0		100·2	88	25
,, 9 ,,	75·1	65·2	31·4	56	5·8	75·0	69·5	26·6		100·2	110	18
,, 10 ,,	73·9	63·3	33·1	59	5·4	74·0	68·0	27·0		100·2	88	25
,, 11 ,,	73·5	64·2	36·7	61	5·4	73·5	68·0	24·5		100·0	90	22
,, 12 o'c. midnight	71·9	63·1	31·7	65	3·6	72·0	67·0	18·0		100·0	72	15
August 13, 1 o'c. a.m.	70·8	63·2	29·0	69	4·5	70·0	66·0	17·0		100·0	72	15
,, 2 ,,	69·8	63·2	24·2	73	5·1	69·0	65·0	17·0		100·0	100	26
,, 3 ,,	68·9	62·3	23·9	74	3·6	69·0	65·0	17·0		100·0	100	18
,, 4 ,,	68·0	64·2	16·2	79	3·1	No observations in spinning and weaving sheds of these temperatures						
,, 5 ,,	66·9	62·5	15·1	85	0·9							
,, 6 ,,	68·1	64·3	20·4	82	1·8							
,, 7 ,,	70·8	64·6	23·4	75	2·2	70·0	66·0	17·0		100·0	100	18
,, 8 ,,	73·2	66·9	28·0	69	2·2	73·0	70·0	14·0		100·0	80	15
,, 9 ,,	76·7	66·8	34·8	61	1·8	76·0	70·0	29·0		100·2	88	25
,, 10 ,,	78·8	67·0	48·4	55	3·1	79·0	72·0	38·0		100·0	90	23
,, 11 ,,	83·0	70·8	61·0	49	4·5	83·0	74·0	47·0		99·8	104	21
,, 12 o'c. noon	85·8	65·7	87·5	35	5·4	86·0	77·5	49·0		99·2	80	20
,, 1 o'c. p.m.	88·1	65·5	95·0	28	6·7	88·0	77·5	61·0		100·2	104	20
,, 2 ,,	88·8	65·2	103·0	29	7·2	89·0	76·0	73·0		99·6	98	18
,, 3 ,,	87·6	63·4	102·0	27	8·1	88·0	77·5	61·0		100·2	104	20
,, 4 ,,	87·9	64·1	101·5	29	8·1	88·0	77·5	61·0		100·2	104	20
,, 5 ,,	85·8	65·1	92·5	31	6·7	86·0	77·5	49·0		99·2	80	20
,, 6 ,,	84·2	64·3	85·5	33	6·7	84·0	77·0	39·0		100·3	84	26
,, 7 ,,	81·3	63·2	73·5	36	4·0	81·5	74·0	39·1		99·2	86	20
,, 8 ,,	78·2	63·8	60·0	44	4·0	78·0	73·0	25·0		100·2	108	24
,, 9 ,,	75·9	61·2	54·6	46	3·2	76·0	70·0	29·0		100·2	88	25
,, 10 ,,	72·8	61·5	40·0	55	2·2	73·0	70·0	14·0		100·0	80	15
,, 11 ,,	68·8	62·3	19·7	71	0·9	69·0	65·0	17·0		100·0	100	26
,, 12 o'c. midnight	68·1	62·1	21·9	69	1·8	No movement of air perceptible.						
,, 1 o'c. a.m.	67·6	60·6	23·9	69	2·7							
,, 2 ,,	66·3	60·5	20·0	72	3·1	No observations of lower temperatures than 69·0 (dry), and 65·0 (wet), recorded in spinning and weaving sheds.						
,, 3 ,,	63·6	58·6	16·2	78	2·2							
,, 4 ,,	63·3	59·5	13·5	81	2·7							
,, 5 ,,	62·7	57·7	15·5	79	2·2							
,, 6 ,,	63·3	59·3	14·1	80	3·1							

None of the above atmospheric conditions would raise body temperature as much as the conditions in the spinning and weaving sheds did.

hours, and very much greater at most hours at Kew than it was in the spinning and weaving sheds. And this greater loss of heat would, of course, tend to keep body temperature lower. The Kew atmosphere would not therefore raise body temperature as high as the atmospheric conditions in the spinning and weaving sheds did. But the latter only raised body temperature to 37·9° C. (100·2° F.) at most. I therefore conclude that the atmospheric conditions at Kew, in Surrey, on August 12, 13, and 14, 1911, were not such as would raise body temperature above normal. In coming to this conclusion I have left out of consideration the effect of the rate of movement of the air, by which loss of heat from the body by conduction and convection is controlled. If we compare the rate of movement of the air in both atmospheres this only confirms the conclusion arrived at. It is to the drying power of the air at Kew on the dates mentioned that I desire to call the reader's attention in connection with the disappearance of malarial fevers from England. For if the drying power of the air at Kew between 9 o'clock p.m. on the 12th and 3 o'clock a.m. on August 13 was less, by as little as from 4·0 to 13·7 gr. per 10 cubic feet, according to the hour, the atmospheric conditions at Kew would then have been such as would raise body temperature above normal, *i.e.*, they would cause fever.

Surrey, where the above meteorological observations were recorded, is one of the counties of England in which malarial fevers, formerly prevalent, are now practically extinct. The disappearance of malarial fevers from those parts of England where they at one time prevailed is a mystery, the explanation of which would be very interesting. They were very common in the early part of the nineteenth century, but in this the early part of the twentieth century they are almost unknown.

The absence of malarial fevers from England at the present day can hardly be due to any paucity of malarial parasites, for they are imported every year in abundance in the blood of soldiers, sailors, and others who are invalided home for this disease from countries where they had contracted it. The absence of malarial fevers from England at the present day can hardly be due to any scarcity of anopheles. *A. maculipennis*, *A. bifurcatus*, and *A. nigripes* are now found in Cambridgeshire, and the two former are widely distributed in the south and east of England, the districts in which malarial fevers were formerly so prevalent. And it has been amply proved by experiment that the English anopheles in July and August is just as fond of human blood as its continental *confrères* are. The absence of malarial fevers from England at the present day can hardly be due to any great scarcity of suitable breeding places for anopheles, for if there are fewer suitable breeding places, how is it that this mosquito is now found distributed over even a wider area in England than malarial fevers formerly were? The absence of malarial fever from England at the present day cannot be due to any immunity of the English people, for they suffer from the disease to the same extent as others on arrival in a country where it prevails. The absence of malarial fevers from England at the present day has not been brought about by the extensive administration of quinine, or by the construction of mosquito-proof houses, or the organization of mosquito brigades, or by the filling up or oiling of small puddles of water. No anti-malarial measures were adopted in England with the exception of the drainage and cultivation of marsh land, and yet malarial fevers have disappeared.

It is sometimes said that malarial fevers do not now prevail in England because the parasite cannot develop within the mosquito at low temperatures. It requires a sustained average atmospheric temperature of 16·5° C. (60° F.). I do not know whether a sustained average atmospheric temperature of 16·5° C. (60° F.) was common or not in England at the time when malarial fevers prevailed there, but it is sometimes found in July, August, or September at the present day, when malarial fevers are almost extinct.

On looking through the hourly values from autographic records at Kew for 1911, issued by the Meteorological Office at South Kensington, I observe that the mean absolute temperature for July was 292·6, and for August 292·7. This would give a mean temperature of 19·5° C. (67·2° F.) for July, and a mean temperature of 19·6° C. (67·4° F.) for August. I also observe that for 163 hours consecutively—viz., from 7 o'clock a.m. on the 8th to 1 o'clock a.m. on August 15, 1911—the *minimum* temperature of the atmosphere did not fall as low as 16·5° C. (60° F.). Whether an atmospheric temperature thus sustained above 16·5° C. (60° F.) for 163 hours consecutively, or a *mean* atmospheric temperature of 19·5° C. (67·2° F.) for two months would be sufficient for the development of the parasite within the mosquito or not, I am unable to say. But experts tell us that the period required for the development of the parasite within the mosquito is only one or two weeks.

It seems certain that malarial fevers have disappeared from England without the employment of any anti-malarial measures except the drainage of marsh and fen land. And as the drainage of marsh and fen land has not exterminated anopheles in England it is difficult to understand what caused their disappearance if they are spread by this mosquito.

The parts of England where malarial fevers were very prevalent a century ago, and the period during which they gradually disappeared, are well known. In an essay on malaria by Sir John Macculoch, M.D., F.R.S., Physician in Ordinary to H.R.H. Prince Leopold of Saxe-Coburg, published in 1826 by Longman, Rees, Orme, Brown and Green, the parts of England in which malarial fevers had formerly prevailed, and where it even then to some extent lingered, are given, viz., Lincolnshire, Cambridgeshire, Norfolk, Suffolk, Essex, Middlesex, Kent, and Surrey. Before being drained the Lincolnshire Fens are described as a vast morass, interspersed with lakes, about sixty in number, and from ½ to 2 miles in circuit, communicating by

reedy straits 4 ft. deep, containing great numbers of fish. Fogs prevailed, the light winds which cleared the fog from the higher land having little effect in clearing the humid air of the low and sheltered fens. Although the rainfall was not great the air was damp. The greater dampness of Fenland air did not show itself equally all the year round. It was most remarkable in autumn.

Similarly the Cambridgeshire Fens, before being drained, were extensive sheets of water or reedy marshes, the home of bitterns and cranes and a vast variety of water-fowls. When to the above conditions is added the high atmospheric temperature of July, August, or September, there can be little doubt but that before the fens were drained the atmosphere of Fenland and its neighbourhood must have been at times, in summer and autumn, warm or even hot, damp and stagnant, similar to the atmosphere in the spinning and weaving sheds which raised body temperature above normal in less than four hours. And, as we know, malarial fevers were prevalent in Fenland and its neighbourhood before the fens were drained.

It has been said that drainage, as it has not exterminated anopheles, can only have played a subsidiary part in the disappearance of malaria from England. This is, of course, true if the disease is caused by a parasite and spread by anopheles. But if the disease is of climatic origin drainage of marsh land has played the most important part in the eradication of the disease.

Many attempts, with varying degrees of success, were made to drain the fens. That by Rennie, under Acts of Parliament passed in 1801, 1803, and 1818, was the most successful. The subsequent installation of steam-power pumping engines rendered it more efficient. The drained land was gradually brought under cultivation, and the drainage and cultivation of the fens were certainly accompanied by, if they did not cause, a gradual reduction in the prevalence of malarial fevers, just as at the present day the reclamation of the land of the Roman Campagna is being accompanied by, if it is not directly causing, a similar reduction in the prevalence of malarial fevers there.

As regards the *time* when malarial fevers began to disappear from Fenland and its neighbourhood, the Rev. Leonard Jenyns, F.L.S., in his "Observations on Meteorology," published in 1858, says: "When I commenced residence at Swaffham Bulbeck (a village seven or eight miles E.N.E. of Cambridge, bordering on the fenny parts of that county), in 1823, this complaint (ague) was so prevalent amongst the poor of the village that it was necessary to keep on hand a stock of medicines for its relief. Of late it has become so infrequent that hardly more than one or two cases occurred, to my knowledge, during the last ten years (1840-50) of my living in the neighbourhood."

In Watson's "History of Wisbeach, in Cambridgeshire," published in 1827, reference is made to a book on intermittent fevers by a Dr. Brown, in which the author states that these (malarial) fevers were not then so prevalent as they had been fifty or even twenty-five years previously, as observed by the older inhabitants and by medical men, although it was admitted that ague still existed there. This reduction in the prevalence of ague was attributed to the drainage and cultivation of the fens. Previous to such reclamation of the fens few families escaped ague.

The authors of "Fenland, Past and Present," published in 1878, say: "We have the testimony of resident medical men, and particularly of Mr. F. Fawcett, F.R.C.S., that within their memory the prevalence of malarial fevers, formerly so frequent, especially amongst the labouring classes, has been reduced to nihility."

These quotations fix approximately the period during which ague gradually disappeared from Fenland and its neighbourhood, which is practically the period of and following the reclamation of the Fens.

Although the reclamation of the fens has not exterminated anopheline mosquitoes, it has certainly produced a marked change in the *climate* of Fenland and its neighbourhood. For the amount of water vapour in the atmosphere imparts to climate its particular character quite as much as the atmospheric temperature does. The air of marsh land is damper all the year round than the air of cultivated land, but this greater dampness is more marked in the autumn. When the marsh is drained its atmosphere becomes drier, and this change is most evident in the summer and autumn. The greater drying power of the atmosphere so produced induces freer evaporation, and therefore greater loss of heat from the body, which must tend to prevent body temperature rising. There is less tendency to rise of body temperature produced by the drier atmospheric conditions.

The authors of "Fenland, Past and Present," say: "It is not necessary here to go into all the evident *changes of climate* effected by the drainage of the Fens," but throughout their book the changes of the climate of Fenland which were so brought about are clearly indicated. Fogs which before the drainage had been common became very rare. The damp atmosphere became drier. Sunny days and starlight nights became as common and the air as clear and bright in Fenland as in other parts of England.

As in Lincolnshire so in Cambridgeshire, the atmosphere had the reputation of being very damp before the drainage of the fens. The Rev. Leonard Jenyns, F.L.S., in his "Observations on Meteorology" remarks: "Cambridgeshire must, however, have had its climate improved in this respect from what it formerly was. The extent to which drainage has been carried on in modern times, especially since the application of steam power to this object, can hardly have failed to render the atmosphere less humid. Thousands of acres which were formerly more or less under water at least during the winter months, have been reclaimed in this way and brought under cultivation."

The changed atmospheric conditions in Cambridgeshire and Lincolnshire so produced by drainage of the fens would not be very different, on similar dates, from those recorded at Kew, in Surrey, on August 12, 13, and 14, 1911, which have been given at the commencement of this paper, and which, as we have seen, are such as would not raise body temperature above normal. And Surrey is one of those counties of England in which malarial fevers, formerly prevalent, are now extinct.

From the quotations I have given it seems certain that a considerable change of climate has taken place, not only in Fenland and its vicinity, but also wherever artificial methods have been introduced for the drainage of soil too damp for agricultural purposes. And concurrently with the introduction and carrying out of such artificial methods malarial fevers have disappeared. The change of climate so produced is not a change of the temperature or rate of movement of the atmosphere. It is a reduction of atmospheric humidity which has been brought about by the drainage of damp or saturated land. And consequently that degree of atmospheric humidity which, in combination with heat and stagnancy, raises body temperature above normal is not now common in Fenland and its vicinity since the completion of the drainage of the fens. It will be remembered that in the spinning and weaving sheds of Lancashire and in Ireland it was the humidification of the hot, stagnant atmosphere, artificially and by the evaporation from the bodies of the operatives, which raised body temperature above normal.

It should not, however, be concluded from what I have written that I consider that atmospheric conditions which raise body temperature above normal are never found in England at the present day. I think such atmospheric conditions are sometimes, although seldom, found in July, August, or September. But they continue for so few hours consecutively that any rise of body temperature so caused can last but for a few hours. And such atmospheric conditions recur so very seldom on consecutive days, or on the second or third day, that an intermittent rise of body temperature so caused must be very rare. Of such nature, however, I think are those cases of intermittent fever, and ague, in persons who have never been out of England, which are at long intervals recorded in the medical journals.

If the malarial fevers which were formerly prevalent in England were caused by Laveran's parasite and spread by anopheles, it is difficult to understand why they are now extinct.

If, on the other hand, they were caused by the atmospheric conditions, the climate, a sufficient explanation of their disappearance is apparent. The climate has changed owing to the scientific drainage of the fens.

TECHNIQUE OF INTRAMUSCULAR INJECTION OF SALVARSAN.

By W. M. McDonald.

Medical Superintendent, Holberton Hospital, Antigua.

On admission to the Hospital the patient is bathed, then the patient is examined to see that there is no serious organic disease. In the entire series of 440 cases to date I have never had to reject a case from organic disease. No preliminary treatment whatever is given. If convenient the patient is treated on the day of admission. All the injections are done in the operating theatre, under the strictest aseptic conditions.

Apparatus used.

All Glass Pestle and Mortar.—This is sterilized on each occasion by placing in cold water and raising to boiling-point.

Glass Record Syringe.—This is sterilized in same way.

Freshly prepared distilled water.

Solution of caustic soda, 15 per cent. strength.

Pure carbolic acid.

Collodium.

Preparation of Solution of Salvarsan for Intramuscular Injection.

The solution is not prepared until the patient is lying ready on the operating table. This is important, as the solution must be injected as soon as it is prepared.

Method.—The ampoules of salvarsan are nicked with the files provided with each dose and then broken over the dry sterile glass mortar. Ten drops of the 15 per cent. caustic soda solution are then added and the mixture is thoroughly ground up in the mortar with sterile glass pestle. Then about 8 c.c. of freshly distilled water is added and thoroughly mixed up with the salvarsan and caustic soda mixture. Lastly, the 15 per cent. caustic soda solution is added drop by drop to this mixture until the solution clears up into a bright, crystal, golden coloured solution. (While this caustic soda is being added the solution is vigorously stirred with the pestle until the last particle of salvarsan goes into solution.)

About twenty drops of caustic soda, 15 per cent. solution, is usually required, and must be added until the solution is absolutely crystal clear. There must never be the slightest particle of sediment (there is no harm in using an excess of caustic soda). As soon as prepared this solution of salvarsan must be immediately injected into the patient, who must be ready on the operating table.

Preparation of Patient.

The patient is placed in the prone position on the operating table.

Site of Injection.—It is very important that the sites of the sciatic nerve and the gluteal artery and sciatic artery be made out and avoided. I always choose a spot well to the *upper* and *outer* part of the buttock.

While the salvarsan solution is being prepared this selected spot on the upper and outer part of the buttock is dabbed with pure *carbolic acid*. In about one minute this spot turns white and is ready for the injection, which is immediately done. The skin over the white spot is tightly pulled to the outer side and the needle of the syringe is plunged into the middle of the white spot and deeply into the gluteus maximus muscle and the contents of the syringe are *very slowly* driven into the muscle. On withdrawal of needle the puncture is immediately securely sealed with gauze and collodium.

Points that need emphasizing

This small operation should not be lightly undertaken. It should be performed in a proper operating theatre, where everything is prepared in an aseptic manner.

The spot chosen for injection should be painted with pure carbolic acid and not tincture of iodine, as the carbolic acid is a stronger antiseptic and it also deadens the pain of injection.

There is no harm in using an excess of the caustic soda solution.

The solution of salvarsan must be clear and free from any sediment.

Great care must be taken that the injection does not injure the sciatic nerve and artery and the gluteal artery.

After being injected the patient walks to the ward and goes to bed for two days, and the majority of cases are well enough to go home on the third day.

Reactionary Effects.—In all cases there is a rise of temperature in about eight hours to about 100° F., which falls to normal in twenty-four hours. The highest reactionary temperature I have seen is 102°.

In about 20 per cent. of the cases a hard painful infiltration forms at the site of injection. This infiltration usually subsides under fomentations in a few days.

The pain at the site of the injection lasts about two hours.

In five cases sloughs formed at the site of injection.

Curative Effects.

In all cases that had complained of pains in the joints, feet, and hands the effect of the injection was magical. In the majority of cases these pains ceased within twenty-four hours.

By the third day the yaws tubercles began to dry up, and at the end of a week they had dried up and disappeared. The ulcers also had rapidly improved.

Dose.

For an adult of either sex the full dose of 6 grm. of salvarsan was used; between 4 years and 14 years the whole or part of the 4 grm. dose was used according to the age, and below 4 years the whole or part of the 2 grm. dose was used according to the age.

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RELIGIOUS BELIEFS AND MEDICAL TREATMENT OTHER THAN OUR OWN.

The discussion recently held at the Royal Society of Arts in London brought home to many the truth and meaning of several of the religions of India and also the importance of Europeans knowing more intimately the literary teaching and tastes of the Asiatic peoples. The more one dips into the religions and the religious ceremonies of the universe the more one becomes impressed with the belief that there is but one God in all minds. Material emblems of

deities are but outward expressions to those we call "the heathen," as saints and sacred emblems are to the Christian. In Europe the former were uprooted by Christianity, but saints were put in their places, whereas in Asia the former remain as passive agents in shaping the destinies of the people.

The importance of Europeans grasping the good accruing to a better and deeper knowledge of native beliefs and the power thereby acquired is brought home to us daily. It is ignorance of each other for the most part that separates people imbued with different outward expressions of rules of life; but when these are probed more deeply the basis of most appear fundamentally akin. As Sir F. P. Leslie states: "Nothing gripped the heart of the ordinary native in India so much as the discovery that his companion knew something about his heroes and saints, names which were household words in the family. The Indians were a nation of mystics; they lived in a supernatural atmosphere, which was always present with them."

The phrase "always present with them" corresponds to the Christian teaching to act always as in the presence of God. That the Indians perform this injunction according to their own lights is abundantly evident throughout the length and breadth of India. It is the cause of much misconception amongst foreigners in India and elsewhere in Asia and Africa, and leads to troubles which were the circumstances better understood would often smooth difficulties.

In confirmation of this, Sir David Barr, K.C.S.I., gives an instance which is fraught with deep meaning as indicating the advantage of knowing the determining factors of the mode of action of Indians in certain circumstances. He states: "In 1887-1888, when he was Political Agent at Rewa, he became a great friend of the head priest, the Swami of Lachman Bagh, who was a very pious and good man, with whom he spent many hours sitting outside his temple, learning a great deal about the Hindu religion and the manner in which it was propagated, and being taught a few of the mantras from the Veda. Some years afterwards, when he was at Indore as Agent to the Governor-General, a great fair, which was held once in a period of so many years, and was attended by Hindus of various castes from all parts of India, was about to take place at Ujjain, a sacred city about forty miles from Indore. It so happened that at the time cholera, in a very virulent form, broke out at Ujjain, and he was asked to do everything in his power to stop the large gathering of 200,000, 300,000, or 400,000 pilgrims taking place, and so prevent the epidemic spreading. The pilgrims had already arrived in their thousands at Indore, and the Maharaja suggested that he (Sir David Barr) should enlist the assistance of some of the holy men. Accordingly he invited twenty or thirty of them to the Residency, and told them that the pilgrimage to Ujjain was likely to result in a serious outbreak of cholera, and he begged them not to go there, but he was not able to impress them at all. He ascertained that the Priest of the Temple of Juggernaut was the most important of these holy men, and he tried to persuade him, but at first unsuccessfully. He then repeated in a low voice the mantra he had learned years before from the Swami of Lachman Bagh. The Priest at once turned round and said: 'Where did you learn that?' He told him, and the Priest asked him if he was the sahib who, when at Rewa, called himself the Chela of the Swami. On replying that he was, the Priest said: 'I have heard of you; we will not go to Ujjain.' And they did not. He mentioned that as an instance of the advantage and importance of getting into touch with the people, and as showing how bread cast upon the waters in that way returned after many days."

Many instances of this nature could be recorded, but it would be well did more of the kind occur.

It is, however, unfortunate that the number of men who have the leisure, not to mention the inclination, to study "natives and their ways" is limited. European contact with tropical peoples is, as a rule, commercial merely. The European merchant or banker engages an Indian or Chinese clerk, or has dealings with merchants in the purchase or selling of goods, and there the matter ends. Neither knows anything about each other further, and have little or no interest in each other beyond seeing that the transactions are fulfilled and the money satisfactorily arranged. The business man has no time for anything more, even if he desired to. The only classes of Englishmen who, as a rule, attempt to gain an insight into the literature or the rules which regulate their neighbours in India, China, or elsewhere are the members of the Indian Civil Service, of the Consular service, and the missionaries. Of these the missionaries have the most leisure and should do more than any other section of British folk in the direction indicated. Several of these have done a good deal, but with a few brilliant exceptions they are not imbued with the spirit necessary for the kind required.

The missionary should be recruited from the best educated of our community. The men should be on an educational level with the men of the Civil Service itself. Religious fervour is not the sole requirement of a missionary if the greatest good is to be done; a more intimate knowledge of the "foundations of belief," a mind trained by education to grasp the meaning of things and to probe the deep philosophy which cloaks the mysticism of so many "native" beliefs, is required. This power is, of course, granted to but few men, but from amongst the many, were the standard of education higher, more would emerge to help our knowledge in this direction than at present.

In this field also Medicine would do well to take a lesson. We are apt to despise native practitioners and their ways. Yet when we come to look into them we find that most of the drugs we employ to-day were used for ages before they were ever heard of in Europe. Rhubarb and ipecacuanha, mercury and arsenic, and almost all the condiments and carminatives were in common use in India and China before Europe was civilized. Their adminis-

tration was obscured, as their religions are to-day, by mysticism, but the basis of treatment was and is the same as it is to-day. The compound we call Warburg's tincture was in universal use (without the quinine ingredient) 2,000 years before the Christian era, and it remains to-day the compound *par excellence* for treatment of "fever" in all its branches and variations.

The young men trained in medicine in India, China, and even in advanced Japan are accused of reverting to "native ways of practice" after they have left their medical schools where they were trained in Western medicine. Before condemning them, let us be sure that they are wrong, and let us beware of shutting our eyes to the good that may lie underneath their "native ways of practice."

Annotations.

Prevention of Malaria.—The *Medical Bulletin* 10, of the University of Missouri, on the "Prevention of Malaria," says that 1,500,000 people in the United States suffer from malaria every year, and that it causes annually 12,000 deaths. If each life were valued at $5,000 the loss from this cause would be $60,000,000, to say nothing of the enormous value of time lost by and money expended for the treatment of those who do not die. As it is a preventable disease, its continued prevalence is a reproach to the people, and its eradication would be a good money investment.

Tuberculous Abscess in the Liver (F. Saltzman, *Finska Läkaresällskapets*, Hardlingar, lvii, No. 1).—A man of 50 had for ten years symptoms of mild pulmonary tuberculosis, during the last three years accompanied by symptoms due to the kidneys and chronic diarrhœa. No tubercle bacilli could be found in the sputum. Necropsy disclosed a large abscess in the liver, surrounded by cirrhotic liver tissue. The course of a tuberculous abscess in the liver is insidious and chronic. Except for vague gastro-intestinal disturbance, there is nothing to call attention to the liver as a rule. The hectic fever is usually ascribed to the primary process until the liver lesion spreads to involve the peritoneum.

Blumberg's Sign of Appendicitis (P. N. Nikolaieff, *Vrach*, xiv, No. 44).—The pressure sign of peritoneal irritation is the pain in the region of the appendix following rapid removal of the hand after it has been applied to the spot to induce pressure. It is not specific for appendicitis, and is found not only in appendicitis, but in every case of peritoneal irritation, whatever its cause. Thus it is found in perforative peritonitis, gastric or duodenal ulcer, in cholecystitis, typhoid ulcers, &c. Each of the four quadrants of the abdomen is examined separately. It is especially pronounced during the first twenty-four or forty-eight hours, being thus one of the earliest and therefore most valuable signs of acute involvement of the peritoneum by any of the above-mentioned diseases. In chronic peritonitis—for instance, tuberculous peritonitis—it is absent.

Latent Filariosis.—T. Padilla (*Semana Medica*, xxii, No. 38) has found a new species of microfilaria in the blood of 25·21 per cent. of the persons examined in the Calera district and in 16·04 per cent. in Arcadia, all in the Tucuman Province in Brazil. Those harbouring it do not seem to suffer from it in any way. There is some evidence that the mosquito is the transmitting agent. No adult form was seen, only the embryos; no *post-mortem* examination was made. They are smaller than other filarias known, and are most numerous in the peripheral blood drawn at night, although they could also be detected in the daytime. In one case he found from thirty-three to thirty-four specimens in each field, in others from four to six; twelve to eighteen, and in one case from sixty to seventy-five at midnight and only from thirty to forty-five at noon.

Tonsillar Endamœbiasis and Thyroid Disturbances (J. S. Evans, *Journal of Medical Research*, February).—Tonsillar lesions of an infective character were found in 22·8 per cent.; and nasal together with tonsillar lesions existed in 90 per cent. of 362 goitrous individuals examined from this standpoint. In typically diseased tonsils, out of thirty-four cases examined microscopically, 97 per cent. were found to harbour *Endamœba gingivalis* in the tonsillar crypts. Of sixteen individuals of this group who after treatment by means of emetine hydrochloride were re-examined, thirteen, or 81 per cent., were shown no longer to have endamœbas in the crypts. In twenty-three persons to whom emetine was administered a reduction in the bulk of the goitre was appreciable in eighteen; and of seven dysthyroid cases included in this group of those treated, six were benefited in degrees varying from slight amelioration to apparent cure.

Introduction of Mumps into Greenland (Bertelsen, *Ugeskrift for Læger*, lxxvii, No. 49).—Primary epidemic parotitis was never encountered in Greenland to his knowledge until the infection was brought in 1913 by a ship from Denmark, and of the 2,425 individuals in the district, about 1,500 contracted the disease. In his special district, 191 of the 285 individuals were affected, that is, 66 per cent. of the men and 68 per cent. of the women. No infant under 2 was affected; 18 per cent. of the male patients developed orchitis and 5·3 per cent. of the women had mastitis; that is, about half of the women who were nursing infants at the time. In three of the eight cases of mastitis this was evidently the primary localization of the disease,

the parotitis following later. There was suppuration of the parotid gland in one case and of the breast in one. Oöphoritis could not be determined with certainty in any case. There were no fatalities and no chronic trouble seemed to be left in any instance.

The Nutrition Question for Invalids (Boas, *Berl. klin. Wochenschr.*, December 6).—The prevailing scarcity of animal food in Germany allows persons who used to have to take spa treatment regularly to keep themselves in good condition without it. The War is thus proving an actual benefit for those inclined to overeat, and for the complications of obesity and gout. The diet of the masses is becoming a strictly vegetarian diet. The endurance of vegetarians on long marches and in other tests of the physical strength has been so conclusively demonstrated during this War that such facts can no longer be ignored. At the same time, in order to manage with a vegetarian diet providing the adequate amounts of nourishment required, severe physical exercise is indispensable. He agrees with the dictum: "The less the amount of physical work and the greater the amount of intellectual work, the more necessary is it for the food to be of kinds easily digested and not taking up much space." It is important to recognize further that meat stimulates the appetite besides supplying valuable nourishment, and this question of relish is by no means negligible.

Unique Lesion of Heart in Systemic Blastomycosis (T. D. Hurley, *Journal of Medical Research*, January).—A labourer, aged 61, was troubled by cough which had persisted for three months. A diagnosis of pulmonary tuberculosis was made, though sputum examinations were negative. There was evidence of heart disturbance, but this was a minor feature. The most distressing symptoms were cough and dyspnœa, thought to be due to bronchial asthma. Death, which occurred eight months later, was apparently due to the pulmonary condition with a terminal septicæmia. *Post mortem*, blastomycotic lesions were found in the skin of the face, scalp, chest and arm; in the bones of the skull, chest wall, and elbow- and wrist-joints on the right arm, as well as in both lungs, the spleen and the cerebrum and its meninges. The subcutaneous abscesses of the chest wall seemed to arise from the underlying necrotic ribs. From the lower abscess a sinus continued inward through the fifth intercostal space and was found to communicate directly with the pericardial cavity. The pericardial cavity contained numerous dense fibrous adhesions between the thickened pericardium and the heart, among which was much fibrin and many collections of purulent material. The largest of these was in communication externally with a subcutaneous abscess and internally with a necrotic area in the anterior wall of the left ventricle of the heart.

General Pathology of Pellagra, with special reference to Findings in Thyroid and Suprarenals.—P. F. Morse (*Journal of Laboratory and Clinical Medicine*, January, 1916) reports a *post-mortem* in a case of pellagra. Summary: Simple or brown atrophy of the heart, liver, spleen, lungs, intestinal muscles (?) and kidneys. Degenerations and brownish pigmentation of the posterior root ganglia (and other groups of nerve cells). Active ulcerative proctitis and marked chronic glossitis. Hyperkeratosis and sclerosis of the skin with areas of round-celled infiltration. Chronic interstitial thyroiditis with compensatory reaction on the part of the follicles. Small areas of round-celled infiltration in the thyroid, suprarenal, liver, lung, bladder, tongue, rectum and skin. The changes found in the thyroid and suprarenal are unusual ones, thus lending support to the tendency to consider them of importance in the production of the clinical state presented by the patient. The nervous lesions hitherto described and now partially confirmed are wholly of toxic or nutritional origin. Many of the lesions are *post-mortem* changes and other artefacts, along with secondary changes which are common in many other conditions. Reports of degenerations based on the appearance of granules and other slight changes in nerve-cells have to be interpreted with extreme caution, inasmuch as so much depends on the functional state of the cells at the time of death, *post-mortem* change, fixative, method of preparation, &c. One of the safest criteria for the establishment of the fact of nerve-cell degeneration is fat, none of which was demonstrable in this case.

Alkali Disease (*Journal of the American Medical Association*, February 19, 1916).—The occurrence in certain parts of Utah of a disease that seems to be specific in its character, but which so far as he knew had not previously been described, was reported by Dr. T. B. Beatty, Secretary Utah State Board of Health. The disease appears to have occurred for some time past in Box Elder and Millard counties, from seventy-five to 100 cases occurring each year, and has been known among the inhabitants of those localities as the "alkali disease." It occurs only from the middle of June to the latter part of July, and is always preceded by the bite of a fly, probably the deer-fly. Many such bites, however, are not followed by infection. Those familiar with the disease report a coincident high mortality among rabbits, and conceive some possible relationship between such mortality and the occurrence of the disease in man.

The "alkali disease" occurs most commonly in men who have been working in the fields. Bites are usually on the exposed surfaces of the body, most frequently in the vicinity of the ear and about the neck. Within twenty-four hours after having been bitten, the patient's temperature rises, possibly reaching 104° F. Swelling and marked induration of the skin occur about the bite and in the neighbouring lymphatic glands. The skin breaks down in about three days, leaving an ulcer, cleanly

punched out, involving the skin and subcutaneous tissue. Full convalescence requires from five to seven weeks. An extensive scar always remains. Deaths are rare. No immunity follows the disease.

Serotherapy of Bubonic Plague.—F. Moreno (*Semana Medica*, xxii, Nos. 30-42) gives details of eight cases from the epidemic at Oporto and of thirteen that were in his personal charge, including the case of Dr. C. Pestana, who succumbed to infection from a scratch in dissecting a plague cadaver. The first symptom of trouble was itching in the axilla on one side, the third day, followed in a few hours by chills, fever and swelling of a gland in the axilla with death the seventh day after the infection. There were only two other deaths in the twenty-one cases here reported. Study of all these cases shows that in certain cases bubonic plague develops for a time as a localized infection. Although the bubo or buboes are accompanied by high fever, &c., yet there does not seem to be general intoxication. Subcutaneous injection of 20 or 40 c.c. of antiplague serum at this stage helps the organism to throw off the disease. It is naturally more effectual the earlier it is applied. But the frequency of severe general intoxication and the difficulty in recognizing it early make it much safer to push the serotherapy with large doses and give it both by the subcutaneous and intravenous routes. The cases related emphasize the prompt benefit from the intravenous serotherapy, comparable only with that from diphtheria antitoxin. Within twenty-four hours the temperature drops and the general health improves. As it is impossible to foretell the course of the cases from the early symptoms, intensive treatment should be instituted at once, and at least 80 c.c. of the serum should be injected intravenously. This wards off general intoxication and tends to abort the disease and save the internal organs from the destructive action of its toxins. The initial dose advised is 100 c.c., repeating it within twenty-four hours, taking the temperature as the criterion. It should be reduced to normal. The clinical charts demonstrate the utility of this dosage and its harmlessness. Buboes are of no more clinical importance than any ordinary local inflammatory process. Five cases of pneumonic plague with three deaths are reported. The two patients who recovered had been given each three intravenous injections of antiplague serum on successive days.

Drugs and Appliances.

RECONSTRUCTIVES.

Of the alternatives to cod-liver oil and malt preparations, combining malt, fresh bone marrow with hypophosphites of lime, potash and soda, Roboleine is in increased demand. It is of special use in anæmia and debility, as the fresh bone marrow contains blood-forming elements as well as lecithin and cholesterin. It is manufactured by Messrs. Oppenheimer, an entirely British house since its foundation.

Abstracts.

THERAPEUTICS OF TETANUS.[1]

The War has shown two very important facts concerning this infection: (1) The germ is more or less universal in the regions of warfare. (2) The results of its infection may be made negligible by the preventive use of tetanus antitoxin. A brief review of this disease may be of interest.

Tetanus is more frequent in the Tropics than in temperate climates, and of that in the latter climates 86 per cent. of all cases are traumatic in origin.

The incubation period of acute tetanus is from one to ten days, and of subacute tetanus from ten to twenty days. Fifty per cent. of all cases develop between the sixth and ninth day, the majority apparently on the seventh day after infection. Acute tetanus lasts from one to ten days, and subacute tetanus from ten to twenty days. Not until the patient has lived until the tenth day of the disease is there an equal chance for life. After the tenth day the patient's chances of recovery increase day by day.

There is probably always more or less leucocytosis in tetanus, and the average count is 13,000. The eosinophiles seem to be diminished in number.

The tetanus bacillus is a cylindric rod, larger at one end than the other, and is an anaerobic germ. It is constantly present in the dirt of cities and on most country roads, as well as in barns and pastures. Noble[2] has recently shown that this bacillus occurs in the intestines of otherwise normal animals, and he found the germ in the fæces of eleven of sixty-one horses examined. Further examination of these infected animals showed that the germ could disappear in a few weeks, but could also remain present as long as four months. Such animals become tetanus carriers,[3] and are a constant menace to other animals which may receive injuries, and to their drivers and ostlers, who may have slight wounds on their hands. These tetanus-carrying horses infect the dirt of the fields or streets on which they work or travel.

The reason for the perpetual danger from the tetanus organism is that it will live, when not subjected to intense light or heat, for years. The germ has also been found in the fæces of cows, and has even been found in the fæces of man. Animals obtain the bacillus from their food, probably principally from infected grass and hay. When it is found in the fæces of the human being, he has probably obtained it from eating contaminated uncooked vegetables.

This bacillus gains entrance to the system almost always through a wound or abrasion, and, as has long been recognized, the most frequently infected wounds are contusions and crushing or lacerating wounds, especially those that occur from sliding, grinding, and friction injuries in the streets and

[1] Abstracted from the *Journal of the American Medical Association*, December 11, 1915.
[2] Noble: *Journ. Infect. Dis.*, 1915, xvi, 132.
[3] "Tetanus Carriers," editorial, the *Jour. of the Amer. Med. Assoc.*, May 29, 1915.

from lacerating wounds acquired in warfare, explosions, &c. At first the infection is a local one, and it is stated that the bacilli do not often wander from the point of infection; but they soon produce their toxins which cause the general disturbance.

As this germ grows without air, it is evident that infection with other bacteria, pus germs, &c., which will use up the oxygen in the tissues, or in a more or less closed wound, will thus aid in the growth of the anaerobic tetanus bacillus. Also, the destroyed tissues at the base or around the wound should be very carefully removed, as such structures, with their impaired circulation, instead of normally combating infection, promote it. Flushing suspected wounds with oxygen, perhaps, well furnished by hydrogen peroxide solutions, as oxygen inhibits or stops the growth of the tetanus bacillus, is of use.

The toxins of tetanus bacilli ascend the motor nerve sheaths and thus reach the spinal cord. They unite with nervous tissue and seem to remain in a more or less fixed combination; hence the difficulty of the tetanus antitoxin combating the toxin that has become thus combined. Prevention of tetanus by the use of antitoxin is easy; the cure of tetanus with antitoxin is difficult. It is probably only late in the disease that the toxins circulate in the blood. Sinigaglia[1] found the tetanus bacillus in the blood in a case of slow infection.

The beginning symptoms of poisoning from this germ are aches and pains in the muscles, with a general lassitude, some headache, and soon some stiffness of the muscles of the back of the neck, face, and jaw. The wound or source of infection may show no change; in fact, may apparently be healed. The more or less permanent contraction of some muscles and the convulsions of tetanus are too well understood to need description. Spasm of the sphincters may make urination and defæcation almost impossible. The mind generally remains clear, unless there is very high temperature, which is one of the causes of death. Death may occur during a convulsion from spasm of the diaphragm or spasm of the laryngeal muscles, or it may occur from exhaustion.

It was for many years thought that tetanus antitoxin was of no great value when the disease was positively in evidence. It was considered and taught that it was too late to expect any antitoxin activity. Therefore, it is encouraging, in the treatment of this disease, to note that in animal experiments anti-tetanic serum will save life when tetanus has already developed, and therefore should perhaps not infrequently save life in the human being. If the patient cannot be treated before serious intoxication of the central nervous system has occurred, the toxins, Irons believes, may be neutralized by a large intravenous injection combined with an intraspinal injection of the antitoxin.

Nicoll[2] has determined by animal experimentation, and also by clinical experience, that from 3,000 to 5,000 units of antitoxin should be injected into the lumbar region of the spinal canal as soon as tetanus is diagnosed. This injection should be done under an anæsthetic, to inhibit any possible convulsion during the infection. The volume of the fluid injected should be "brought up to 10 to 15 c.c. by the addition of sterile normal saline, the exact amount being regulated according to the age of the patient and the amount of spinal fluid withdrawn." At the same time he advises the injection of 10,000 units of antitoxin intravenously. The spinal injection dose should be repeated in twenty-four hours, and a subcutaneous injection of 10,000 units should be given three or four days later. Nicoll finds that the death-rate has been reduced by this method of treatment of those who already show symptoms of tetanus.

These investigations, with the added clinical experience, would seem to make it doubtful if subcutaneous injection alone of anti-tetanic serum could cure tetanus, although Comby[3] states that he has cured three cases of tetanus in children by the subcutaneous injection of anti-tetanic serum.

Subsequent injections of antitoxin, especially when given intravenously, can cause anaphylaxis, sometimes severe.

It has been shown that if the tetanus antitoxin is injected into the tissues surrounding the wound soon after the injury tetanus will be prevented, even if the tetanus bacillus is later recovered from the wound. If, in such cases, a little stiffness or tendency to stiffening of the muscles of the part injured begins, immediately another dose of antitoxin is given.

The prophylactic dose of tetanus antitoxin should be about 1,500 units, given subcutaneously, preferably in or about the region of the injury, and this should be given whenever the character of the injury or the region in which the injury is received presents any possibility of tetanus infection. This dose can be repeated in a few days if deemed advisable. The serum may also be perfused into the open wound, but the antitoxin powder applied to the wound can probably not be relied on as an effective prophylactic. An antitoxin impregnated pad is described by Robertson.[4]

As in administering diphtheria antitoxin, it should be ascertained if the patient is susceptible to emanations from horses or stables; if he shows hay fever and asthma symptoms from such emanations, it is unwise to administer horse serum, especially as a prophylactic for something that may not occur.

The newest of the drug treatments of tetanus is that by magnesium sulphate. Ten c.c. of a 10 per cent. solution of this salt is injected into the spinal canal. This drug more or less successfully inhibits the convulsions. If active symptoms recur in two or three days, another dose of 8 c.c. of the 10 per cent. solution is given. Certainly the intraspinal

[1] Sinigaglia: *Riforma med.*, April 24, 1915.

[2] Nicoll, Matthias: "Intraspinal Administration of Antitoxin in Tetanus," *Journ. Amer. Med. Assoc.*, June 12, 1915, p. 1982.

[3] Comby: *Brit. Journ. Child. Dis.*, 1915, xii. 1.

[4] Robertson: *Jour. Amer. Med. Assoc.*, August 28, 1915.

injections of magnesium sulphate should be given only in very severe cases. The dosage suggested is not large; very much stronger solutions have been injected. The danger lies in causing paralysis of the respiration. Subcutaneous injections of magnesium sulphate solutions are of value in relieving spasms and convulsions. The action of magnesium sulphate is similar to the action of curare, perhaps not quite so dangerous, as its action may be inhibited by calcium. It has been shown that magnesium sulphate diminishes heat production, and that the intensity of its action may be determined by the temperature curve.

Injections of magnesium sulphate into the system, and especially into the spinal canal, are always more or less dangerous, and it would seem that in serious convulsive conditions, while waiting for the antitoxin to have its effect, inhalations of chloroform would be safer in quieting and controlling the patient than injections of a substance whose activity passes beyond the control of the physician.

The chloral treatment of tetanus is used in conjunction with the anti-tetanic serum. As high as 5 grm. of chloral by rectum twice a day, with $\frac{1}{6}$ gr. of morphine hypodermically, has been given; the anti-tetanic serum treatment is continued, both intraspinally and subcutaneously, until the active symptoms of tetanus cease.

While the dose of the chloral given is very large, some such combination of morphine and chloral, with the dose gradually increased or diminished, depending on the symptoms, seems much safer than the magnesium sulphate treatment.

Bathing all lacerated wounds with the ultra-violet rays is claimed to kill the tetanus bacilli as well as other bacteria. It is believed that tetanus infection of wounds is prevented by applying chlorinated lime in the form of a mixture of 1 part of the chlorinated lime to 9 parts of kaolin. This powder is blown into and over all wounds. This treatment does not cause pain, allows the wounds to heal, and seems to prevent tetanus infection.

Phenol treatment has been advised many times, and has been termed "Baccelli's treatment."

SPRUE.[1]

Sprue is a tropical disease of growing importance to American physicians. It has already been reported in the Southern States,[2] and imported cases seem to be becoming more frequent. Sprue in its clinical manifestations is similar to pellagra; some authors have even asserted that the two diseases are identical.[3] The cardinal symptoms of "typical" or "complete" sprue are usually given as stomatitis, a peculiar diarrhœa, diminution in the size of the liver and secondary anæmia with wasting. There are neither skin nor nervous manifestations. In pellagra, however, skin symptoms are often in abeyance, and nervous symptoms may be so slight as to be negligible. Reduction in the size of the liver, anæmia, and wasting are common to the two affections. Both diseases have been denied classification as morbid entities, being regarded rather as syndromes which may appear secondarily in many wasting affections.

One important difference between them is to be found in the character of the diarrhœa, and more especially in the stool itself. In sprue the diarrhœa occurs usually in the early hours of the day, the stool is voluminous, light in colour, acid in reaction, and of a foamy, gaseous character. In pellagra these characteristics are not observed. The chemical study of the stool, in the light of later studies, seems to be highly important in differentiation between the two diseases. The large size of the sprue stool is due to the lack of digestion and absorption of certain bodies, notably the fats. Wood[2] thinks that the only certain means of differentiating sprue from pellagra is the chemical study of the fæces. Fatty stools with great fat and nitrogen loss, in his opinion, are characteristic of sprue, while in pellagra the fat and nitrogen absorption are about normal. This character of stool, it is to be noted, is also characteristic of pancreatic disease, and actual disease of this organ has been reported in some cases of sprue. The sprue stool is often lacking in pancreatic ferments, but this need not necessarily be due to organic changes in the pancreas, and may be caused simply by disturbed intestinal function. Further studies are needed to determine just what part lesions of the pancreas play in the diarrhœa of sprue.

Sprue does not always appear in its "typical" or "complete" form. "Incomplete" sprue is characterized by the diarrhœa alone, and "tongue" sprue is when only the mouth signs occur. These varying degrees of intensity are not so peculiar as they are confusing in diagnosis. The same difficulties are encountered in pellagra without erythema—pellagra sine pellagra.

The question of the etiology of sprue is in a most unsatisfactory state. The idea advanced some years ago that sprue is an infectious disease due to some variety of yeast has received new impetus from the studies of various authors, notably Bahr, in Ceylon, and Ashford,[1] in Porto Rico. Bahr's researches led him to express conservatively the opinion that the *Monilia albicans* is the cause of the disease. Many of his colleagues expressed their inability to accept as the causal agent a fungus common in England, where sprue does not occur. It is interesting to note that the *Monilia albicans* is the organism most usually found in the mouths of children suffering from thrush.

Ashford's studies seem to corroborate Bahr's evidence in all points save in the species of fungus involved. He regards the disease as a moniliasis due to an undetermined species, not hercofore

[1] Abstract of Editorial, *Journal of the American Medical Association*, February 12, 1916.

[2] Wood, E. J.: "The Occurrence of Sprue in the United States," *Amer. Journ. Med. Sci.*, 1915, cl, p. 622.

[3] Journal of Tropical Medicine and Hygiene, September 15, 1913 (Editorial).

[1] Ashford, B. K.: "Studies in Moniliasis of the Digestive Tract in Porto Rico," *Amer. Journ. Med. Sci.*, 1915, cl, p. 680.

described. Further, he believes that the infection is probably derived from bread. He has cultivated the organism from a loaf of bread baked in a zone where the disease was endemic. He has found it constantly present in the mouth lesions and fæces of patients with sprue, and in only 3 per cent. of healthy persons. Complement fixation tests, in which his monilia was used as antigen, have proved negative in healthy persons and encouragingly positive in those suffering from sprue. The monilia is pathogenic for small laboratory animals, producing a mycotic septicæmia, and in partially immunized animals intractable mycotic ulcers. These results, while highly interesting, are likely to be received with considerable scepticism. Much additional work and more definite evidence will be required to establish such a thesis.

In this connection it is perhaps somewhat discouraging to recall that the etiology of pellagra has also passed through a "mycotic" stage. Many have sought some etiologic connection between fungi and pellagra, both with and without relation to "spoiled" maize. Students of pellagra will recall the series of papers by Ceni, who contended that this disease was an aspergillosis—an opinion which, though supported by apparently excellent evidence, has remained unconfirmed.

Sprue, while rare in the United States, is a formidable disease in some places. Ashford reports that in Porto Rico during the last decade it has made startling advances, and "has now come to occupy a position in the very front rank of the serious and fatal affections of our island, especially dreaded by American residents, among whom it seems to be far more common and fatal than tuberculosis."

Notes and News.

A BICENTENARY OF SCIENCE.

During the present world's upheaval the most pre-occupied may pause to reflect on the two hundredth anniversary of an establishment still conducted on the same site in Lombard Street, the birthplace of the poet Pope, the meeting-place of pioneers of the world-wide anti-slavery movement—Lord Brougham, Wilberforce, Clarkson, and others. For two hundred years the firm of Allen and Hanbury have been established in Plough Court, Lombard Street, but now its works, laboratories, branches and products have expanded, until they are known wherever scientific medicine exists. It must be a unique honour for a firm to have two members Fellows of the Royal Society, William Allen, first President of the Pharmaceutical Society, and Daniel Hanbury, perhaps the more distinguished scientist; striking examples of the tie that binds science to success.

Plague and Yellow Fever in Ecuador.—During 1915 there occurred 236 cases of bubonic plague, with 109 deaths. Of yellow fever nineteen cases were reported, eleven being fatal.

Typhus fever at Aleppo was estimated in November to be causing 200 deaths daily.

Typhus in Mexico.—During the first week in January 962 cases of typhus were reported in Mexico City, fifty less than the number reported in the previous week, and 500 cases at Queretaro.

Monument to Leader of Campaign against Malaria.—It is proposed to erect a monument to Professor Angelo Celli, of Rome, the founder and the animated and guiding spirit of the foundation of the Society for the Study of Malaria, which instituted the great Italian campaign against the disease. It is contemplated that this monument will stand on the Roman Campagna, the field of the studies and the object of the most loving care of Professor Celli, on the spot where he redeemed man and earth from the scourge of malaria.

Reviews.

Yellow Fever (West Africa) Commission. Third Report. London: Churchill. 1s. 6d. net.

Since February 15, 1914, no case has been reported in the West African colonies. The commissioners review the present state of our knowledge of the virus of yellow fever, and after a lengthy consideration of the evidence relating to *Paraplasma flavigenum*, conclude:—

(1) No proof has been given that these bodies are of protozoal nature.

(2) Under that name a number of microscopic objects are included.

(3) Excluding artefacts, the origin of most of these is at present uncertain, and so far none has been proved to possess any definite physiological or pathological importance.

(4) There is so far no reason to regard any of these bodies as the cause of yellow fever.

(5) The nature of the virus of yellow fever still remains undetermined.

We have recently received for review the latest of the Illinois Biological Monographs, No. 1, vol. ii, entitled "The Classification of Lepidopterous Larvæ," by Stanley Black Fracker, published by the University of Illinois, Urbana, U.S.A., price $1.50.

The work is well arranged and embraces an analysis of the studies of other workers in the subject. The author suggests the adoption of Greek letters in place of the numerals at present in use for denominating the setæ of lepidopterous larvæ. Ten plates are given on the cheatotaxy, with this suggestion utilized. Classification tables for the families, genera, and some species are also included.

The work is largely outside the sphere of tropical medicine, but should prove of value to entomologists interested in the lepidoptera.

Original Communications.

A NOTE ON VACCINE TREATMENT IN STREPTOCOCCAL PUERPERAL FEVER.

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Introductory.—This is the fourth brief note dealing with the subject of streptococcal infections in the Anglo-Egyptian Sudan and published in this journal. In the second of the series it was shown that a number of cases of puerperal fever were caused by members of the Salivarius Group of streptococci, and in this paper it was stated that we had no practical experience of vaccine therapy in this disease, as the patients were either dead or recovered before an autogenous vaccine could be prepared. However, such a vaccine was prepared and stocked for future use. In the third paper attention was invited to streptococcal infections caused by the Fæcalis Group, and among these a case of puerperal fever was mentioned. Since then we have met with another case of this disease also caused by the Fæcalis Group of streptococci, and as the vaccine therapy in these two cases was not merely successful but also interesting, we venture to bring forward our results, especially as the Sudan cases of streptococcal puerperal fever are peculiarly suitable for vaccine therapy being localized infections, in which so far we have been unable to find any evidence of septicæmia as demonstrated by cultures of the peripheral blood taken from a vein.

Modern Views.—As far as our reading goes, it tends to show that works on vaccine therapy are singularly silent as to the use of streptococcal vaccines in puerperal fever, while those dealing with obstetrics advise that not more than five million cocci be given to start with, and that this line of treatment is best suited to the more prolonged type of case, and especially to that in which there is markedly remittent fever. These last statements will be observed to agree with our first case, except as regards the dose. In 1909 White and Eyre recorded an unsuccessful case, though the patient improved considerably for a time. In 1912 Western found that vaccine treatment in his hands reduced the mortality of the cases very considerably, but that stock vaccines gave inferior results to autogenous vaccines, a point which is also borne out by our first case, though Rowlette of the same year had considerable success with stock streptococcal vaccines, which is borne out by our second case, finding that they caused amelioration of the symptoms, and sometimes a very striking fall in the temperature. He recommends doses of 2½ to 5 millions given about three times, and he also finds that serum treatment aided the work of the vaccine. In 1913 Wynn also obtained good results from vaccine treatment in puerperal fever.

It will thus be seen that there is a tendency to support autogenous vaccine therapy in streptococcal puerperal fever and to give the vaccines in small doses, aided, if need be, by serum injections.

Sudan Cases.—The first case was in a multipara, who is said to have had an easy confinement which was conducted without intra-vaginal examination. She kept quite well for seven days, when for the first time she received an intra-vaginal douche, after which the fever began. No organisms were obtained from the peripheral blood, but an intra-uterine swab produced a pure growth of a streptococcus, which eventually proved to be *Streptococcus versatilis* Broadhurst 1915, belonging to the Fæcalis Group.

She at first only received antistreptococcal serum, but on admission into the hospital the uterus was thoroughly cleansed and more antistreptococcal serum was administered, as is shown in the chart. These therapeutic measures were followed by improvement, and it was decided to give her some of the stock Salivarius Vaccine because:—

(1) This was the common organism causing the disease in Khartoum and Omdurman.

(2) It was not known at the time that she was infected by a streptococcus belonging to a different group.

She was only given 5 millions because the actual species of the infecting organism was not known, and because this dose is mentioned as the maximum for a first dose, and is also commonly used in these laboratories as an initial experimental dose when the causal organism is unknown. It will be observed from a study of the temperature chart that there was a slight reaction in the general symptoms. No good or evil effects resulted from this dose. It was, however, quickly discovered that the streptococcus with which she was infected belonged to the Fæcalis and not to the Salivarius Group, and therefore an autogenous vaccine was given in a 5 million dose six days after the preliminary dose of *S. salivarius* Andrewes and Horder 1906.

This vaccine also appeared to do no good, and five days later the patient became obviously worse with a markedly remittent temperature, when 200 millions of the Fæcalis Group vaccine was administered with the result depicted in the temperature chart, to which may be added that she made a good and rapid recovery.

This is obviously a chronic case in which the treatment of uterine cleansing and anti-streptococcal serum did much good, while the heterologous vaccine did no good, but a large dose of the homologous vaccine produced a cure. It is to be noted, as mentioned above, that this beneficial action was associated, accidentally or really, with a remittent temperature instead of with a continuous fever.

The lack of effect by the first dose of 5 millions may possibly be due to the fact that it was made from a heterologous organism, and if this is admitted

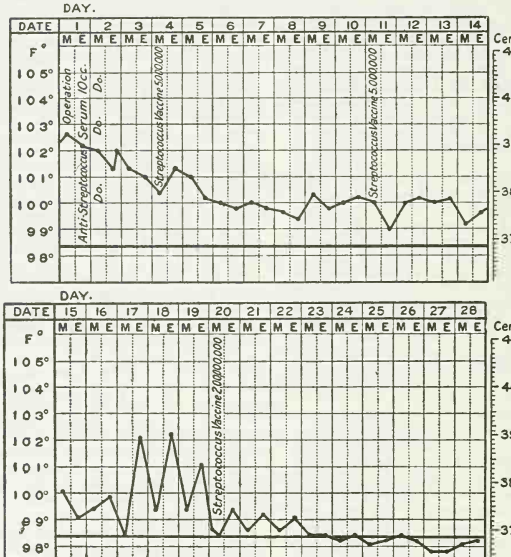
it would help to accentuate the differences between the Fæcalis and Salivery Groups of streptococci.

The second dose of 5 millions was most probably too small, especially as a hcterologous dose had previously been given.

The second case was a very severe type of fever which had lasted six days, and when first seen had a temperature of 104·6° F., with a weak, very compressible, and exceedingly rapid pulse. There was much purulent discharge from the uterus, and in the opinion of the medical officer who saw her the patient was in a dangerous condition. The uterus was douched out with antiseptics, but this had to be stopped on the third day as the patient's friends refused to allow it to be done, and she had to trust entirely to vaccine therapy. As some human fæcal matter had been observed in the vagina, it was decided to treat her at once with the same vaccine as that made from the first case, and this was done in less than twenty-four hours after the case had been first seen by the medical officer. She received on that occasion a 5 million dose, and, as the effect was to slightly lower the temperature, and as the patient showed some improvement, three days later she received 50 millions, when the temperature gradually fell, reaching 100° F. on the sixth day after the first vaccine dose. On the next day it rose to 101·4° F. in the morning and 102·6° F. in the evening, and next day, *i.e.*, on the eighth day after the first injection, she received 200 millions, subsequent to which the temperature declined and reached normal on the third day after this dose, and the eleventh after the commencement of vaccine therapy, and she made a good recovery.

There can be no doubt that this woman was seriously and dangerously ill, and as the only therapeutic remedies which she received were some irrigations of the uterine cavity, which had to be quickly stopped, and a cardiac tonic, it is not unreasonable to assign her recovery to the vaccine.

Practical Application.—In Mohammedan countries there is the greatest difficulty in obtaining permission to examine, douche, or curette the uterus, but there is not so much difficulty in obtaining permission to abstract some blood from a vein or to give injections. Hence there is always a



Temperature chart of Case 1.

To illustrate paper on "Blastomycosis (?) in Central Africa," by A. YALE MASSEY, B.A., M.D., C.M.

possibility of obtaining the causal organism from the blood. There can be no doubt that the first and most important therapeutic remedy is to cleanse the cavity of the uterus, but if the woman herself would rather die than have this done, then other methods must be adopted, and this is where vaccines may be of great service in raising the resistance of the body against the germs which may be passing from the uterus into the blood-stream in such small quantities that they are killed in the blood, and yet do not produce sufficient reaction to raise the anti-bacterial powers of that fluid. If necessary, polyvalent serum with saline injections can also be used to combat and remove the toxins.

Under these conditions it is obviously important to know the strains of streptococci causing puerperal fever in any district, and to prepare a polyvalent vaccine for that district, for we believe that if stock vaccines fail when administered to cases suitable for vaccine therapy, the reason is to be found in that they do not contain the causal organism, and when they succeed it is because the causal or a nearly allied organism is contained therein.

Another point of practical importance is to consider whether the case is or is not suitable for vaccine therapy. It is obvious that in a severe septicæmia this method of treatment is useless and may do great harm, while in localized infections, even if small quantities of streptococci are entering the blood, it is useful. Having decided that vaccine therapy is to be used, the experience of this laboratory in vaccines of all natures is that the therapeutic dose should be sufficiently large, and we believe that many of the failures of vaccine therapy are due to using too small doses.

We distinguish in this laboratory between an initial experimental dose of 5 to 10 millions, which is used to discover the condition of the patient as regards the organism, when there is not time, or possibility, of discovering the true nature of the streptococcus and the first therapeutic dose, which should not be less than 50 millions in the case of streptococci, and should be followed, preferably in a week or less according to the symptoms, by another therapeutic dose of 200 millions, and further doses as may be required, but in other classes of organisms we use much larger doses than these.

Acknowledgments.—We have much pleasure in acknowledging the kindness of Dr. Bousfield, Medical Officer of Health of Khartoum and Omdurman, and Dr. Ativah, Medical Officer in Charge, Omdurman Civil Hospital, in supplying us with clinical notes with regard to these two cases.

Khartoum,

November 18, 1915.

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BLASTOMYCOSIS (?) IN CENTRAL AFRICA.

By A. YALE MASSEY, B.A., M.D., C.M.

Lusambo, Belgian Congo.

DURING the past four years there have come under my observation about a dozen cases of a disease which presents an uncommon resemblance to what books on tropical medicine call blastomycosis. To exclude the possibility of syphilis or yaws as a causative factor, I have tried salvarsan with no apparent beneficial result.

The accompanying photograph gives a good idea of the appearance of the disease as it attacks the legs. These are two native soldiers of about 20 years. An amber-coloured serum exudes from the nodular protuberances. In each case one leg only was affected. The bone was attacked in the case on the left.

In one case the foot was attacked, giving the typical appearance of Madura foot, but I failed to find anything resembling grains. No cultures have been attempted. In another case the neck and submaxillary region showed the same nodules with openings leading into sinuses which exuded an amber-coloured fluid.

Treatment.—Local applications were of no avail. In the case on the right, I curetted away all the diseased tissue and in a few weeks healthy skin had reformed. I think surgical interference is the only thing for these cases. I sent pieces of the curetted material to several European pathologists. Le Dantec, of Bordeaux, believed it to be of mycetome origin, but cultures would be necessary to verify the diagnosis. Langeron, of Paris, thought it was possibly a blastomycosis, but did not find a fungus in the material sent him.

The disease is not uncommon in this part of Africa (5° S. and 23° E.), evidenced from the fact that the natives have a special name for it—mulandala—and say it may attack any part of the body and is incurable.

Tubercle Bacilli in Air and Dust.—Kaurin (*Norsk Magazin for Lægevidenskaben*) inoculated animals with culture mediums long left exposed to the air in rooms occupied by the tuberculous. Also with dust from the toilet rooms, hall, and other parts of the sanatorium where the inmates congregated. No acid-fast bacilli could be detected in any of the tests, and none of the animals showed any sign of infection. These findings harmonize with the experiences of the seventeen years during which none of the attendants or other persons connected with the sanatorium has contracted tuberculosis.

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THE JOURNAL OF

Tropical Medicine and Hygiene

APRIL 1, 1916.

FOOD AND ITS ADULTERATION IN WARM CLIMATES.

IT has been frequently stated, and it is a daily experience, that food for Europeans in the Tropics is deficient in many ways. Both as regards quality and variety much is left to be desired, and especially is this the case in the matter of the prevention of disease. Animal food, so far as beef and mutton are concerned, is inferior in both quantity and quality. Quantity because it is unobtainable in the majority of areas; and where it is to be had the quality may often be said to be unwholesome. Except at coast ports, as a rule, beef and mutton are negligible as articles of diet; and it is only since frozen or tinned meat was introduced that even at these ports has anything like a regular supply been obtainable. It is not necessary to enter into the question of the physiological benefits of such forms of prepared food; but nothing does, nor ever will, take the place of fresh meat. Fish may be had in most coast ports; but the fish from tropical seas, and notably that from the Pacific and Indian Oceans, is not of the quality yielded by the Northern Atlantic. To inland districts it is impossible to transport sea-produced fresh fish owing to the difficulties of preservation and the general slowness of carriage, and smoked or preserved fish, although a welcome change, is not readily digestible.

Chicken—or more correctly mature fowls—can be obtained everywhere; it is, however, so constantly on the table that the appetite is repelled rather than stimulated by the frequency of its recurrence. Now roasted, now boiled, then minced, fricasseed, or devilled, it becomes tiresome and eaten without relish. Game is occasionally to be had, but too infrequently to be of much importance as an article of diet.

Pork, being as a rule of local production, is avoided by Europeans owing to the native method of feeding pigs; and, in common with Mahommedan communities and the Jews, Europeans in the Tropics view the flesh of the pig with suspicion. The pig is but a scavenger in hot climates, and no serious attempt has been made, as far as our information goes, to supply wholesome-fed pork which would be acceptable to Europeans. The bacon consumed is imported, so that the plentiful local supply of pig flesh as food is negligible.

Were, however, pigs fed in a clean and wholesome manner, a plentiful source of food, at any rate in the form of bacon, would be available. A pig farm at which all the work of feeding was done by Europeans, to the exclusion of native help, thereby excluding the filthy garbage usually supplied to the pig, or which it is allowed to wander about and consume, would prove of great benefit, but this attempt has never been made as far as we know.

A review of the animal flesh food supply, therefore, is fraught with disappointment, and it is difficult to see the way out of the dilemma. Veal, however, should be plentiful, and if carefully cooked should prove wholesome enough; but veal cannot take the place of mature beef. It is unripe meat, and although a pleasant change if found digestible, does not fill the place of matured beef. Again, sheep are not to be met with in many parts of the tropical world, so that lamb or mutton is a rarity.

Dairy farms on European lines, and having European-bred animals, have been tried, and, although expensive and difficult of maintenance owing to disease, but chiefly through absence of pasture land and suitable dry food, have proved useful and financially successful.

There are, however, other considerations which prove detrimental to health in the Tropics; and although these obtain in every country in Europe and America, they are specially marked in their evil consequences amongst Europeans in hot countries Adulteration sums up the evil referred to; the most recent confirmation of this is the report of the Municipal Analyst for Singapore. He states that 82·9 per cent. of the rice examined was adulterated—that is, that phosphorus pentoxide was abstracted from it, and to this fact the prevalence of beriberi (from which 800 persons died in Singapore in 1914) is attributed. Of the ghee, 68 per cent. was absolutely adulterated; of milk, imported and tinned milks showed adulteration to the extent of 78 per cent., while that sold by itinerant vendors showed 24·9 per cent. adulterated. Aerated waters were examined for lead contamination, and thirty-one out of fifty-four samples examined were found to contain lead in dangerous quantities. Lastly, beer was found to contain preservatives in every case, the favourite being sulphites, which, if used in too great a quantity, cause diarrhœa and kindred complaints.

Singapore is no exception, however, in the extent to which adulteration is present in almost everything the public eat and drink, at home and abroad.

The German chemist is the chief offender in teaching the world the art of substitution in food and in drink. Not as a war measure, but for several decades he has been labouring to supplant natural products by artificial jugglings, tricks, and deceptions. It is a good many years ago since a German wine merchant in London told in open court that he had 3,000,000 bottles of hock in England manufactured in Hamburg that had never seen the grape. Beer in Germany is likewise compounded of chemicals alien to beer brewed and prepared in a wholesome way. Many other instances could be cited of this prostitution of chemistry, with an effect more deadly than that of the injurious materials said to have been put in tinned foods, into children's sweets, &c., for consumption by Germany's enemies, in that it is more difficult to detect. The greatness the Germans claim in every branch of science and literature is a fetish believed in not only by themselves, but by many in this country. Their literary claims are too often on a par with their claims as chemists. The latter are a prostitution of all the talents; the productions are unwholesome, detrimental to health, and degrading in their influence upon the minds of the men who prepare them.

Others have imitated them until, by preservatives and substitution, the folk of the modern world have few things left to eat or drink that have not been tinkered with in some way. Cream, milk, preserves, all suffer from the detrimental influences of this prostitution of science, and Nature and natural productions are ousted from their places by its baneful effects.

Will war improve matters? It is to be feared that it will not. The people who prepare devilish means of fighting have been preparing, under the cloak of science, a diabolical crime, namely, the deterioration of human food. How they are to be circumvented and Nature and its ways re-established is another matter; the evil teaching has penetrated to many countries, and to allay the demon of substitution in food, drink, medicines, &c., is a problem which will tax legislators and health authorities for many a long day.

Annotations.

Insect Vector of Uta.—The disease known as uta, occurring on the west face of the Andes in Peru, has been proved to be due to a leishmania. Townsend (*Journal of Parasitology*, December, 1915) suggests that it is highly probable that the various forms of leishmaniasis thus far known are due to as many species of herpetomonads originally parasitic in the intestine of the insect carriers concerned, and that, with regard to the occurrence in man, these herpetomonads are as yet in the stages of parasitism ranging from habitually abnormal or frequent to merely accidental or infrequent.

Street Dust and Disease.—Bacteriological examinations made in New York show that street dust contains a variety of living pathogenic organisms such as tubercle bacilli and various types of streptococci which are recognized as causative agents of many respiratory and other diseases. Although few authentic cases of disease can be traced to bacteria in street dust, yet the fact that appreciable numbers are found in street dust and inhaled or ingested, establishes a presumption that street dust may be the cause of disease. Studies of the incidence of respiratory diseases show that persons free from exposure to city dust are less liable to suffer from such diseases. Dust has long been recognized as an injurious mechanical irritant and as a cause of lowered bodily resistance. Dry sweeping should be entirely abandoned, and street flushing should be introduced in street-cleaning processes. All efforts should be made to render streets as free from dust as possible.

Intrahepatic Cholelithiasis (R. Lewishon, New York Academy of Medicine, December 3, 1915; *Medical Record*, February 12, 1916).—The patient was a man, aged 31; the day before admission to hospital had pain and rigidity in the right upper abdomen, diagnosed as gangrenous cholecystitis, or perforated duodenal ulcer. An immediate laparotomy showed the liver studded with small nodules. One at the upper surface was incised, and presented three small gall-stones weighing 2 to 3 mg. Perforation by one of the stones at the under surface of the liver had caused localized peritonitis. The condition is extremely rare, this being the first diagnosed on the operating table.

For eight months a biliary fistula remained; it closed automatically two months ago. The patient is apparently in perfect health.

Retrogression of Goitre under Continuous Mild Purging and Disinfection of the Intestines (Messerli, *Revue médicale de la Suisse romande*, December).—The men were all recruits; in the first case the circumference of the neck was reduced from 45·5 to 38·5 cm. under twenty-nine days of treatment. Parenchymatous goitre is extremely common at Basel where these measurements were made, and Messerli noticed that his own thyroid increased in size during his stay there, but it subsided to its normal outlines after he had taken 2 grm. of salol a day for two weeks. He never ventured to apply this treatment to much degenerated goitres, but with simple follicular enlargement and parenchymatous goitre some benefit was apparent in every instance. Benefit from mild continuous purgation and disinfection sustains the theory of parasites in the drinking water as the cause of goitre.

Mental Manifestations of Pellagra.—W. F. Lorenz (*Public Health Reports*, February 4, 1916), as the result of examination of the cases seen in America, arrives at the following conclusions:—

The psychosis that accompanies pellagra has the characteristics of the toxic psychoses in 90 per cent. of the uncomplicated cases admitted to an institution for the insane.

It has great resemblance to the acute alcoholic psychoses.

When pellagra develops in an individual already insane synchronously with the physical manifestations, a mental confusion or delirium may be added to the existing psychosis.

Were an etiology to be suggested from the mental disturbances alone, the causes would fall among a group of agents similar to alcohol in that they are not products of bacterial or parasitic invasion of the body, but chemical intoxicants in the narrower sense.

Life Insurance in the Tropics (Römer, *Nederlandsch Tijdscrift voor Geneeskunde*, January).—Life insurance in the Tropics is profiting by the progress of recent years in tropical medicine. Life expectancy for officials in the Dutch East Indies is 5 years less, up to 35; 4 years less at 40; 2 years less at 50; while at 70 it averages the same as in the Netherlands. No statistics are available for non-officials. The intestines are in a condition of lessened resistance, the result of errors in diet, especially overloading with rice. The mortality among Europeans seems to be highest the third year of their residence in the Tropics, then the fourth and fifth. On return to a temperate climate they are liable to pneumonia, and amœbic dysentery may be responsible years later for an abscess in the brain or liver. Chronic malaria, sprue, heart disease and, especially, gout may reduce the life expectancy after return to Europe. An assumed simple cardialgia or gastritis may be the first manifestation of an ulcer or cancer. He urges that careful records be kept of persons who have returned from a residence in the Tropics.

Tuberculosis runs a particularly malignant course in the Tropics, attributed to the fact that the heart beat is accelerated on an average ten beats a minute and the respiration often by 4·5. Especially in the Tropics, married men are better risks than the unmarried, as there is more attention to hygiene. Lands newly opened to colonization reduce the life expectancy somewhat. A tendency to corpulence is particularly risky in the Tropics on account of the disinclination to exercise and the tendency to over-eat.

Mode of Infection in Pulmonary Distomiasis. Certain Fresh-water Crabs as Intermediate Hosts of Paragonimus Westermani (K. Nakagawa, Formosa, Japan, *Journal of Infectious Diseases*, February).—Of three species of fresh-water crabs examined, the encysted larvæ of the human lung distomes were found in two, the occurrence in the third being problematical. The liver, the gills, and other organs of the crab that harboured a large number of encysted larvæ were given to two puppies. One of the dogs died sixty days after feeding. *Post-mortem* examination showed the lungs to have a number of cysts. Within each cyst two or three distomes were present. They had no eggs in the uterus at this time. The other puppy died after a lapse of ninety days from feeding. His lungs contained numerous cysts, in which adult distomes with eggs ready to be discharged were found. Further observation showed that the encysted larvæ that have been taken into the alimentary canal of the host creep out of the cysts, and, making their way through the intestinal wall near the jejunum, reach the abdominal cavity. They then penetrate the diaphragm and, reaching the thoracic cavity, scatter all over the space under the pleura, whence they can easily find their way to the lung. They pierce the lung parenchyma, and there the cysts are formed until they become fully grown. These parasites can bore through various tissues, and may reach other organs than the lung, where they form their regular cysts; but the lung seems to be the most favourable place for their development and the laying of their eggs; in other organs they can never reach the perfect growth.

Pyorrhœa Alveolaris (J. S. Ruoff, *Public Health Reports*, January 21, 1916).—As a preliminary patients were treated by a dentist, the teeth scaled, old roots and hopeless teeth were extracted, and the mouths put in as good condition as possible. A microscopical examination was made for end-amœba.

Each patient was given fluid extract of ipecac. to use locally: 10 drops in one-fourth to one-half glass of water to be used as a mouth-wash after cleaning the teeth night and morning.

Twenty men received three ½-gr. injections of

emetine on consecutive days: on the fourth day all had endamœbæ. After a second similar treatment eleven were negative, two were discontinued on account of nausea, vomiting and loss of appetite, and seven were still positive. These seven had a third course of three injections of $\frac{3}{4}$ gr.; one remained positive, he received another three $\frac{3}{4}$-gr. injections. No amœbæ were found after giving him $7\frac{1}{2}$ gr. in twelve days.

Four weeks later all had amœbæ. Of a second lot, one discontinued treatment on account of rise of temperature. The rest received six $\frac{1}{2}$ gr.; all had endamœbæ three weeks later. Of a third lot, six were discontinued treatment on account of various disagreeable symptoms. The rest had amœbæ two weeks later. The conclusion arrived at after examining 190 cases, 187 with endamœbæ, is that emetine is an amœbacide, but alone will not cure pyorrhœa alveolaris.

Abstracts.

Public Health Bulletin, No. 75, January, 1916, epitomizes the results of the work of the U.S. Leprosy Investigation Station, Hawaii:—

"Chaulmoogra Oil Treatment of Leprosy." Geo. W. McCoy and Harry T. Hollmann review the results of others. Their own experience is that the oil is helpful to many cases of leprosy, perhaps the majority. Hypodermic injection gives good results, and ought to be given a further trial. Weekly, 5 c.c. of a 50 per cent. mixture, sterilized by heating to 100° C. for fifteen minutes, is their dose.

"Carbon Dioxide Snow in the Treatment of Leprosy." By Geo. W. McCoy and Harry T. Hollmann. "As satisfactory a local agent as we have."

"*B. leprae* in the Circulating Blood of Lepers." By Harry T. Hollmann.

"Leprosy in a Nineteen Months Old Child." By Wm. J. Goodhue and Geo. W. McCoy. The only one among 100 born at Malokai and removed at once after birth from a leprous environment.

"The Cultivation of a Non-chromogenic Acid-fast Bacillus from a Case of Nodular Leprosy." By Moses T. Clegg.

"A Note concerning the Favourable Influence of Glucose on the Growth of Acid-fasts." Geo. W. McCoy finds a combination of 0·5 per cent. lævulose and 0·5 of glucose in agar meat extract gives particularly favourable results.

MALARIA.

The surgeons of the United States Public Health Service have found that in certain sections of the South 4 per cent. of the inhabitants have the disease. This estimate is based on 204,881 cases reported during 1914. According to the report of the surgeon-general of this service, 13,526 blood specimens were examined during the year, of which 1,797 were positive for malaria. The infection rate among the white persons was found to be more than 8 per cent., and among the coloured 20 per cent. In the Yazoo Valley, in two counties, 40 out of 100 persons presented evidence of malaria. The surveys have resulted in gratifying reductions of the disease through the efforts stimulated by the survey, in thirty-four places in nearly every southern state. In some places the reduction was from 15 per cent. in 1914 to 4 or 5 per cent. in 1915. An important feature of this study of malaria was the discovery that malaria is probably not carried through the winter in the bodies of the malarial mosquito, so far as that section is concerned. Mosquitoes dissected and examined during the early spring months in 2,000 instances showed no infection, and none was discovered until May 15. The conclusion is that malaria carriers should be treated during the winter and spring with quinine, so that chronic sufferers may not renew the infection in mosquitoes. Quinine is still the best means of curing the disease and preventing infection, but destruction of the breeding places of the malaria mosquito is necessary for eradicating the disease. This should be done by draining, filling, regrading of streams, oiling of breeding places, the stocking of streams with suitable fish, &c.

ANOPHELES PUNCTIPENNIS, SAY: ITS RELATION TO THE TRANSMISSION OF MALARIA. REPORT OF EXPERIMENTAL DATA RELATIVE TO SUBTERTIAN MALARIAL FEVER.[1]

By M. Bruin Mitzmain.

Summary.

(1) Two hundred and nineteen specimens of *Anopheles punctipennis*, Say, were dissected from three to thirty-eight days after multiple bites on individuals whose blood contained varying numbers of subtertian gametocytes (æstivo-autumnal crescents). No infection was observed in the dissection of stomachs and salivary glands.

(2) Two healthy individuals were bitten 91 and 180 times by specimens of *A. punctipennis* four to thirty-three days after sucking blood of a subtertian malarial carrier. In this experiment, and subsequently in the employment of a healthy volunteer to feed twenty-two additional mosquitoes of this same species, *A. punctipennis*, Say, could not be incriminated in the transmission of subtertian malarial fever.

The negative results in this experiment check only with the negative findings in the dissections of *A. punctipennis*, as it is recognized that the volunteers were not under absolute control; that is, because of the possible exposure to bites from infected anophelines while living in New Orleans.

(3) Control feedings with seventy-four specimens

[1] United States Public Health Report, February 11, 1916.

of *A. quadrimaculatus*, Say, resulted in an infection of 13·8 per cent., and with three specimens of *A. crucians*, Wied., of 33·3 per cent.

(4) The coincidence in which one person developed subtertian malaria eleven days following the single bite of an *A. quadrimaculatus* that had become infected (as shown by dissection) seventeen days previously by biting a heavily infected carrier pointed strongly to this as the source of infection.

This might be offered as an additional check in the experiment, recognizing, however, the limitations that might be placed on it because of lack of absolute control of the volunteer living in New Orleans.

THERAPEUTICS OF AMŒBIC DYSENTERY.[1]

The value of ipecacuanha in the treatment of bowel infections with the endamœba has long been known, as has also the disagreeableness of the treatment. A. Rogers's assertion,[2] in 1912, that the soluble salt of emetine, the active principle of ipecacuahna, could be given hypodermically to cure amœbic dysentery, was welcome. The truth of this assertion has now become generally established, and the points for discussion are the best method and the best dose, and the prevention of recurrences of the disease.

Vedder[3] recently discussed the present status of the treatment of this disease, and Lyons[4] answers some of the suggested questions. Lyons finds that emetine will probably not act locally in the intestines, but must be absorbed to act, and hence kills endamœbæ only in the tissue. When they are killed the lesions heal. Emetine is irritant to the stomach and intestines, and causes vomiting and diarrhœa when given by the mouth, unless in small doses. It will cause diarrhœa if given too long by the mouth or subcutaneously, and the best method to give it is subcutaneously. Intramuscularly it is too irritant, and intravenously too dangerous. In the colon it is more irritant and no more efficient as a bactericide than some other antiseptic, a silver salt, for instance. The soluble hydrochloride is slightly acid, and even in small doses subcutaneously will cause pain and some considerable local irritation; but if the dose is small, this inflammation is not serious, and the induration is not great.

Lyons finds that the best dose in an average case of endamœbic dysentery is for an adult ½ gr. of emetine hydrochloride three times a day, given hypodermically, and this dose should be continued from one to two weeks, or at least four days after the stools became formed. When it is given for longer than two weeks a diarrhœa is liable to be caused by the emetine.

Previous to the emetine treatment, Lyons gives a saline cathartic, and castor oil or a saline occasionally throughout the treatment. This not only washes out the dead endamœbæ, but may also cause the encapsulated germs to change their form into one that the emetine can attack. It is these encapsulated endamœbæ which cannot be killed by the emetine that often cause recurrences.

Permanently to eradicate the disease, he advises giving a second series of emetine injections two weeks after the first, and a third short series after three weeks more, and, if there has been a recurrence, even a fourth series later.

The only undesired effects of emetine injections in the dose recommended, besides the local irritation, are vomiting and diarrhœa. Large doses have caused peripheral neuritis, purpuric eruptions, and œdema. Emetine may, of course, be given by the mouth if there is a serious objection to hypodermic administration, but it is unadvisable.

Twenty-five per cent. of Lyons's cases were recurrences; hence the necessity for repeated bacteriological examination of the fæces, and the wisdom of the intermittent treatment advised.

Not every patient who shows endamœbæ in the stools is ill. Some become tolerant, and are then carriers. Emetine is not very successful in these cases. Vedder suggests colon washing with quinine or silver solutions.

Barlow[5] reports a study of endamœba dysentery in Honduras. He examined forty cases from eight to fourteen months after cessation of treatment, and found that 80 per cent. of the patients did not have a relapse for seven or more months, if they were treated for ten days continuously by not less than 1 gr. of emetine per day. A shorter number of days of treatment allowed relapses, and a combination of the emetine treatment with ipecacuanha by the mouth did not prevent such relapses. He found it preferable to give the emetine once a day in 1-gr. doses.

Ravaut and Krolunitski[6] found the endamœbæ in the dysenteric stools of some French soldiers in Northern France. In these cases they did not find emetine injections very satisfactory. They did, however, have success with the administration of salvarsan intravenously.

BERIBERI, WITH SPECIAL REFERENCE TO PROPHYLAXIS AND TREATMENT.[7]

By William Henry Willcox.

The paper is based upon the study of over fifty cases of beriberi seen during the latter half of the past year in the Mediterranean area.

Many cases showed that in addition to the etiological factor of diet there was some toxic influence at work, such as a previous attack of dysentery, chronic diarrhœa, purpura, or jaundice.

[1] *Journ. Amer. Med. Assoc.*, February 26, 1916.
[2] Rogers, A., *Brit. Med. Journ.*, June 22, 1912, p. 1424.
[3] Vedder, E. B., "Origin and Present Status of the Emetine Treatment of Amœbic Dysentery," *Journ. Amer. Med. Assoc.*, February 14, 1914, p. 501.
[4] Lyons: *Amer. Journ. Med. Sci*, July, 1915, p. 97.
[5] Barlow: *New York Med. Journ.*, October 23, 1915.
[6] Ravaut and Krolunitski, *Bull. et mém Soc. méd. d. hôp. de Paris*, October 21, 1915.
[7] Abstracted from the *Lancet*, March 11, 1916.

Thus in cases in British troops from the Dardanelles area twenty-six cases of beriberi were seen. Of these, twelve had recently, before the onset of symptoms, suffered from jaundice. One patient suffered from paratyphoid fever A associated with slight jaundice; another from a slight attack of jaundice three weeks *after* the onset of beriberi. Five patients had suffered from previous chronic diarrhœa or dysentery and three from purpura.

In eleven cases of beriberi seen in British troops from the Mesopotamia district one had suffered from recent jaundice previous to the attack, and one from chronic diarrhœa.

The dietetic conditions in the two series of cases previous to the onset of the disease were similar, except that in the Mesopotamia series of cases, owing to difficulties unavoidable to an expedition of that nature, the dietetic factor undoubtedly played a more important part than in the Dardanelles cases.

Clinically and pathologically there is not the slightest doubt that all the above cases were typical cases of beriberi.

Of the twenty-six Dardanelles cases, twenty-one had suffered from some toxic factor associated with recent jaundice, diarrhœa, paratyphoid fever, or purpura. It must be remembered, however, that the diet on campaign given in hospital for diseases like epidemic jaundice, diarrhœa, dysentery, and paratyphoid fever, while being suitable for the treatment of these diseases, is nevertheless very deficient in anti-beriberi vitamines, and thus, if one regards beriberi as due entirely to dietetic influences, these cases cannot be excluded as beriberi cases, since the diet associated with the treatment of the diseases in question might undoubtedly cause beriberi in a patient who, as regards his previous dietary, had only a small margin as regards his protection *qua* diet against beriberi.

In the Mesopotamia cases the toxic factor was quite unimportant and calls for no consideration, since the occurrence of toxic factors would undoubtedly have been as great amongst any other disease occurring in these troops.

Symptoms.

In the cases observed, which were almost entirely of the œdematous or wet type, the earliest symptom noticed was usually some weakness of the legs, or shortness of breath on exertion, generally accompanied by malaise and anorexia. In a few cases the œdema of the legs was the first symptom observed, but it must be remembered that the detection of a preliminary symptom is dependent on the subjective observation and intelligence of a patient, and can only be elicited by means of "leading questions." Paræsthesia of the legs occurred quite early in some cases, patients complaining of numbness, "pins and needles," and alteration in the tactile sense. The weakness of the legs was shown by inability to march or walk properly, the gait being somewhat unsteady. Probably one of the earliest evidences of weakness of the legs would be shown by the "squatting test," which was quite too much for any of the patients to perform at the time of examination. This test consists in the patient bending his knees and separating them while standing so that he assumes a squatting position with the buttocks a few inches from the ground. A beriberi patient is unable to raise himself up from this position, and often attempts to do so by climbing up his knees with his hands very much like a patient suffering from pseudo-hypertrophic muscular atrophy. The test should be remembered as a simple way of picking out early beriberi cases from amongst a body of men who may be likely to be affected with the disease. One patient said that he first noticed that something was wrong because he could not step up on to the firing ledge of his trench. For a few days he was lifted up there by his comrades and supported while he did his allotted task. He soon became too weak to walk, and then became a hospital patient.

Dyspepsia was an early symptom in most cases; it was not of a severe type, and consisted of epigastric discomfort and flatulence. There was commonly definite tenderness on palpation over the duodenum.

Swelling of the legs and feet was a marked symptom in many of the cases, and in some the œdema extended on to the thighs, scrotum, and abdomen. In severe cases there may be œdema over the sternum. In some cases the œdema was slight. It must be remembered that one important factor in causing the œdema is the standing position. In mild cases after resting in bed and appropriate treatment the œdema quickly clears up.

Nervous Symptoms.—Anæsthesia and analgesia occurred in all the cases; there was inability to distinguish on the feet and legs the difference between a pin-prick and finger touch when the eyes were closed. The exteut of this anæsthesia varied in different cases: in some cases the feet only were affected, in others the feet and legs, and in some cases the anæsthesia of the feet and legs was complete. In a few cases the upper extremities were affected. All cases showed definite weakness of the legs, and marked wasting occurred in all. The extensor muscles were affected more than the flexors, so that foot- and wrist-drop were present in cases showing severe nervous symptoms. There was not opportunity to test the electrical reactions of the affected muscles.

Tenderness of the calves on pressure was present in all the cases. In some cases cramps in the calves occurred.

Gait.—This was unsteady in type, and there was a tendency for the toes to drop and render walking difficult; the gait was somewhat high-stepping in type in some cases. The gait had not the stamping character peculiar to tabes dorsalis.

Some cases, *e.g.*, two out of the twenty-six Dardanelles cases, showed definite circumoral anæsthesia.

Laryngeal paresis occurred in two of the twenty-six Dardanelles cases, and in two of the eleven

Mesopotamia cases; there was loss of voice for some days.

Pharyngeal paresis shown by difficulty in swallowing, especially marked for liquids, occurred in one of the Mesopotamia cases and in one of the Dardanelles cases.

Reflexes.—The knee-jerks may be increased in the first few days. They are soon, however, diminished and become quite lost even with reinforcement by pulling the hands apart, the fingers being opposed.

An interesting symptom often present in beriberi cases is that the knee-jerk disappears before the Achilles-jerk, and when both reflexes are lost the Achilles-jerk is recovered before the knee-jerk when the patient improves.

Late signs in some of the cases showing severe multiple neuritis may be contractures of the muscles, *e.g.*, those of the calf causing a condition of talipes equinus; these are not common.

Cardio-vascular Symptoms.—The pulse is usually quickened, especially on exertion. In severe cases it may be feeble and irregular. Palpitation is a common symptom. The cardiac dulness is increased, both on the right and left sides. The heart shows signs of myocardial degeneration. The impulse is feeble, and the first sound of the heart is short and poor in quality. Often a systolic murmur replaces the first sound of the heart more or less completely. There may be a definite galloping rhythm in severe cases. Mild cases may show reduplication of the second sound of the heart. In the twenty-six Dardanelles cases twelve showed signs of marked cardiac involvement. In four of the cases the cardiac symptoms were of a very severe type, there being marked dilatation, irregularity, and galloping rhythm.

Pyrexia is absent in beriberi cases unless they are associated with intercurrent affections. Vomiting occurred in a few cases; it is a bad sign, and many of the cases terminate fatally. Loss of weight was marked in most of the cases.

Other Types of Beriberi.

(1) *The Acute Pernicious Type.*—In this type sudden death without previous complaint of illness may occur and the *post-mortem* examination shows signs of beriberi. Usually anorexia, nausea, vomiting, epigastric discomfort, and tenderness occur first, and these are quickly followed by marked cardiac symptoms. Dropsy usually occurs and also some signs of neuritis, such as anæsthesia, hyperæsthesia, paresis, or paralysis. The patient dies from severe cardiac symptoms within a few days.

(2) *The Dry or Atrophic Form of Beriberi.*—This is similar in its symptoms to the œdematous type, except that dropsy is absent. Marked wasting is a prominent feature. One of the Dardanelles cases was of this type.

(3) *The Rudimentary Form.*—In this type the symptoms are slight. The patient complains of malaise, dyspepsia, with paræsthesia and anæsthesia of the lower extremities, and some loss of power. The symptoms rapidly clear up under appropriate treatment.

Post-mortem Signs.

Three of the Dardanelles patients died. Careful *post-mortem* examinations were made on two of them. The following were the special *post-mortem* signs found in these two cases: Very marked œdema of the lower extremities, and to a slight extent on the trunk and upper extremities. The stomach showed marked redness of the mucous membrane, which was most marked in the pyloric half where the colour was deep crimson. The duodenum showed intense crimson congestion of the mucosa, most marked in the upper part. The jejunum and ileum showed marked congestion, some petechiæ being present in the ileum. The large intestine showed congestion. Numerous small hæmorrhagic patches about half an inch in diameter were present in the wall of the ascending colon. The mesenteric glands showed slight enlargement. The heart showed marked dilatation of the right and left cavities. No valvular disease was present. The lungs showed œdema and congestion of bases. The kidneys were congested and showed some œdema. The liver was congested and showed slight nutmeg change. The popliteal nerves were removed for subsequent examination for degenerative changes.

Etiology.

Gowland Hopkins in his recent studies of the important part played by vitamines in metabolism has confirmed the conclusions of the above mentioned investigators. Modern research on metabolism has shown that a diet of pure protein, fats, and carbohydrates, with due admixtures of salts and water, is not sufficient to maintain health, though the quantities given may be theoretically correct. A growing animal fed on the above dietary will cease to grow and will develop some deficiency disease, such as polyneuritis (heriberi) or scurvy. Some other addition is necessary in the dietary if the animal is to maintain health and thrive. Many natural foods contain the necessary additional substances, and these additional substances need only be present in most minute amount in order to make a diet which was formerly deficient quite ample for growth and health. The necessary additional substances are known by the name of "vitamines." The vitamine for preventing beriberi, or polyneuritis, in animals is different from that which prevents scurvy.

The katjang idjoe bean contains anti-beriberi vitamine, and its addition in amount of ¼ lb. a day to a polished rice diet will prevent beriberi in natives.

Yeast is perhaps the richest in anti-beriberi vitamine. Egg yolk, brain, liver, kidneys, sweetbread, oatmeal, haricot beans, peas, are all fairly rich in this vitamine. Milk and fresh meat contain only small amounts.

In the cases of beriberi in this series the dietetic conditions were compatible with the development of beriberi.

In the Dardanelles series the presence of a toxic factor such as jaundice, diarrhœa, or paratyphoid,

necessitated a special diet, which, though suitable to the diseases in question, was almost devoid of anti-beriberi vitamine, and so an additional dietetic factor was added to a borderland case, thus causing the development of beriberi.

It cannot be said that any of the above have been definitely established as causes of the disease. Certain is it that the "deficiency" theory has been proved to be the most important factor. It is possible that infective causes, such as microbic or fungoid, may also play a part.

Predisposing causes are undoubtedly bad sanitary conditions, an insufficient and poor quality diet, and previous debilitating diseases, such as dysentery, jaundice, and others.

Differential Diagnosis.

Scurvy.—In the Dardanelles series of beriberi cases three showed scorbutic symptoms, *e.g.*, purpura, though they could not be said to have scurvy. In scurvy important diagnostic signs are the following: The purple swollen gums with tendency to bleed. Purpuric patches on the skin. Anæmia. Hæmorrhage into the hard palate. Tenderness and swelling of bones due to subperiosteal hæmorrhage. This condition is most often evident in the tibiæ, and then there is a good deal of firm œdema of the skin around the affected bone. Indeed, swelling of the legs may be very marked, but there is great local tenderness over the tibiæ and not in the calves. The above signs clearly distinguish scurvy from beriberi. In scurvy also multiple neuritis is absent. The effect of treatment often serves to distinguish the two diseases. Thus, while scurvy rapidly clears up if special anti-scorbutic substances, such as raw potato, lemons, fresh vegetables (uncooked) are given, beriberi requires a special dietary of a different nature, as described below.

Multiple neuritis from other causes, such as alcohol, diphtheria, arsenical poisoning, &c., must be carefully distinguished from beriberi. The history of the case and other evidences of the action of the toxic agent—*e.g.*, cirrhosis of liver from alcohol, pigmentation, and rashes, and presence of arsenic in the urine or hair in arsenical neuritis—will usually enable a differentiation from beriberi possible.

Diseases of the spinal cord, such as tabes dorsalis, myelitis, sclerosis of various kinds, may be mistaken for the neuritis of beriberi. A careful examination for such symptoms as lack of bladder control, extensor plantar reflex, ankle clonus, distinguishes myelitis and sclerotic conditions of the cord from beriberi. In tabes the Argyll Robertson pupil, the marked ataxy, the absence of muscular wasting or tenderness of the calves are signs distinctive from beriberi.

Dropsy from other causes, such as renal disease, where the presence of albumin and casts in the urine and absence of neuritis are points of distinction; cardiac disease, where the history of the case—*e.g.*, previous rheumatism or syphilis, or other cause of valvular disease, the long duration of the cardiac symptoms without signs of multiple neuritis, and the physical signs of actual valvular disease make the distinction from beriberi easy. Epidemic dropsy is characterized by pyrexia, anæmia, and absence of multiple neuritis, which serve to distinguish it from beriberi.

Treatment.

Rest in bed is essential in the early stages and in all cases showing cardiac symptoms.

Diet.—In an acute case, where gastric symptoms are marked, the diet will necessarily be light and mainly liquid.

Yeast should be given. Two ounces of dried yeast, such as is supplied on campaign under the name of "export yeast," should be administered daily. This is conveniently given by pouring on the yeast a little boiling milk, stirring up into a thin cream, and then adding more warm milk and sugar, so that a palatable food results. In place of export yeast cakes of dried yeast mixed with a little starch are often available. These are supplied under the name of "Royal yeast cakes," which are like small biscuits weighing about ½ oz. each Six of these should be given daily. The following was found a convenient and palatable method of preparing the yeast cakes for consumption: One or two yeast cakes were placed in a basin, boiling milk was poured on them, and the cakes broken up and rubbed round with a spoon into a thin cream. Then warm milk and sugar were added, and the mixture was then ready for taking.

If neither of the above forms of yeast is available on campaign yeast can always be obtained from the Army bakeries, where yeast brews are constantly kept going. The yeast obtained here will be mixed with the liquid of the brew. About half a pint of this should be taken daily. It may be sweetened with sugar and flavoured with lemon rind or essence of lemon. It is quite palatable.

Pea soup is a useful article of diet, the pea powder containing anti-beriberi vitamines. Three or four raw eggs should be given daily, beaten up with milk, or taken in any other way.

The above dietary is rich in anti-beriberi vitamines, but a valuable addition to it will be fresh lemon-juice—*e.g.*, the juice of two or three lemons per day. This will contain anti-scorbutic vitamines, which are often needed by beriberi cases, owing to the close association etiologically between beriberi and scurvy.

Extracts of yeast are on the market. These taste exactly like extract of meat, and when mixed with warm water form a drink like ordinary meat extract or bovril. Yeast extracts may be given with advantage in beriberi cases, both acute and chronic.

Fresh vegetables, fruit, and, generally speaking, an ample dietary should be given in beriberi cases where there is no gastric disturbance.

The symptoms of beriberi call for special treatment. The cardiac symptoms will require treatment by means of cardiac tonics—*e.g.*, digitalis, strychnine, strophanthus, &c. In severe cases

strychnine and digitalin may be given hypodermically, and oxygen.

PROPHYLAXIS.

Diet is most important. On campaign it is often difficult to avoid some deficiency in those articles of diet which are especially rich in anti-beriberi vitamines. Haricot beans, pea powder given in pea soup, and porridge are valuable and convenient articles of an Army dietary in the field. Fresh vegetables are also important.

If beriberi is prevalent, undoubtedly some preparation of yeast should form a constituent of the dietary of men exposed to danger from this disease. Dried yeast or yeast cakes may be given, or else the yeast extract taken with hot water should be issued.

Beriberi cases can be recognized early by the application of the "squatting test." Cases showing the early symptoms should at once be put upon special treatment, since in the early stages the disease is easily and quickly cured.

Reviews.

BEDSORES: THEIR PREVENTION AND CURE. By Catherine W. Smart. 52 pages. Bale, Sons and Danielsson, Ltd., 83, Great Titchfield Street, W. Price 1s. net.

The authoress has set before herself a definite task: to instruct those who nurse both in hospitals and in private houses. The information she gives must be possessed by all who have the care of patients, and considerable advantage is obtained by having it all under one cover rather than scattered through a manual or text-books devoted to nursing in general. The authoress commences with the general remarks, and next deals with the treatment for prevention and cure. A chapter is devoted to utensils, simple but ample; a chapter to the bed and its requirements, and the final chapter headed "Concluding Remarks," which may be appropriately described "Nursing in War Time, or the Bedding of Fracture Patients."

RURAL SANITATION IN THE TROPICS. By Malcolm Watson, M.D., C.M., D.P.H. Pp. 320 + xvi. John Murray, Albemarle Street, W. 1915. 12s. net.

The author is so well known to practitioners of tropical medicine that little need be said to them on the utility of this work. With regard to the laity, particularly employers of labour, both native and European and Government officials, it is impossible to conceive a more practical book, or one more conducive to good health, the utilization of labour, and likely to yield satisfactory financial results. The book gives evidence that its compilation has been a work of love, and has given zest to the author's travels in all parts of the Tropics. He deals with quinine prophylaxis, and concludes with the place of sanitation in tropical colonization. Beginning with British Malaya, passing on to India, dealing with the Dutch West Indies, then with Hong Kong, Formosa, and the Philippines, and finally with Panama, British Guiana, and Barbados. What is particularly useful to the reader, and one that is so often lacking that it is permissible to appreciate it when found, is that every left-hand page indicates the subject-matter of the chapter, and every right-hand one the contents of the page, an epitome of each chapter being given at the commencement of every one. Considerable care has been devoted to the preparation of the plates and diagrams; the excellent photographs are well chosen and practical. Considering the interest that is now displayed in rubber and other companies situated in the Tropics, it is desirable that all having tropical interests should study this work. They will then know the difficulties that have been overcome and the problems yet to be solved.

Personal Notes.

INDIA OFFICE.

From November 9, 1915, to March 7, 1916.

Arrivals reported in London.—Lieutenant G. H. Mahony, I.M.S.; Colonel P. Strickland, I.M.S., A.D.M.S.; Lieutenant-Colonel G. G. Giffard, I.M.S.; Captain D. M. C. Church, I.M.S.

Extensions of Leave.—Lieutenant J. D. Wilson, I.M.S., 3 m., M.C.; Lieutenant A. E. Hamlin, I.S.M.D., 3 m., M.C.; Colonel P. Strickland, I.M.S., to March 28, 1916.

Permitted to Return.—Lieutenant A. E. Hamlin, I.S.M.D.

LIST OF INDIAN CIVIL OFFICERS ON LEAVE (INCLUDING MILITARY OFFICERS UNDER CIVIL RULES).

Showing the Name, Province, and Department, and the Period for, and Date from, which the Leave was granted.

Childe, Lieutenant-Colonel L. F., I.M.S., 7 m., April 18, 1915.

Gwyther, Lieutenant-Colonel A., I.M.S., Bl., 24 m., October 10, 1915.

Harrison, Major C. B., I.M.S., Ms., 13 m. 24 d., June 7, 1914.

Long, Major W. C., I.M.S., Ms., 12 m. 18 d., January 9, 1915.

MacLeod, Lieutenant-Colonel E. C., I.M.S., Assam, 19 m., March 16, 1915.

Melville, Lieutenant-Colonel H. B., I.M.S., Delhi, 29 m., April 1, 1914.

LIST OF INDIAN MILITARY OFFICERS ON LEAVE.

Showing the Name, Regiment or Department, and the Period for which the Leave was granted.

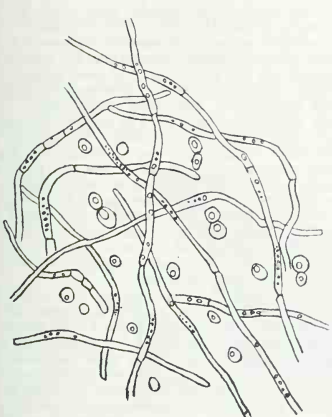
Church, Captain D. M. C., I.M.S.
Dawson, Lieutenant-Colonel A. W., I.M.S.
Giffard, Lieutenant-Colonel G. G., I.M.S.
Hamlin, Lieutenant A. E., I.S.M.D., to April 24, 1916.
Long, Major W. C., I.M.S., to January 26, 1916.
Mahony, Lieutenant G. H., I.M.S., to April 8, 1916.
McWalters, Captain M. R. C., I.M.S.
Nelson, Captain J. J. H., I.M.S.
Strickland, Colonel P., I.M.S., to March 28, 1916.
Wilson, Lieutenant J. D., I.M.S., to April 16, 1916.

Original Communications.

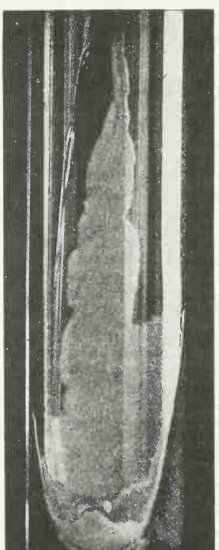
A CASE OF VAGINITIS PROBABLY DUE TO *MONILIA PINOYI* CAST. 1910.

By Aldo Castellani, M.D., M.R.C.P.

Singhalese woman—a vagrant—age about 35, was admitted to the Colombo Lying-in Home in October, 1914, being in a condition of advanced pregnancy. She was almost a dwarf, and greatly deformed, owing probably to rickets in childhood. The surgeon in charge of the Home, Dr. Sinnetamby, decided to perform a Cæsarean operation, but refrained from doing so by the discovery of a thick vaginal discharge, which, from its macroscopical appearance, was suspected to be of gonorrhœal origin. The discharge, collected by means of sterile swabs and also by a large sterile pipette with all precautions, was examined by me at the Bacteriological Institute. It was thick, of a yellowish colour, and contained some thick membrane-like formations in it, but the mucosa did not show any white patches like thrush. No gonococci or cocci of any kind were present; instead, an enormous number of yeast-like cells, long mycelial filaments, and a few bacilli were seen. The membrane-like bodies apparently consisted of enormous masses of the fungus. Several maltose and glucose agar tubes were inoculated, and white, creamy, roundish colonies, characteristic of a monilia, developed within twenty-four hours, and soon coalesced together. The fungus, for purposes of identification, was inoculated in litmus milk, gelatine, and various sugar broths. The results are collected in the following table:—



Fungus found in vaginal discharge.



Glucose agar culture of the fungus.

Litmus milk	..	..	O	Sorbite	..	..	O
Glucose	..	..	AG	Broth	..	..	O
Lævulose	..	..	AG	Peptone water	..	..	O
Maltose	..	..	AG	Indol	..	..	O
Galactose	..	..	O	Gram	..	..	+
Saccharose	..	..	O	Gelatine	..	..	O
Lactose	..	..	O	Serum	..	..	O
Mannite	..	..	O	Neutral red	..	..	O
Dulcite	..	..	O	Inosite	..	..	O
Dextrine	..	..	O	Salicin	..	..	O
Raffinose	..	..	O	Amygdalin	..	..	O
Arabinose	..	..	O	Isodulcite	..	..	O
Adonite	..	..	O	Glycerine	..	..	O
Inulin	..	..	O	Erythrite	..	..	O

O, negative result, viz., no coagulation of milk, no formation of gas, as the case may be; AG, introduction of acid and gas.

From the above table it will be seen that the cultural characters of the fungus are those of *Monilia pinoyi*, a hyphomycete I described in 1911.

Conclusion.

In a case of vaginitis with thick purulent discharge and no thrush-like patches on the mucosa, a fungus was grown with all the characteristics of *Monilia pinoyi* Cast. 1910. This fungus was probably the cause of the condition.

THE PREVENTION OF CONCEPTION AMONGST THE NATIVES OF THE KASAI BASIN, CENTRAL AFRICA.

By Walter E. Masters, M.D.Brux., L.R.C.P.Lond., &c.

Late Medical Officer in the Republic of Colombia, S. America; Medical Officer, District du Kwango, Central Africa.

The prevention of conception is practised by civilized as well as uncivilized people perhaps the whole world over. It is very common in India where widows are not allowed to re-marry.

The reasons for the practice vary greatly, among which are:—

The desire not to have large families.

Indulgence without result in married and unmarried couples.

The outward attempt to maintain caste rules in India.

To limit the frequency of childbirth.

The means used also vary greatly, some being mechanical on the part of the male, others mechanical on the part of the female, but perhaps the administration of drugs by the mouth and the mechanical obstruction of the vagina are more common among uncivilized people.

Amongst the Bapiudas, Bambundas, and other tribes of the Kasai Basin there prevails the desire not to have a child more frequently than once in three years. To prevent the possibility of this, native remedies are taken by the mouth, but more frequently the vagina is plugged with rags or finely chopped grass. As can well be imagined, the results are often disastrous to the females in question: Constipation, or rather, the physical retention of fæces, with tenesmus; reteution of urine with incontinence and urænia are common, not to mention the ascending of the local iufection to the genital organs and kidneys. The following three cases have recently come under my observation:—

Case 1.—A native female, aged about 35, was admitted to the hospital moribund. There was a history of coustipation for eight days, and of urinary retention for several days with slight incontinence. There was marked abdominal pain and increasing drowsiness for six days. The bladder was distended nearly to the sternum and there was free fluid in the peritoneal cavity. The "husband" emphatically refused permission to examine the patient *p.r.*, as did also a crowd of women who had accompanied her to the hospital. They threateued to remove the patient by force if the attempt was made. Purgatives were given and a large amount of fæcal material was passed. It was not possible to pass a catheter. The patient died in twenty-four hours and a partial *post-mortem* examination was done. The vagina was found to be very firmly plugged with a cloth which was about half the size of a man's closed hand. This pressed upon the rectum behind, causing retention of fæces and occluded the urethra against the pubis in front. Urine came away freely when the cloth was removed; there was no stricture. The cloth was replaced and the abdomen opened. The bladder, ureters and the pelves of the kidneys were distended with urine and the abdominal cavity contained about 1 litre of fluid of the same nature as the urine, but no rupture of the bladder could be found.

The withdrawal of the cloth would certainly have saved the woman's life. The "husband" and the other women denied any knowledge of the cloth plug.

Case 2.—A native female, aged about 30, was brought to the hospital by the "husband" and a crowd of women who desired to be present to the last. The "husband" stated that the woman had been ill for one month and had been dying for six hours. There was retention of fæces with tenesmus and retention of urine with incontinence. There was great abdominal pain and marked exhaustion. An examination was permitted. The bladder was distended to just above the umbilicus; the vagina was plugged hard with finely chopped grass and made into a pulp. The rectum was pressed backwards and the urethra forwards, as in the former case. The urethra was prolapsed and looked like a "red cherry" at the urinary orifice. The grass plug was removed and the urine flowed in a good current. The bowels acted regularly, there being no real need for purgatives.

Two days later, when visiting the wards, the patient, who had made remarkable progress, did not seem so well. Upon examination a cloth was found tightly wedged in the vagina "to prevent the urine from dribbling away." This cloth had been torn from her loin-cloth and put into position surreptitiously. An attendant was placed in charge of her and in ten days she was discharged well, the prolapse having much improved without an operation. She was two months preghant.

Case 3.—The patient was a chief's daughter, aged about 17, who had beeu "given to a white man." Conception was not desired. Several decoctions were prepared from native plants and given by the mouth but without success, for the girl became pregnant. The natives then administered a black powder to her which "was sure to bring the child away prematurely." The dose was followed by severe vomiting, acute abdominal pain, diarrhœa, and exhaustion for two days. In a month another dose was given with the same result. One month later a third dose was given and the contents of the uterus were expelled, which contained an embryo of about six months. The girl was seen by me for the first time three days after this latter incident, when I found her suffering from a foul vaginal discharge. Temperature 104·6° F., pulse 140, retained secondaries, left salpingitis and localized pelvic peritonitis. The vomiting and

diarrhœa had ceased. After twenty days in hospital she was discharged cured.

This latter case is one more of criminal abortion than an attempt to prevent conception, but it indicates what drastic measures the natives will adopt in order to prevent childbirth.

As a result of the methods described above and the scourge of trypanosomiasis the region will not be decimated, but depopulated, in a few years. As many as 45 per cent. of the thousands whom I have examined have enlarged cervical glands, which means that they will die off within about three years. Labour has to be imported in consequence and the development of the country is seriously set back.

MADURA FOOT IN TRINIDAD.

By R. Sheuult, M.D.Edin.

Resident Surgeon, Colonial Hospital, Port of Spain, Trinidad.

The patient, a poorly nourished male East Indian immigrant, aged 38, was admitted to the Colonial Hospital, Port of Spain, Trinidad, on September 29, 1914, with the following history:—

On admission to hospital the left foot was found to be enlarged; it had lost its natural contour, and was more or less ovoid, the sole being slightly curved and the sides rounded. The whole of the foot as far up as the ankle was covered with raised, rounded, slightly vascular fungating masses about half an inch in diameter, with minute fistulous openings pouring out an offensive sero-purulent discharge which contained small, dark, roe-like granules. The openings led into sinuses which penetrated deeply into the tissues in various directions. On probing the sinuses dead bone was felt. The leg was atrophied from disuse.

The reproduction from a photograph of the foot shows the characteristic appearance of mycetoma.

Surgical intervention was deferred for a time in view of the presence of diabetes mellitus and cataract, which complicated the case, but as the patient was suffering great pain and was prepared to take the risk of operation, the leg was amputated just below the knee on January 14, 1915, with successful result.

It does not appear that the patient was affected with the disease on his arrival from India sixteen years ago if his history can be relied upon, and

Fig. 1.—Photograph of foot before amputation, showing openings of sinuses.

He had arrived in the colony in 1899 under terms of indenture, and had been employed as as agricultural labourer on a cocoa plantation until about a year ago. In 1908, while picking cocoa, a pod fell on his bare foot and caused him considerable pain at the time, but there was no apparent injury. Three years later he noticed some swelling of the same foot and the formation of "three sores" on the instep. These healed, but soon broke out again, and were followed by the appearance of similar sores until the whole of the foot was studded with them, especially on the inner side. Pain, which was at first absent, became a prominent feature as the disease progressed, and latterly it was so severe that the patient clamoured for amputation of the limb. It may be noted that usually it is with the greatest difficulty that consent to operation is obtained from the East Indian immigrant.

there is no reason to disbelieve him, especially as indentured immigrants are carefully examined in India and on their arrival here before they are allotted to the various plantations in the colony, and for at least five years they are under careful medical inspection. I hardly think that such a condition, if it existed, could in these circumstances have escaped recognition.

I have looked into the literature of the subject, but can find no record of the occurrence of mycetoma in the British West Indies. The disease, however, is not unknown in the New World. Cases have been reported from Brazil, Argentina, Chili, U.S.A., Nicaragua, Cuba, and Costa Rica by competent observers.

Dr. F. C. Lassalle, the acting bacteriologist, who examined the discharge from the sinuses, reported as follows:—

"Microscopical examination of the dark, roe-like granules in the discharge showed a mycelium of thick, septate, and branching filaments of the characteristic Streptothrix mycetomi, the periphery showing a zone with radiate arrangement. Culture on agar produced a felted grey mass and black granules amongst the mycelium."

In the absence of more definite cultural and other evidence it is difficult to identify the species of mycetoma in this case, but it would appear to be the classic black mycetoma caused by the Madurella mycetomi, which is probably an aspergillus. It is interesting to note that a new Discomyces has recently been reported from Brazil by Dr. Lendenberg; the grains, however, described by him differ in colour and size from those observed by me.

Dr. Andrew Balfour and Dr. Stevenson, who kindly examined sections of the sinuses for me, have not been able to establish the identity of the

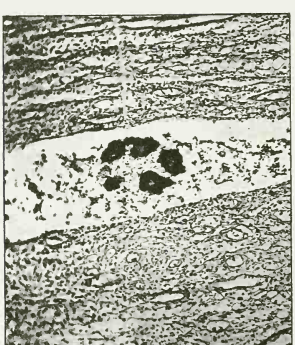


FIG. 2.—Photograph of section of sinus, showing mycotic nodule. x 150 diameters.

species of mycetoma, but the former tells me that it resembles very closely a type met with by him in the Sudan, and which has not been classified.

I have ventured to place this case on record, not on account of any special feature presented by it, but because of the extreme rarity of this parasitic disease in the colony. This is the first case of mycetoma I have met with during twenty-two years' hospital practice here.

BERIBERI EARLY DIAGNOSED AND READILY CURTAILED.

By A. P. DRAPER, M.D.

Colonial Service, St. Helena.

IN a letter addressed to C. W. Daniells, M.B., F.R.C.P., Dr. Draper gives the following interesting account of an early outbreak on board ship:—

A Norwegian barque five months out from Lamu, near Zanzibar, put in at St. Helena in the summer of 1915 for water, &c. The captain brought to my notice one of the crew who had been for some days complaining of nausea and a feeling of cramp and pins and needles in his legs and feet. On examination I found there was slight œdema over both tibiæ, slight loss of sensation in the legs, knee-jerks normal. His pulse was rapid, and the apex beat displaced slightly outwards and downwards. I went very fully into his diet. He, in company with the rest of the crew, had eaten very sparingly of rice which was not over-milled, but the ordinary brown rice. I prescribed for him plenty of fresh air—indeed, told him to sleep on the deck—green vegetables and no rice, absolute rest, and also put him on a mixture containing tr. digitalis, sp. ammon. aromat. and liq. strychninæ. When he had gone, the captain complained to me that he felt somewhat the same symptoms himself. On examination his condition corresponded precisely with that of the previous patient, save that the heart was more markedly dilated. There was a slight mitral systolic murmur, pulse-rate 112, with accentuated second sound. The œdema of the legs was more marked. There was tenderness on deep pressure over the calf muscles, with slight anæsthesia over the tibial region and dorsum of foot, knee-jerks normal.

I inquired if any more of the crew were complaining of like symptoms, and he said several. I overhauled the entire crew, with the result that out of fourteen men and boys nine had some of the common symptoms, but to a greater or less degree. I admitted three men into the civil hospital, viz., the captain, the carpenter, and a seaman whose case was the worst and the most interesting. He had complete loss of sensation over both legs from a line drawn round the legs at a distance of about 2 in. below the lower margin of the patella. There was only slight œdema of the legs, but they were both covered with a punctate rash which exactly corresponded with the zone of anæsthesia. He had exaggeration of knee-jerks on first admission to hospital, but they grew more sluggish, and in three days were hardly present. He had marked Rombergism, but no history of syphilis. I put all the patients on a stimulant digitalis mixture, and also on a purely vegetarian diet, and made them sleep in the open air. They improved so rapidly that they were able to rejoin their ship in a week, which sailed three days after.

The interesting point about these cases is the origin of this disease. The crew had eaten very sparingly of rice and had plenty of fresh vegetables. The water-tanks had been freshly lined with cement before leaving Zanzibar and water taken in there. The forecastle was no doubt overcrowded and very dirty, but then the captain, who lived quite apart from the crew, was taken ill, too.

I should be very pleased if you could give me your opinion on these cases. I may mention that the patients in hospital passed very scanty and high-coloured urine, sp. gr. averaging 1035.

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THE JOURNAL OF

Tropical Medicine and Hygiene

APRIL 15, 1916.

TYPHUS FEVER AND THE WITTENBERG CAMP.

SOME months ago we read in the newspapers a personal account of an epidemic of typhus fever amongst the prisoners at the Wittenberg Camp in Prussia. The account was so circumstantial, so deliberate and precise, that one was convinced it was true; but it was not until the evidence had been duly sifted by legal authorities in England that the terrible truth was brought keenly home to us. There is no difference between the earlier and the recent account in any important point, and what was regarded as pure gossip is now established as a fact.

Perhaps medical men of different nationalities are more attracted towards each other than any other section of the communities of alien countries. Their interests have so much in common; their dependence upon each other for information and scientific findings is so intimate; their professional services to each other's patients so constant owing to migrations, spa treatment, &c., that they are both socially and professionally associated from the very nature of their life's work.

It comes, therefore, as a great shock to the medical men in Britain that the desertion of the afflicted prisoners in Wittenberg Camp by the German medical staff should turn out to be true. It is a slur on the medical profession throughout the whole world. Luckily, but few instances of the kind are recorded in the world's history; in fact, we cannot recall anything of the kind occurring previously in Europe, nor even amongst qualified medical men in other continents, whatever their creed, colour, or nationality. The writer has seen in both Africa and Asia severe outbreaks of cholera and plague, but in neither occurrences did the native qualified practitioners desert their posts.

Those of us in Britain who know German doctors personally—and which of us does not?—cannot imagine the medical men of their personal acquaintance behaving in so inhumane a manner; and somehow one consoles oneself that the cowards referred to in the report could not possibly include the men of his acquaintance. Yet no one who has visited a German clinic can forget the seemingly harsh and unsympathetic manner in which the doctor in charge speaks to and behaves generally towards the patients under his care. In the first place, he speaks of them as "materiale," not as patients, and treats them accordingly. Were one to deal with the out-patients in a British hospital in a similar manner the hospital would soon be emptied, and it would be given the "go-by." This even extends to the other grades in our hospital staffs. The porter, when calling up the patients to go to the consulting-room, addresses the female patients not as women, but as ladies. "Now, ladies, please come this way," is how he calls them to come forward to go before the doctor, a term which indicates a wide step forward in civilization from the crude methods by which the German or Austrian porter deals with patients. Even in the consulting-room in Germany the doctor speaks to and strips his patient in a manner which often makes his British listener resent the behaviour; but when he sees the cowed appearance of the patient thus addressed he resigns himself to the "ways of the country," and forgets the circumstance after a time. This disregard for the feelings of the sick and injured is inured in the German; "materiale" should have no feelings, and should any be shown they are disregarded.

It requires but a step in imagination to under-

stand the desertion of the sick amongst men thus bred. The whole training in Germany has materialism for its basis; sentiment is not allowed to enter into the consideration, and if it is a question of personal convenience or State needs, sentiment is excluded and materialism reigns supreme. If this is "Kultur," let us have done with it; the German behaviour throughout the War has been practised on a non-sentimental basis; but when it comes to the medical profession deserting the sick and suffering committed to their care, then has that nation sunk low indeed.

The report has it that over 15,000 men were confined by barbed wire within an area of ten acres. One thousand five hundred people on an acre of ground is surface crowding beyond all the rules of sanitation. And when it is remembered that in a camp drainage is always primitive; that prisoners' fare in Germany is notoriously a starvation allowance only; that without clothes to cover them, and mostly without a roof over their heads during the severity of a North German winter, men could be expected to live at all was either a piece of ignorance on the part of the German doctors or a definite conspiracy on the part of their superiors to get rid of the inconvenience of housing and feeding prisoners by letting them die. It may be put forward in amelioration of the desertion that the doctors were not free agents in the matter, and that they had to obey the behests of those in higher command. One wishes to be able to think so; but the behaviour generally of doctors towards their own people in hospitals in Germany is so repugnant to British folk that one can understand their loathing of the hated enemy prisoners, men who had dared to thwart the will and power of the German Army and its heathenish-conceived ideas of "Kultur." A nation which has set aside Christian teaching and does not hesitate to crucify Christ afresh, under the pretext of war, can descend to any level; but to desert helpless prisoners so that disease may annihilate them is a piece of satanic fiendishness hitherto unknown to nations with any pretensions to civilization.

The medical profession of this nation so steeped in devilry will come amongst us again with professions of "Kamerad," with the doctrine that science knows no country, no boundaries, and that all medical and scientific men are brothers. We would remind them that Cain killed his own brother; a poisoned mind has a poisoning influence, and we do not want "Kamerads" of the kind, whether spelt with a "C" or a "K."

It was a misfortune for the Germans that of the six British doctors sent to treat their comrades only three died, for then they would have been able to give their version of the matter only. But the evidence taken and sworn to by three British medical officers is irrefutable, and no amount of "Kultur" explanations or evidence can ever remove this stain from the annals of the German medical profession.

The "brave" German medical officer who visited the camp once in a way, wrapped in waterproof clothing and with other mediæval methods of protection against infection, and condescended to address the occupants as "swine," as he termed the prisoners, was on a level with the crowd of men, and especially women, who found a daily pastime in jeering at these afflicted men from over the wire entanglements, and rejoicing when a coffin containing the body of one of the prisoners, done to death by neglect and disease in this authorized German pest-house, was borne to its last resting place.

The German doctor wore the Iron Cross, an "honour" no doubt given to the more violent of the deriding savages who helped him to take vengeance upon the fever-stricken prisoners and the dead victims of their perfidy.

MEMORANDUM ON SPIROCHÆTES IN THE GOLD COAST.

By Professor W. J. Simpson, M.D., C.M.G.

In 1908, when I was in Cape Coast in the Gold Coast Colony dealing with plague, the head man of the gang employed for cleansing and disinfecting the houses was suddenly attacked with illness, which proved fatal within thirty-six hours. He was a Krooman.

There was a history of high fever, vomiting, and collapse. A few hours after death a *post-mortem* was made by Dr. Barker and myself, as it was important to determine whether he had died of plague. The skin showed at this early stage well-marked blotches and hæmorrhages, and was of a yellowish hue, which caused us both to wonder whether he had died of yellow fever or from some indigenous poison that had produced this effect. On opening the body there were no signs of buboes, the lungs were congested, the liver was enlarged, of a yellow colour and apparently fatty; the spleen was enlarged and congested; the stomach and bowels were congested.

Examination of the blood and juices of the several organs and glands showed no plague bacilli, but the blood contained great numbers of spirochætes, and others were also present in the spleen juice.

I am now publishing this note, for until recently I was under the impression that the spirochæte found by Dutton in relapsing fever in the Congo was also known to exist in other Colonies of West Africa.

LONDON SCHOOL OF TROPICAL MEDICINE.

Examination Results. Fiftieth Session. January—April, 1916.

H. Bayon, M.D.Genoa (Distinction); J. A. Beels, M.D.; E. A. Blok, L.R.C.P. & S.Edin., L.F.P. & S.Glas., L.M.S.Ceylon; Miss V. G. Field, L.R.C.P. & S.Edin.; W. N. Leak,[1] M.R.C.S., L.R.C.P. (Distinction).

[1] Dr. Leak gains the "Duncan" Medal, this being awarded to the student who obtains the highest aggregate of marks.

Annotations.

Quassia in Ankylostomiasis.—W. S. Barnes writes in the *Argosy*, Demerara, that he doubts if any intestinal parasite can withstand the B.P. infusion (concentrated by boiling to half its bulk) given in doses of 5 oz., with ½ to 1 dr. of Epsom salts for a week or less. The dose is taken fasting every morning; it is essential that no food or drink be taken before or for some time after the dose to prevent its dilution.

Paratyphoid Complications (Minet, *Presse Medicale*, January 20).—Paratyphoid fever is not a mild affection, over in two weeks; in a typhoid hospital near the Front its localizations and complications are liable to be the same as with typhoid, although less frequent. In sixty paratyphoid cases there was intestinal hæmorrhage in three. The hæmorrhages kept up for several days, and in one case returned two weeks later, but the men recovered. Another paratyphoid B patient developed acute cholecystitis, with colic, in the course of which the pulse became thready and the heart-beat 160. The man died suddenly when apparently on the road to recovery. In two cases there was paratyphoid phlebitis, with recovery; and physical signs of myocarditis were manifest in nineteen. Heart tonics were given regularly to all; epinephrin was a valuable aid in some cases; caffeine gave no relief. The heart should be examined regularly, every day, in every paratyphoid case. In seven of his sixty cases there were pleuropulmonary complications like those encountered in typhoid. In one case paratyphoid bacilli were found numerous in the sputum, some pre-existing lesion having afforded a nest for the bacilli, entailing a chronic process. In time the pre-existing infectious germs got the upper hand and crowded out the paratyphoid bacilli.

Typhoid treated by Injections of Polyvalent Sensitized Typhoid Vaccine Sediment (F. P. Gay and H. T. Chickering, *Archives of Internal Medicine*, February).—In sixty-five of 105 cases of suspected typhoid the diagnosis of typhoid was made from both clinical and laboratory data. In these sixty-five cases Widal was positive in sixty (93·7 per cent.) and as early as the fifth day, the high percentage of results being due, in a large measure, to the method employed, namely, the use of the macroscopic method and a formaldehydized culture of the typhoid bacillus. Of the blood cultures taken in fifty-eight cases there were forty positive (70 per cent.), including a case first seen on the thirty-second day. In only one case of the sixty-five were both Widal and blood culture negative, which case was diagnosed by the presence of *B. typhosus* in the stools. The method of treatment employed consisted in the intravenous injection of $\frac{1}{50}$ to $\frac{1}{25}$ mg. (150,000,000 to 300,000,000 bacteria) of a sensitized, polyvalent, killed typhoid vaccine sediment prepared after the method of Gay and Claypole. In 66 per cent. of the cases a distinct benefit was obtained; in 41·5 per cent. of this 66 per cent. the recovery was of an abortive form, with a critical fall of temperature and a permanent normal temperature established within a few days. This permanent normal temperature was reached on an average seven days after beginning treatment in these cases. A series of subcutaneous injections following the intravenous treatment apparently aids in preventing relapses.

Collection of Blood to avoid Errors in Sero-diagnosis (M. Parvu, *Archives des Maladies du Cœur*, December, 1915).—It is far from being immaterial whether the blood for the Wassermann or similar tests is drawn from the finger or the ear, or by the puncture of a vein, or whether the serous fluid in a blister is taken. The antibody content is always highest in the blood obtained by puncture of a vein. Hence this should be used in testing for antibodies; positive results may be obtained here when the blood from the ear or finger is constantly negative. Error from this was noted in 40 per cent. of twenty cases examined for the purpose. There is also danger of contamination with the other techniques, which is avoided with the vein puncture, while the serum obtained in this way contains the maximum of antibodies, alexins, and hæmolysins. Further, the blood must be allowed to clot naturally; the ten or twelve hours which this requires allow time for the leucocytes to yield up to the serum all their lysins and antibodies. The blood should never be centrifugated or defibrinated for sero-diagnosis; otherwise the leucocytes keep alive and retain the antibodies. This is easily demonstrated by testing the serum for antibodies, alexins, and lysins at different stages of the coagulation process. It is better to wait till next day before decanting the serum.

Abstracts.

WORM OVA IN FLIES.

Observations made at the Mombasa Hospital showed that European patients assigned to the surgical wards, after varying intervals, contracted bowel troubles which were found to be due to intestinal parasites. An examination of 100 natives of indigenous races, admitted into or attending the hospital, complaining of intestinal troubles, had earlier shown evidence of helminthic disease in 83 per cent. of the cases. The most frequently found ova of parasitic worms were those of *Ancylostoma duodenale*, *Ascaris lumbricoides*, and tapeworm, multiple infections being very frequent. This combination of circumstances placed the flies frequenting these wards under suspicion. An investigation[1] showed that a con-

[1] Shircore, T. O., "A Note on some Helminthic Diseases, with Special Reference to the House-fly as a Natural Carrier of Ova," *Parasitology*, 1916, viii, 239.

siderable number of the flies actually harboured ova. Inasmuch as the flies are readily captured and can be preserved and subjected to examination subsequently, when opportunity is afforded, this plan offers a method whereby prevalence of helminthiasis may be determined in a locality where it is either difficult or impossible to obtain fæcal matter for examination.

FURTHER OBSERVATIONS ON THE CAUSE OF RAT-BITE FEVER.[1]

Since our comment on the subject, further contributions have appeared. Investigators[2] at the Imperial Japanese Institute for Infectious Diseases, in Tokyo, have identified spirochætes in preparations from two well-defined cases. The organism is described as somewhat larger than the *Spirochæta pallida*, but smaller than the *Spirochæta duttoni* and *S. obermeieri*. One of the patients was treated with mercury, and the other with salvarsan. Both recovered. In this connection the Japanese investigators recalled the fact that in recurrent fever, one of the spirochætal diseases which shows a temperature curve similar to that of rat-bite fever, salvarsan has proved effective; in syphilis likewise, which also resembles rat-bite fever in the swelling of the lymph glands and in skin eruptions, there is improvement with salvarsan and mercury. On the basis of these analogies, as well as of the microscopic findings, they suggest, with due reserve, that the newly discovered spirochæte is in all probability the cause of rat-bite fever.

On the other hand, Blake,[3] in Boston, has lately described a case of rat-bite fever which terminated fatally and furnished an opportunity at necropsy to add to the almost unknown pathological anatomy of the disease. The clinical picture which justified the diagnosis was typical of the recognized syndrome of the disease. There was a history of a rat-bite, a latent incubation period, non-suppurative lymphangitis, high fever ushered in by a severe chill, severe generalized muscular pain, stuporous condition, and a characteristic bluish-red macular exanthem. From the blood of this patient during life Blake isolated a streptothrix in pure culture, and apparently identified it with *Streptothrix muris ratti* first described by Schottmüller,[4] in 1914, after its isolation by him in eight consecutive blood cultures taken during a period of two months in a case of rat-bite fever.

Although successful animal inoculations have not yet fulfilled the strict requirements for the demonstration of the unquestioned etiologic relation of the streptothrix of Schottmüller to the disease, Blake is inclined to emphasize the high probability of this causative factor. Not only did he isolate the organism, but he succeeded further in showing the development of a powerful agglutinin in the patient's blood serum for the streptothrix. Furthermore, the necropsy revealed an ulcerative endocarditis caused by a streptothrix; and the presence of a morphologically similar organism in the sections of the mitral vegetation in the absence of other demonstrable organisms is taken as strong presumptive evidence that the same organism was the cause of the endocarditis.

In addition to the striking streptothrix septicæmia with localization of the organism in the mitral valve, producing an acute ulcerative endocarditis, there were the infarcts of the spleen and kidneys as a natural consequence. The subacute lesions of the myocardium, liver, suprarenals, and kidneys, glomerular and interstitial, were all of a similar nature, consisting of areas infiltrated with leucocytes, lymphocytes, plasma, and endothelial cells with varying degrees of degeneration of the normal cells of the affected area. It may be assumed that these lesions were toxic in origin, since the presence of the streptothrix itself was not demonstrated in them.

Commenting on the facts at present known in reference to rat-bite fever, with the indications of similarity in symptomatology to cases occurring in Asia, Europe, and America, Blake[5] remarks that it no longer appears necessary to consider that cases are due to the bites of rats that have been imported from Japan. The greater frequency of the disease in Japan than elsewhere is probably due to the housing conditions and habits of the people, resulting in more frequent occurrence of rat-bites. So long as some uncertainty remains as to the actual etiology, the scientific basis for rational treatment must remain in doubt. Meanwhile, salvarsan and similar chemotherapy deserve continued trial on the basis of clinical experience, if nothing else.

"CAMP JAUNDICE" AND THE PARATYPHOID EPIDEMIC AT THE DARDANELLES.[6]

By MM. A. Sarrailhe and J. Clunet.

Surgeons who have had colonial experience have frequently observed that epidemics of jaundice make their appearance. Thus, in the Transvaal, a serious epidemic of jaundice, preceded by an epidemic of "intestinal fever," and a few years later another under the same conditions, affected the Indian troops in a camp in the Punjab. From 1901 to 1911, a period of ten years, an annual epidemic of jaundice occurred in the camps at Servières, Tunisia, in which there were about 800 men. "Every year at the beginning of June a few cases of jaundice

[1] Abstracted from the *Journal of the American Medical Association*, March 18, 1916.

[2] Futaki, K., Takaki, F., Taniguchi, T., and Osumi, S., "The Cause of Rat-bite Fever," *Journ. Exper. Med.*, February, 1916.

[3] Blake, F. G., "The Etiology of Rat-bite Fever," *Journ. Exper. Med.*, January, 1916.

[4] Schottmüller, H., *Dermat. Wochenschr.*, 1914, lviii, Supplement 77.

[5] Blake, F. G., *loc. cit.*

[6] Abstracted from the *Lancet*, March 25, 1916.

appear; they rapidly become numerous, being accompanied by fever towards the end of June. Three weeks after the appearance of the jaundice the epidemic of febrile gastro-enteritis commences. The jaundice epidemic reaches its height in July and disappears in August. On the other hand, the febrile gastro-enteritis is especially common at the end of September and in October, only disappearing in February. The nosological history of the camp is identical each year to within about fifteen days." One month before the Dardanelles epidemic there appeared at Chatby camp in Egypt an epidemic of jaundice, and it was often associated with a gastro-intestinal infection.

In practice amongst civilians small epidemics of jaundice, confined to a restricted number of cases, have often been noticed. Thus, recently P. Carnot and B. Weil-Hallé reported an interesting observation of a family epidemic caused by an "icterogenous paratyphoid bacillus"; this epidemic was limited to eight cases in which blood culture was impracticable, and in which bacteriological research was confined to the stools of the patients.

Conditions of Observation.—At the Dardanelles in a serious epidemic of "camp jaundice," the number of cases affected, amongst the French troops alone, exceeded several thousands.

Blood cultures to the number of 606 were made, of which 294 were positive.

Course of the Epidemic.—From the first weeks following upon the disembarkation a large number of cases of febrile gastric derangement were observed. This number increased in June, during which month 80 were notified, then 150 per week were evacuated per 10,000 men present on the peninsula. The height of the epidemic was reached towards the middle of July (196 were evacuated per week per 10,000 men present). Then it slowly decreased in August and in September (100 to 150 evacuations weekly); it was reduced to 30 to 60 in October, and to 25 to 30 in November and in December. But while the curve of the "typhoid group" of illnesses was declining in August, an epidemic of jaundice began which rapidly developed until it equalled the first-named epidemic in importance at the end of September, and exceeded it in October. In December they both persisted, though reduced and nearly equal to each other. It is remarkable that the troops from the peninsula who were sent to Serbia in October took with them the seeds of their epidemic to a quite different climate, and that even at the beginning of January, in Salonika, the epidemic of jaundice persisted amongst them, whilst no single case of jaundice had been observed amongst the troops coming direct from France, though subjected to the same conditions of life.

In the British forces in Gallipoli the jaundice epidemic started a fortnight later than in the French force, but it followed an absolutely parallel curve, though retarded, and was still more important.

It is remarkable that, according to various precise and "revised" reports furnished by intelligent Turkish prisoners, there was no case of jaundice amongst the Turkish troops, whose sanitary condition was in other respects deplorable and far inferior to that of the Allies, and who were separated only by a few yards from the French and British troops who were at the height of the jaundice epidemic.

The commencement of the epidemic presents certain interesting peculiarities. The first case appeared about August 10 amongst the sappers of a company of French Engineers who were just then detailed to organize the first-line trenches and subsidiary defences—a task in which the men were especially exposed, and which was rendered very trying by the temperature, dust, and flies. On the next day two fresh cases were reported, the next day three or four, then eight or ten. Malingering was suspected, and picric acid was vainly searched for in the urine. Eight days later isolated cases were reported in the artillery, then in the infantry, then amongst the camp followers. From the end of August the epidemic numbered its patients among all formations in the peninsula, and blood cultures afforded proof that it was indeed a question of infectious jaundice.

The epidemic of febrile gastric derangement and of jaundice was not the only one in the peninsula. In June, July, and August, and the beginning of September, a time when the *Phlebotomus papatasi* was swarming in all the old walls of Sedd-ul-Bahr, the tertian fever was raging. During the same time dysentery made its appearance. The latter, amongst the French troops, always remains in the background. Only a few cases of amœbiasis occurred, and the "dysentery bacilli," isolated from the stools and studied, appeared for the most part to be of diminished virulence and somewhat different from the usual types. On the other hand, amongst the English the epidemic was more serious, and there was an abundance of cases of amœbiasis contracted at Gallipoli, which is in no way surprising if the numerous germ-carriers who, before arriving in the peninsula, made long sojourns in Egypt or on the Suez Canal, are kept in mind.

Some fancied that dysentery especially and summer diarrhœa—from which but few members of the Expeditionary Force were entirely free—were the cause of the jaundice epidemic. Dengue could only have acted as quite a secondary predisposing cause, contributing to weaken the organism, and from that point of view being far less important than the conditions of fatigue, climate, and feeding. Prolonged diarrhœa and dysentery certainly played a more important etiological part; but they are absent in a large number of typical jaundice cases under observation, and must also themselves be reckoned amongst predisposing causes.

Clinical Study.

(1) *Febrile gastric derangements before the epidemic of jaundice*, during the months of June, July, up to mid-August, did not seem to us to differ sensibly from what we had observed on the French front. The very great majority of the patients had been vaccinated; true cases of typhoid

were rare; in spite of fatigue, of climatic conditions, of conditions of dwelling and bad nourishment, the more serious types were few in number from the start, and typhus exceptional. True that at that period of the campaign the larger part of the sick were rapidly evacuated from the peninsula and were removed from our observation a few days after the blood culture. The clinical fact which especially attracted attention during that period, and which, moreover, persisted since, was the frequency of sudden attacks. The night before a man would be performing his usual duties; in the evening he complains of a slight headache; he sleeps badly that night; the next day his temperature (subaxillary) is 38° or 40° C., his tongue is coated with red edges, and continuous fever appears. The premonitory symptoms usual are headaches and prolonged insomnia, epistaxis, progressive rise of temperature; eruptive pink patches are not so common.

(2) *Febrile gastric derangements during the period of jaundice*—that is to say, commencing at the end of August—differ somewhat from those of the preceding period. True typhoid becomes rarer and rarer. From November not a single authentic case was identified. The epidemic diminished in the number of cases, but especially in the decrease in the virulence of infection. Several cases of the illness ran their whole course in the peninsula without any necessity of evacuation; several patients were not even sent to the ambulances, and their febrile gastritis, with continuous fever for fifteen or twenty days, was nursed and cured at their unit, in the trenches or under canvas, and sometimes the patients were not even undressed. The benign character of certain cases might have caused one to doubt the diagnosis had it not been confirmed by the blood culture.

Another characteristic of the febrile gastric derangements of that period is the frequency of hepatic symptoms—namely, increase in size and sensibility of the liver, and especially increased size of the gall-bladder, with sharp pain on pressure and a sensation of epigastric obstruction and nausea. From the month of September on these hepatic and cholecystic symptoms in more than half of the cases of febrile gastric derangement were unaccompanied by jaundice.

The serious cases with suppuration are quite exceptional. In a case of suppurative cholecystitis with perforation in an English patient, the culture of pus obtained during the operation showed a bacillus of the paratyphosus B type.

(3) *Febrile jaundice* made its appearance in the middle of August. The trouble commences, like an ordinary gastric derangement, with insomnia, headache, sudden heats, general curvature, malaise, and continuous fever between 38·5° and 40° C. From the beginning symptoms of cholecystitis are often observed; epigastric obstruction, nausea, shivering, pain and resistance in the body wall, localized at the gall-bladder. At the end of five or six days the urine becomes brown; one or two days later jaundice appears in the conjunctivæ and the sublingual mucosa, later extending to the skin generally. With the appearance of the jaundice a decrease in temperature to about 38° C. almost always coincides. Then the curve descends very gradually during from eight to ten days, subsequently returning to normal after a rise lasting from twenty-four to forty-eight hours, sometimes very clearly marked—36° C. and less.

The stools, sometimes diarrhœic, and which were brown or yellow before the jaundice, almost always become solid during jaundice. In most of the cases observed they are not colourless during this period; indeed, they often become darker. Pruritis is entirely absent. In spite of the favourable prognosis convalescence is often painful and very long; for one month and more asthenia and anorexia are persistent; sensitiveness of the gall-bladder is also often very clearly marked several months after the total disappearance of the jaundice. The spleen is seldom increased in size at the beginning of the illness, but during convalescence it often becomes enlarged.

Against this clinical type of febrile jaundice, which is the most frequent, are a number of varieties. The jaundice may appear during convalescence from an attack of febrile gastric derangement which had up to then presented no hepatic symptom. Or it may, on the contrary, precede the continuous fever by some days. The jaundice may be slight, betraying itself only by the modification of the mucus and urine, being accompanied by very marked symptoms of cholecystitis. It may, on the other hand, be intense, turning the skin a saffron colour, and the gall-bladder may be hardly painful at all. The stools are nearly always coloured during jaundice, but sometimes colourless later during the course of the jaundice. Fever must often be expected; the temperature rises to 38° or 39° C. during the two days of malaise before the jaundice, then it falls to the neighbourhood of normal when the skin becomes coloured. If the blood culture is practised from the first day when nausea and fever appear, it is positive; as soon as jaundice is present it becomes negative.

At the end of August, when the epidemic was spreading over the whole peninsula, two cases of serious jaundice developed in forty-eight hours, with high fever and then hypothermia, purpura, hæmorrhage, and death. A *post-mortem* examination on one of them showed acute fatty degeneration of the liver, enlarged spleen, and visceral hæmorrhage. Unfortunately, blood culture was not made, and the culture from the bile of the corpse was sterile. In spite of this negative bacteriological result, considering the etiological circumstances, these cases ought to be included in those of febrile jaundice of favourable prognosis which constitute the majority of the epidemic.

(4) *Apyretic cases of jaundice* appeared synchronously with febrile cases of jaundice from the commencement of the epidemic. They could be observed during its whole course, and at the beginning of January amongst the French troops in Serbia arriving from Sedd-ul-Bahr the two forms persisted. Apyretic jaundice usually has an in-

sidious start, but is progressive. The patient does not suffer from headache, insomnia, or curvature. He does his duty, though suffering from general discomfort, anorexia, slight nausea, and sometimes marked asthenia. He gets chilly and very sensitive to changes of temperature at sunset. He often feels a weight in the right hypochondrium, epigastric obstruction, and a definite painful spot over the right breast at the level of the right shoulder. Sometimes these symptoms are absent, and the intense coloration of the urine and skin are the first symptoms to attract the patient's attention. Out of fifty-five cases observed of apyretic jaundice thirty-one had coloured stools; in twenty-four they were colourless. There are, besides, all variations between the plaster-like or gummy stools and the brown or dark-green ones. Several cases had, as also observed in certain cases of febrile jaundice, first a normal coloration or even a bilious coloration, then several days after the appearance of the jaundice a colourlessness of the fæcal matter. The majority of patients were carefully questioned about pruritis, but only one case was observed. In these fifty-five recorded cases of apyretic jaundice only thirty-four gave hepatic and vesicular reactions: distension and sensitiveness of the liver, enlargement and sensibility of the gall-bladder, and resistance of the body wall at its level. The spleen for the most part was not enlarged, or enlarged only slightly, in the prolonged forms which last one month or more.

The course of the illness, which is always benign, is very variable in intensity and duration. Some patients only remained yellow from eight to ten days, and during that time were never incapacitated from duty. Others, on the contrary, were profoundly depressed, and had to keep their beds for one month or more. Some cases of jaundice lasted for more than six weeks, leaving asthenia which necessitated evacuation from the peninsula. In several relapses a fresh jaundice appeared from eight to fifteen days after the total disappearance of all the symptoms of the first attack. The most important element of prognosis appeared to be the degree of enlargement of the gall-bladder, cholecystitis persisting for the most part long after the disappearance of the jaundice, lengthening convalescence for weeks, while those patients who do not present any such symptoms are completely cured sometimes in a week.

Urine.—In 202 analyses of urine from September 21 to December 24 from patients suffering from febrile gastric derangement and jaundice albumin was present in 121 cases, *i.e.*, 60 per cent.; of urobilin in appreciable quantities in 142 cases, *i.e.*, 70 per cent.; of the biliary pigments in 132 cases, *i.e.*, 65 per cent.; and of biliary salts in 70 cases, *i.e.*, 34 per cent.

One fact deserves special attention. During the jaundice epidemic the febrile gastric derangements which were not accompanied by jaundice nearly all showed urobilinuria. In several cases biliary pigments and salts were found in the urine, a fresh proof of the infection of the liver in those cases without jaundice.

Bacteriology.—From June 10 to December 20, of 606 blood cultures on bile and on liver peptone broth, 294 were positive. The germs were identified by various culture media—Endo, neutral red, lead agar, milk, the medium of Petruschky, and by the experimental serums antityphoid, anti-paratyphoid A, and anti-paratyphoid B, furnished by the Pasteur Institute. During the first three months only text-book findings were seen. Thus the typhoid bacillus was isolated on thirty occasions and paratyphoid B on 102, but no paratyphoid A. Towards the middle of August atypical bacteria presented somewhat discordant reactions on lead agar and neutral red, and especially turned the Petruschky medium, whilst otherwise they behaved like paratyphoid B. The most striking thing is the non-agglutination of these germs by the experimental serums. Not to be explained by the alteration of the serums during summer; as fresh ones sent from the Pasteur Institute acted like the old ones, while certain serums of patients behaved on these bacteria like the experimental serums obtained from animals, agglutinating them strongly by the method of microscopical examination.

Comparing the curve of the non-typical germs with the clinical curve of the epidemic, their appearance coincides with the appearance of jaundice, and, in fact, in almost all jaundice patients and those affected by febrile gastric derangement during the epidemic of jaundice true typhoid bacilli and paratyphoid B were no longer found, but that variety of atypical germs which approaches sometimes the paratyphoid A, sometimes the paratyphoid B, but presents the characteristics mentioned, in presence of serum reactions. Called provisionally, for the sake of brevity, by the name of paratyphoid, species *Dardanellensis*, or species D.

A rapid examination of a certain number of strongly agglutinating jaundice serums, and more than 100 specimens of species D, allowed the Pasteur Institute to repeat the reactions that obtained at Sedd-ul-Bahr, but the complete bacteriological study of these germs demands prolonged work and will form the subject of a later note. Nevertheless, a certain number of facts can already be deduced.

(1) The characteristics of the germ cultures and of their serum reactions vary directly as the diminution in virulence of the epidemic and with the frequency of the hepatic localizations—cholecystitis and jaundice.

(2) More than one-half of the blood cultures practised during the two first days of jaundice are positive.

(3) The germs isolated in the febrile jaundice attacks and in the febrile gastric derangements without jaundice during the same period appear identical.

(4) These germs seem to have a selective action upon the liver, but may give rise to clinical mani-

festations in other viscera; thus a paratyphoid D was isolated in a state of purity from a purulent pleurisy with superficial necrosis of the lungs operated on in a case of febrile gastric derangement in November.

(5) The species D was perhaps special to the French epidemic. Four specimens of paratyphoid were isolated from the British epidemic. The two first came from blood cultures effected in febrile jaundice attacks and are typical paratyphoid B. It is the same with a third isolated from the pus of a case of suppurative cholecystitis, and with a fourth isolated from the depth of the wall of an intestinal loop resected for perforation in a case of febrile gastric derangement without jaundice.

Globular Resistance.—The globular resistance was studied in twenty cases of febrile jaundice, nine cases of febrile gastric derangement with cholecystitis unaccompanied by jaundice, and four cases of simple gastric derangement. The technique followed was that of Chauffard and Troisier, while, in addition, in almost all the cases the resistance of the red cells free from plasma, according to the technique of Widal and Abrami, was tested. Considering as normal the limit of hæmolysis with unwashed red corpuscles to vary between 0·40 and 0·49 the following results were found: Reduction of resistance in 64 per cent., normal resistance in 33 per cent., and increased resistance in 3 per cent.

Camp jaundice always appears under the same conditions—tired troops confined for several weeks in a restricted space and tried by imperfect feeding and by unfavourable climatic conditions. In most cases it appears during an epidemic of febrile gastric derangements, or else it follows the latter; more rarely it immediately precedes it.

Conditions were particularly favourable for studying the Dardanelles epidemic. Blood culture showed here was no mere coincidence, but that the jaundice was due to a hepatic localization with a paratyphoid organism. This localization depends upon complex causes, amongst which obstruction, temperature, diet, and previous history of diarrhœa doubtless play an important part, since no "camp jaundice" has yet been reported in the course of numerous epidemics of febrile gastric derangement on the French front.

It is remarkable that alongside of febrile forms where jaundice appears as a simple complication of septicæmia a large number of attenuated forms are observed in which the fever is of short duration, and even of forms completely apyretic which might be confounded with ordinary benign catarrhal jaundice, were it not for the epidemic conditions. The persistence of the coloration of the stools, the absence of pruritus, the albuminuria and urobilinuria associated with the elimination of the pigments through the urine, the diminution of the globular resistance, and the association of the affection of the gall-bladder and liver seemed the most interesting phenomena amongst those most frequently observed.

The biological characteristics of the germs isolated by blood culture coincides with the appearance of the jaundice in the course of an epidemic of paratyphoid.

From the practical point of view blood culture may render the greatest service in establishing the diagnosis in suspicious cases where several cases of jaundice suddenly appear in a collection of men placed in the same conditions of existence.

The prophylaxis of camp jaundice is similar to that of the typhoid diseases: disinfection of the soil, sanitation of dwellings, the quality and variety of food appearing to play a part almost as important as that of the quality of the drinking water.

Possibly the employment upon a large scale of polyvalent vaccines will one day render paratyphoid infections and their hepatic complications as comparatively uncommon in the Army as true typhoid is. But to attain this result it will doubtless be necessary to use vaccines of various origins: as the immunity conferred against typhoid, paratyphoid A, and paratyphoid B does not seem to give immunity against the species of paratyphoid D isolated at the Dardanelles.

New Preparation.

THE great difficulty in prescribing a new preparation is to remember its name, its composition, and the makers. Bynogen at once calls to mind Bynin, the well-known preparation of Messrs. Allen and Hanburys, the two-century-old firm, who also prepare the Allenburys' foods, to which Bynogen is supplementary.

The termination "ogen" suggests milk derived, combined with malt. Bynogen contains 20 per cent. dextrin malt, 75 per cent. milk protein, with 2 per cent. each of glycerophosphate of soda and lime, with 1 per cent. of glycerophosphate of magnesia.

Put shortly, Bynogen is a malt-milk-glycerophosphate preparation. It is a powder containing about 12 per cent. of nitrogen with phosphorus, miscible with any fluid; taken after meals or with meals, mixed with soups, puddings, &c.

Its use is indicated in many tropical diseases—malaria, dysentery, &c. It has a sphere of usefulness in beriberi and any form of debility, whether due to disease, dietary deficiency, or overwork. It also supplies a need in debility of parturition, of infancy, and childhood.

ERRATUM.

ON p. 79 of our issue for April 1, 1916, appeared a list of references to a paper on "Vaccine Treatment in Streptococcal Puerperal Fever," by Albert J. Chalmers, M.D., F.R.C.S., D.P.H., and Captain O'Farrell, R.A.M.C. The first two references are incorrect as printed, and should read:—

CHALMERS and ATIYAH: "Streptococcal Puerperal Fever in the Anglo-Egyptian Sudan," JOURNAL OF TROPICAL MEDICINE AND HYGIENE, January 1, 1916, xix, p. 1.

CHALMERS and MARSHALL: "Pathogenic 'Fæcalis' Streptococci in the Anglo-Egyptian Sudan," JOURNAL OF TROPICAL MEDICINE AND HYGIENE, March 1, 1916, xix, p. 54.

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Original Communication.

PRELIMINARY REMARKS UPON EPIDEMIC CEREBROSPINAL MENINGITIS AS SEEN IN THE ANGLO-EGYPTIAN SUDAN.

By ALBERT J. CHALMERS, M.D., F.R.C.S., D.P.H.
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AND
Captain W. R. O'FARRELL, R.A.M.C.
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CONTENTS. — *Introductory — Historical — Anglo-Egyptian Sudan — Etiology — Pathology — Bacteriological Diagnosis — Bacteriological Treatment — Prophylaxis — Conclusions — Acknowledgments — References—Illustrations.*

Introductory.—This is the first of what is hoped will be a short series of notes upon the difficult subject of epidemic cerebrospinal meningitis as seen in the Anglo-Egyptian Sudan. It contains a few preliminary and tentative remarks which are the outcome of three years' experience during which the disease has become increasingly prevalent in this country.

Historical.—Before commencing our real study it is most desirable to lay before the reader some account of the work already performed by numerous observers with regard to this complaint in order that the difficulties of its investigation may be made apparent.

To our minds the *phrenitis* of Hippocrates and of Celsus has nothing in common with cerebrospinal meningitis. We have been unable to refer to the works of Aretæus or of Paul of Ægina and, therefore, are unable to state whether the disease, which they are said hy Kutscher to have described in Italy, resembled cerebrospinal meningitis or not, and the same remarks hold good with regard to the epidemic described hy Ahdère de Lucien.

On the other hand, we have carefully read Sydenham's "Rise of a New Fever," which Arnell considers to be identical with the disease which he saw in Connecticut in 1807 and which, he also says, is the same as Cullen's "Typhus Petechialis" and the disease described in *Medicus Novissimus* published at the beginning of the eighteenth century. When superficially considered Sydenham's new fever does, at the first glance, read like cerebrospinal meningitis, but when the symptoms are carefully analysed they will be observed to resemble those of the enteric group of fevers, and therefore we are convinced that Sydenham's new fever is not cerebrospinal meningitis.

We have been unable to peruse Vieusseux's original account of the outbreak in 1805 at and around Geneva, but North's translation in 1811 of the article in the *Journal de Médecine de Paris* makes it quite clear that this was undoubtedly the disease in question, and the same author's *verbatim* account of Danielson and Mann's article published in the Medical and Agricultural Register of Boston with its careful clinic and *post-mortem* histories leaves no doubt that these two authors were dealing with an epidemic of cerebrospinal meningitis at Medfield in March, 1806. North's valuable little book containing all the early histories of the disease appeared in New York.

From this date onwards till about 1884 the whole ground of the history has been most ably reviewed by Hirsch in the third volume of his classical Handbook of Geographical and Historical Pathology, in which he divides the epidemics of cerebrospinal meningitis in Europe and America into four cycles, viz. :—

(1) 1805-1830, North America and Europe.
(2) 1837-1850, Europe, North America and Algiers.
(3) 1854-1875, Europe, North America, Africa (parts), Western Asia, and South America.
(4) 1876-1884, Small epidemics in former areas, to which may be added :—
(5) 1885 to present time. Recognition of the disease in the Tropics, West Indies, Fiji, Anglo-Egyptian Sudan, West Africa, Western Australia, Mexico. Severe epidemics in America and Europe, *i.e.*, this is the period of the first Pandemic.

It will thus he seen that the area in which the disease is recognized has gradually extended, and that this has been quicker of late years, probably due to increased facilities for travel which has introduced it by the agency of carriers into lands in which it probably did not previously exist, as, for example, Fiji, the result heing that at the present time it appears to he diffused all over the world and to occur as localized epidemics in different places in different years.

In the study of these epidemics certain important features were brought out, viz., the influences of over-exertion, starvation, over-crowding and bad ventilation, which account for the prevalence of the disease among soldiers and poor people and for its increase in different countries in periods of had weather, *e.g.*, during the winter and spring in cold climates and during the Hahoub seasons of the hot Anglo-Egyptian Sudan, or to a less extent the cold weather of the Sudan, when the people huddle together into crowded, ill-ventilated huts and houses.

The historical portions with which we are mainly interested are those concerned first with its occurrence in the Tropics and secondly with its etiology.

Occurrence in the Tropics.—The first record we have been able to find of the disease in a suh-tropical land is the occurrence of an epidemic in 1840-1847 in Algiers, in which country it has, from time to time, been reported. It is also said to have occurred in 1840 in Brazil and in Monte Video in South America.

In 1872 it was reported in Asia from Smyrna and in 1874-75 in Persia, according to Bruce Low in his paper on epidemic cerebrospinal meningitis published in 1899.

It is believed to have been present in Central America and in the West Indies prior to 1884, but without trustworthy information.

Corney has given an excellent account of the invasion of Fiji hy the disease. It would appear that the first cases were noted in 1876 in an immigrant labourer's depôt at Levuka, and from that time onwards it was probahly diagnosed as tetanus, sunstroke, or meningitis, until it assumed epidemic form in 1885, which he believed was due to the contagion

being spread from man to man—a very advanced idea at that time.

Cerebrospinal meningitis was reported from the West Coast of Africa by the Williams in 1900 and from then onwards from time to time. In 1905 there was a severe epidemic in Northern Nigeria, which was reported upon by Twomey and Davidson, and in 1906-08 in the Northern Territories of the Gold Coast, where it was ably investigated by Horn. In Northern Nigeria it was said that cattle were attacked, and in the Lorha district of the northern territories of the Gold Coast the natives are said to have noted a great mortality among fowls prior to the epidemic of the disease. According to Bargy and Horn the disease was marked at this time in French West Africa to the west of the Black Volta.

In 1909 it was reported as being present in 1907 in the northern districts of Togoland by Jaffé, when it was known to cause 300 deaths. Jaffé obtained the true diplococcus of Weichselbaum from his cases.

Epidemic cerebrospinal meningitis has been recorded in British East Africa since 1906, when Haran noted five cases, and has been ably discribed by Shircore and Ross in 1913.

In 1913 Butler drew attention to *a curious feature* of the disease, in that there are places in East and Central Africa where it has always been endemic and seldom epidemic, and he quotes Uganda in general, whilst in the highlands of British East Africa the endemic form is seldom seen but epidemics of greater or less virulence are known. He says that in one tribe alone between 20,000 and 40,000 deaths are attributed to this disease, a mortality which sleeping sickness can hardly be said to rival.

In India it appears to have been first reported by Vandyke Carter as occurring in July, 1878, in Bombay, where he says that he is not aware that it had been previously recognized. He does not appear to have published this observation until 1882, and then only in his work "Spirillum Fever," p. 436, when he gives not merely a clinical but a *post-mortem* account of one case and clinical histories of three others. As he has been said not to have recognized the disease it may be well to note that he heads the paragraphs in question *cerebrospinal meningitis*.

In 1884 Dimmock gave a full account of an outbreak in the preceding year in the Shikarpur Jail. Since then some cases have generally been reported year by year, and the whole subject of epidemic cerebrospinal meningitis in India was ably reviewed by Robertson-Milne in 1906.

In 1905 Castellani described two cases which occurred in Singhalese natives in Ceylon, and in 1913 Scott described cases of fulminating cerebrospinal meningitis in Jamaica.

This completes the history of the disease as revealed to us by the limited literature available in Khartoum, and we now turn to consider the historical aspect of its etiology.

History of the Organism.—In 1875 Klebs was the first to see cocci in the cerebrospinal fluid of cases of meningitis and to assign to them a causal function. He was followed by Eberth in 1881, in which year Gaucher was the first to see micrococci in the blood and urine in a patient during life and in the exudate from the spinal canal after death; and in connection with these findings in the blood one may invite attention to the observation of Cole in 1915, who obtained films of the peripheral blood in which ten out of 2,000 leucocytes showed the organism, and also to Osler's statement that Gwyn in 1899 was the first to isolate the organism from the blood in pure culture, In 1883 Ughetti also found micrococci in the exudate and in the blood, and in 1884 Marchiafava and Celli wrote a short work on the occurrence of micro-organisms, and especially diplococci, in cerebrospinal meningitis. They were also seen in meningeal exudates by von Leyden in 1883 and by Leichstenstern in 1885, but the last-mentioned observer noted that they resembled the gonococcus by being found in the leucocyte.

In 1886 Senger also noted them in the cerebrospinal exudate, while Fränkel with Weichselbaum, Foà with Bordoni, Uffreduzzi and Lemoine described the pneumococcus as the causal organism of a series of cases of cerebrospinal meningitis unassociated with pneumonia.

In 1887 Weichselbaum published his celebrated paper "Ueber die Ætiologie der akuten Meningitis Cerebrospinalis," in which he described eight cases of meningitis without pneumonia, two of which were due to the pneumococcus and six were caused by an organism which differed therefrom by being generally a diplococcus, more rarely arranged as tetrads and resembling the gonococcus, being often contained in leucocytes and being Gram-negative. He, however, distinguished this organism from the gonococcus by the fact that it produces in subcultures on agar-agar slopes a flat viscous growth which is greyish when seen by reflected and greyish-white when examined by transmitted light. It only grew at incubator temperatures and had but a slight vitality. This organism he called *Diplococcus intracellularis meningitidis* and looked upon its action as being toxic in nature, while he hesitated to regard it as the causal agent of the disease.

Although Weichselbaum's observations were confirmed by Goldschmidt in 1887, and by Edler and himself in 1888, they produced comparatively little influence, and were almost unnoticed until a polemik was started in 1890, which raged till 1893, as to the identity of Bonomé's streptococcus of epidemic cerebrospinal meningitis first reported in 1890, and Foà's meningococcus and the *Diplococcus pneumoneæ*, in which it was decided that Bonomé's organism was the pneumococcus, but the confusion was increased by Bordoni—Uffreduzzi regarding *D. intracellularis* as a variety of *D. pneumoneæ*.

This unhappy condition was accentuated in 1895 when Jaeger, while studying a regimental epidemic of fourteen cases occurring in Stuttgart, found the pneumococcus in two cases, a streptococcus in one case, and in eleven cases an intracellular Gram-positive diplococcus morphologically resembling the gonococcus, producing turbidity in broth, and forming short or even at times long chains, while it retained

its Gram-positive character in cultures. It grew well on gelatine at the temperature of the laboratory and preserved its vitality during fourteen days or more on artificial media. He concluded that this organism was Weichselbaum's *D. intracellularis*, and in this unfortunate conclusion he remained unopposed for years and was supported by Heubner in Berlin in 1896, who not merely was the first to obtain a coccus from the cerebrospinal fluid during life but who produced a fatal meningitis in goats with this germ, which at the time was considered to be an important experiment, as an epizootic meningitis was present in horses and horned cattle in Germany, further, he proposed the name meningococcus for this organism, notwithstanding the fact that Bonomé had already used it for the pneumococcus mentioned above.

This meningitis cerebrospinalis enzootica, or epizootic cerebrospinal meningitis, is often called the *Borna disease*, because of the attention paid to a malignant outbreak in horses at Borna in 1894.

It appears to have been first noticed in horses in 1813 in Würtemburg, and next in North America in 1847 by Large. In 1867 it was described by Meyer in cattle, in 1868 by Rolloff in lambs, and in the same year by Renner in a dog, an observation which was not repeated till 1896, when Uspenski also reported a case in a dog in Russia.

With regard to its etiology, Siedamgrotzky and Schlegel found a coccus measuring 0·6 micron in the subarachnoid fluid in an affected horse. This coccus they cultivated and reproduced the disease by intrameningeal injections. Johne found it both in the cerebrospinal fluid and in the blood of affected horses and noted that it was not constantly Gram-positive.

In 1909 Christiani ably reviewed and studied the whole subject and came to the conclusion that the coccus was not merely Gram-negative but closely resembled Weichselbaum's organism, being in the form of diplococci, tetrads and double short chains, but he rightly concludes that the question of the relationship of this disease to the cerebrospinal meningitis of man must be left to future workers.

There is a belief expressed by Hutyra and Marek in 1913 that this epizootic disease is not an etiological entity and that no conclusions with regard to it can be made until it has been more completely investigated.

It is obvious that it must be of the greatest importance to definitely settle the question as to whether (as is generally believed) the two diseases are quite separate or whether there is some relationship between the human and some undefined fraction of the animal complaint.

Thus we see that confusion has arisen not only between two human organisms, but we must at present confine our attention to the human organisms and their differentiation.

Jaeger has probably been much misrepresented, and although we have been unable to procure and read any of his works except that in the *Centralblatt* for 1903, yet we have met with one case out of the hundreds examined in this laboratory during the last few years which corresponds more or less with his description.

In 1913 we recognized as *Diplococcus crassus* von Lingelsheim 1906 (which we take it as the same as Jaeger's organism) a coccus which we found in the naso-pharynx of two persons associated with cases of epidemic cerebrospinal meningitis in Omdurman. This year (1916) for the first time we were sent a cerebrospinal fluid from a case in Omdurman which was of a greenish tint and had a slight cellular deposit. When this was examined a large number of Gram-positive mixed with Gram-negative diplococci were seen (fig. 13). The Gram-positive diplococcus was present not merely as cocci but also in short chains.

Cultures made from the peripheral blood showed the presence of a Gram-positive—Gram-negative diplococcus resembling that in the spinal fluid.

The woman died, and although it is extremely difficult to obtain a *post-mortem* in a Mohammedan country, especially at the present time, we were able to examine the brain and intestines but not the nose. The external surfaces of the brain is shown in fig. 17 and the congested condition of the choroid plexus of the lateral ventricle in fig. 16.

When sections were cut of the choroid plexus Gram-negative and Gram-positive diplococci were observed in numbers, but in certain places they could be seen forming one and the same streptococcal chain (fig 15). No other organisms were seen in the brain, spinal cord, blood, or cerebro-spinal fluid.

We are therefore forced to the conclusion that there is a Gram-negative—Gram-positive diplococcus which can be found in short and even long chains associated at times with cases of cerebrospinal meningitis.

This was a fulminating case of the disease, i.e., the woman died in about thirty-six to forty-eight hours from the time she was first seen, and the cocci in the spinal fluid at first were, as is usual in these cases, nearly all free, but few being seen in the scanty number of polymorphonuclear cells found in the deposit, but the cerebrospinal fluid became turbid before death. The intestines were apparently normal.

Thus there can be no doubt that at all events at times a true cerebrospinal meningitis can exist due to a Gram-positive—Gram-negative diplococcus found at times in long and short chains and also found in the naso-pharynx of apparently healthy persons.

The further description of this organism will be deferred till a later stage of this paper.

Jaeger and Heubner's results were more or less confirmed by Holdbeim, Petersen, Urban (1897), Rameny (1898), Vanzetti (1901), and many others, while Kiefer, Kister, Kischensky and Berdach and Froz supported Weichselbaum, and so great a confusion arose between the Gram-negative *Diplococcus intracellularis* Weichselbaum 1887 and the Gram-positive coccus of Jaeger and Heubner, which is also known as *D. crassus* von Lingelsheim 1906, that every coccus found in connection with the meninges was considered to be a true meningococcus.

In 1898 Still showed that posterior basic meningitis was associated with an organism like *D. intracellularis*, and Councilman, Mallory, and Wright obtained Weichselbaum's coccus from thirty-one cases of the disease, while Faber in 1900 found the same organism

in an epidemic in Copenhagen and Canuet in the same year showed that it was an obligatory aerobe.

Pfaundler in 1899 recognized both the Weichselbaum type and the Jaeger-Heubner type, and in this he was supported by Hunter and Nuttall and by Lazarus-Barlow in 1901, in which year Albrecht and Ghon, reporting upon the 1898 epidemic at Trefail in Steiermark, not merely confirmed Weichselbaum's researches but were the first to obtain the organism by cultural methods from the naso-pharynx of cases of the disease, an observation which is now of almost daily occurrence, although we are still uncertain as to the proportion of cases which become permanent carriers. They also obtained Gram-negative cocci in the throats of fifteen healthy persons who were contacts with cases, and in one such person the meningococcus was identified by cultural tests.

In 1902-03 Bettencourt and França, in Portugal, found the meningococcus to be present 271 times in 274 cases of cerebrospinal meningitis, and Lepierre in 1903 described a meningococcus which although originally Gram-negative became Gram-positive, and the same year saw the *Meningococcal polemik* between Jaeger as representing the German school and Weichselbaum, Albrecht and Ghon on behalf of the Austrian schools, as a result of which Weichselbaum's organism became firmly established.

In 1905 Koh and Weyl wrote on the subject of Gram-negative and Gram-positive diplococci, and in the same year Castellani described Weichselbaum's organism in cases in Ceylon, and Dunn and Gordon reported upon an epidemic simulating influenza in Hertford in which they obtained *Micrococcus catarrhalis* and forms resembling the meningococcus. It was during this investigation that Gordon brought forward the carhohydrate tests as differential agents for the meningococcus, a point which he further elaborated in 1907, in which year Buchanan introduced a modification of Loeffler's blood serum by adding neutral red in a proportion of 1 in 10,000, and this, as slightly modified by Marsball, Senior Laboratory Assistant of these laboratories in 1915, we have found to be peculiarly suitahle for work in the Sudan.

The outhreaks of cerebrospinal meningitis in 1905 in Prussia and New York produced excellent work, in the former hy von Lingelsheim and by Kolle and Wassermann with reference to the organism, which together with the lahours of other collaborators was published in one volume in 1906. In this epidemic von Lingelsheim found the meningococci to be present in 23·12 per cent. of the cases, but, as many of the samples came from a long distance, it is interesting to note that he obtained 70·6 per cent. positive results from examinations in the hospital near the laboratory and taken during the first day of illness, and 66·6 per cent. in those taken from first to fifth day of the illness, while he obtained 24·5 per cent. from sixth to tenth day, 11·29 per cent. from eleventh to twentieth day, and only 4·39 per cent. after the twenty-first day. Thus in three weeks 90 per cent. of the cases were free from meningococci, but he found that 15 per cent. of the contacts became carriers. He also gave an account of *D. crassus* and, with Leuchs, of experiments on animals with the meningococcus.

The American epidemic was investigated by Elser, Durham, Goodwin and Sholly and produced results similar to those of von Lingelsheim, and in the same year Robertson-Milne reported upon cerebrospinal meningitis as seen in India.

In this year Kutscher described a coccus in the naso-pharynx of carriers which agreed morphologically and culturally with the meningococcus but which could be differentiated by Castellani's absorption test, and Westenhoeffer stated that the primary focus of the disease was in the pharyngeal tonsils, post-nasal region and the nasal sinuses, in which in the early days of the disease he reported that it caused an inflammation. In 1907 Taylor investigated the opsonic index with a view to diagnosis. In 1909 Elser and Huntoon named Kutscher's organism the *Pseudo-meningococcus*. At first it was thought that organism was rare and had nothing to do with the disease, but, when Gordon and Murray's researches mentioned below are considered, it is obvious that it would agree with such of their groups as do not agglutinate with and absorh intracellularis serum ; at the present it is only differentiated from the strains with which Kutscher and Elser and Huntoon were working and may or may not be the same as Dopter's parameningococcus which is mentioned below.

In 1908 von Lingelsheim gave the following differentiation of the organisms found hy him in the naso-pharynx of tbe contacts :—

(1) *Micrococcus catarrhalis*.—Frequent ; colonies, dry crumbling ; when seen under microscope granulated, generally with irregular borders. Attacks neither grape-sugar, nor maltose, nor lævulose.

(2) *Diplococcus flavus I*.—Colonies on ascitic agar very similar to those of meniugococcus. Twenty-four hours' culture exhibits clear yellow pigment in thick layer.

(3) *Diplococcus flavus II*.—Colonies polymorphic, sometimes moist and glistening, sometimes dry and wrinkled. Twenty-four hours' culture exhibits yellow pigment in thick layer.

(4) *Diplococcus flavus III*.—At commencement difficult to cultivate and therefore rarely coming under observation. All three species of *flavus* form acids in the presence of grape-sugar, maltose and lævulose ; whilst the meningococcus ferments only grape-sugar and maltose, the latter regularly.

(5) *Diplococcus mucosus*.—Colonies more prolific and juicy than those of meningococcus. Grows also on gelatine at room temperature. According to many authors markedly pathogenic for mice.

(6) *Micrococcus cinereus*.—Coarse, uneven granular. Colonies and cultures delicate, reminding one of *D. crassus*. Does not attack grape-sugar, lævulose and maltose.

He also considered the possihility of the spread of the disease by insects, hy dwellings, and by clothing, food and water and concluded that none of these were effective agents in the propagation of the disease.

In 1909 there appeared a most important work by Elser and Huntoon in which they described most carefully the cultural, hiochemical and serum reactions of the meningococcus and its allies, as well as its viability and especially its selective affinity for the cerebrospinal fluid, a point little considered by tbe majority of investigators. They also considered the subject of mixed infections which was dealt with hy Specht in the following year.

In the same year Dopter described his *Parameningococcus* which was not agglutinated by meningococcus serum (a fact confirmed hy Gordon and Murray in

1915) but showed complement-fixation. Two years later he described seven cases of cerebrospinal meningitis as being due to this organism.

The agglutination reactions of the meningococcus are unsatisfactory, as may be gathered by a study of Elser and Huntoon's careful work, as well as by the discordant results obtained by numerous observers. In 1915 Hime instituted a rapid method of preparation of a high-titre agglutinating serum in rabbits and Gordon and Murray investigated genuine strains of meningococci obtained from the cerebrospinal fluid of cases, and found that by agglutination tests and by Castellani's absorption method they could split up thirty-two strains into the following groups:—

(I) With serum from No. 1, 19 strains.
(II) With serum from No. 20, 8 strains.
(III) With serum from No. 28, 4 strains.
(IV) With serum from No. 32, 1 strain.

They also distinguished by these sera Dopter's parameningococcus from all the other groups, and they noted that one strain absorbed the specific agglutinins from two groups; while out of ten carriers one belonged to Group (I) and five to Group (II), while the others were not classified.

In the same year Crowe attempted to meet the difficulties met with in the agglutination tests by devising a simpler method.

We have now given a rough sketch of the history of Weichselbaum's organism, and we might well pause, as Crowe has done, and ask where do we stand as regards its recognition.

It is admitted on all sides that there is a close resemblance between the gonococcus and the meningococcus except as regards the human diseases which they produce, and indeed many years ago it was suggested that the latter might be the former adapted to the cerebrospinal nervous system and the naso-pharynx, but to-day it is admitted on all sides that they are separate, mainly because of an experiment in which the meningococcus, was found not to cause gonorrhœa when injected into the human urethra.

As regards the meningococcus, we can aptly quote Crowe who, writing in 1915, says:—

"The present state of our knowledge so far as it pears on the carrier may be summed up:—

"No Gram-negative organism isolated from the naso-pharynx an be proved to oe a meningococcus.

"No Gram-negative organism which resembles even faintly meningococcus can be regarded with certainty as incapable of roducing meningitis."

Hence we have not improved our position since the ays of the meningoccocal controversy but are actually n a position of greater uncertainty as to the differentia-on of Weichselbaum's *Diplococcus intracellularis* and, his being so, we will now briefly review our position s to the causal relationship between this organism nd epidemic cerebrospinal meningitis.

Indeed, this is exceedingly necessary at the present me, because, firstly, a certain amount has been written ith regard to the so-called pleomorphism of the eningococcus, *e.g.*, the papers in 1915 by Lundie, homas and Fleming and by Donaldson in the ar, while in 1915 and 1916 Hort, Lakin and Benians have doubted the causal action of the meningoccocus, and in the last publication Hort has stated:—

"In order to discover the true infective agent, whether biologically related to the meningococcus or not, further research is imperative, attention being particularly directed to filtrable organisms in the naso-pharnyx and cerebrospinal fluid of acute cases."

With regard to the question of filtrable organisms, we have performed an experiment of this nature with a fresh cerebrospinal fluid but the result was negative.

With regard to the meningococcus being the causative factor in epidemic cerebrospinal meningitis, the above observations make it sufficiently clear that it has been regularly found in the cerebrospinal fluid of persons suffering from the disease and that it has been found in the blood and also in the urine when looked for at the correct time or in suitable infections. It is also generally present in the naso-pharynx of the cases, and was found by Sophian, Westenhöffer and others in such complications as arthritis, pyelitis, pneumonia, endocarditis, and in purulent conjunctivitis from a virulent case of the disease.

Epidemiological studies easily convince anyone associated with the disease that some contagion can at times pass from the sick to the healthy, causing an attack of the disease, and moreover, as we have pointed out above, many of the contacts show the meningococcus. It is true that, as a rule, but few attendants on cases acquire the disease, though there are marked exceptions.

It is also true that the accidental infection by Kiefer of his own nose with a culture from the laboratory produced a severe rhinitis, but he did not develop meningitis, and one of us accidentally infected his thumb from some cultures, with the result that hæmorrhagic granulation tissue formed from which the germ was recovered. cultivated and tested biochemically and agreed with the meningococcus in these details. Although the lymphatic glands enlarged and a mild chronic fever lasting for months ensued, with almost constant and sometimes very severe headache, no meningitic symptoms developed although the opsonic index varied from 0·8 to 1·3, until meningococcal vaccine therapy cured the condition.

In the first case it is possible that the coccus never got into the system and in the second that it never entered the blood-stream, and hence the lack of meningeal infection.

Turning now from man to experiments upon animals, von Lingelsheim and Leuchs, followed by Flexner in 1906, reported successful inoculations of monkeys subdurally. They were followed in 1908 by M'Donald, but neither he nor Davis in 1905, nor any of the above experimenters, were able to infect animals by injections into the blood-stream, although M'Donald produced an acute toxæmia by this method, nor were Kolle and Wassermann or Davis able to reproduce the disease in the same animals *via* the nose. Elser and Huntoon consider that the value of these experiments is questionable when the *peculiar affinity* of the meningococcus for the leptomeninges is taken into account. They point out that other organisms injected subdurally will cause a meningitis, but no other

common pathogenic organism shows a similar *selective action* for the meninges of man.

Further, it is to be remarked that Bettencourt and França and Kolle and Wassermann were unable to infect monkeys even by means of subdural injections, and this has happened to us both with fresh cerebrospinal fluid from which growths were subsequently obtained and with cultures, although we have also had successes as will be reported later.

Only Councilman, Mallory and Wright have succeeded in infecting a goat when dealing with the true meningococcus, and Vansteenberghe and Grysez produced meningitis in rabbits and guinea-pigs, but it seems to us to be doubtful whether they worked with a true meningococcus.

We have been unable to peruse Flexner's original papers, but according to Batten the general circulation became infected in his monkeys.

We shall give below reasons why carriers do not become infected, and it is possible that monkeys may be resistant except when damaged by an operation like trephining or otherwise below par; moreover, the meningococcus is often damaged in the drawn fluid and degenerated on cultivation, for we have seen it fail to infect a monkey after five generations of growth of the same organism which was infective during the second generation.

We now turn to enquire in what way the human body reacts to the organism. Davis showed in 1907 that at the end of the first week agglutination up to 1 in 50 could be obtained and in the eighth week up to 1 in 200, and pointed out that the agglutinins were thermostable, resisting a temperature of 65° C. for an hour, while they appear to be practically absent from the cerebrospinal fluid, but many observers, including ourselves, have found this test uncertain.

Davis in 1905 showed that the coccus multiplied in two normal defibrinated bloods, but in four other bloods it was killed, as it was by the blood from patients after the tenth day. He noted that the meningococcidal power of the blood serum of patients, which seemed to be greater than that of normal blood serum was diminished by heating to 60° C. for thirty minutes. He found that the phagocytic index was 13 for normal human serum, 0 for serum heated to 60° C. for thirty minutes, while in meningitic serum from cases between the second and seventh week of convalescence it was 11·1. Normal cerebrospinal fluid did not contain opsonins.

Houston and Rankin in 1907 found that opsonins were exceedingly low in normal serum and lower still in cerebrospinal fluid, while in cases from the sixth day onwards they rose remarkably, except in two fatal cases, while in one relapse the rise was postponed till the eleventh day.

MacGregor observed that the highest indices occur in the second and third week of the disease, but that the degree of immunity after recovery, as measured by the opsonic index, was variable, and concluded that a high opsonic index was a sign of forcible reaction to a fairly severe infection.

Meakers and Dopter have shown the presence of immune bodies in the blood of meningitic patients by means of complement-fixation, and McKenzie and Martin have also demonstrated the presence of these bodies by injecting the serum of recovered cases intraspinally into other acute cases with fair results. It would therefore appear that immune bodies are formed in patients' systems, which is in support of the causal action of the meningococcus.

We now turn to see whether specific serum treatment and vaccine therapy will help the problem.

With regard to the serum treatment, Jochmann in 1905 experimented with a specific immune serum which was afterwards manufactured by Merck. He tested his serum by the opsonic test, the bactericidal test, and by agglutination.

Kolle and Wassermann also made an immune serum upon which they reported in 1907.

In 1906 Flexner wrote upon a specific serum which protected monkeys and small animals. Later this serum was made from immunized horses and has been extensively used.

With regard to vaccine treatment, Davis in 1907 was the first to inject killed meningococci into normal persons and into patients suffering from the disease, and Collis in 1913 tried specific serum treatment together with vaccine therapy. In the same year Sophian reported on his experimental inoculation of eleven medical students, and eleven months after these inoculations Merck re-tested eight of them, comparing the results with those of a normal person and a recently recovered case, and concluded that a person *so vaccinated may consider himself to be immune for at least one year.*

In October, 1915, Surgeon-General Rolleston reported upon sixteen cases of vaccine treatment with four deaths and twelve recoveries; the vaccine, however, was never used alone but combined with serum treatment in some form or with soamin. In his report lumbar puncture alone in thirteen cases resulted in four deaths and nine recoveries, serum intrathecally alone forty-three deaths and nineteen recoveries, or alone and combined with vaccine, soamin, or hexamine, sixty-four deaths and forty-one recoveries, while symptomatic treatment gave ten deaths and four recoveries.

All these enquiries tend to show that the meningococcus is the true causal agent of the disease, but from the above brief and incomplete history it is seen that many problems require elucidation, and among these we may mention the following:—

(1) The diagnosis of the meningococcus and its strains.

(2) The presence or absence of organisms other than the meningococcus in cases of cerebrospinal meningitis.

(3) The relationship of the meningococcus to the disease, and the reasons of infection.

(4) The value or otherwise of vaccine treatment.

(5) The value or otherwise of vaccines in prophylaxis.

(6) The spread of the disease by any other agency than by that of man?

In this preliminary report we are only able to touch on some of these questions, but we consider

that perhaps our few tentative remarks may be of interest to some workers; but before making these we desire to invite attention to two points of importance which we believe are apt to be overlooked at the present time, viz.:—

(1) The great danger of contamination of cultures when working with highly nutrient media.

(2) The possibility of intestinal organisms entering the circulation of experimental animals and thereby complicating the results.

Having now cleared the ground of previous knowledge as far as the literature at our disposal enables us to do, we will pass on to consider the disease as seen in the Anglo-Egyptian Sudan.

Anglo-Egyptian Sudan.—Cerebrospinal meningitis has been present in the Anglo-Egyptian Sudan as far back as living man can remember, and is said to have caused eight to nine hundred deaths per annum in the large town of Omdurman in the days of the Khalifa, when it was popularly known as *plague in the head*; but it is also known as "Abu Ferar" and in proper Arabic "Iltihabel Sehaee."

His Excellency General Sir Reginald Wingate, G.C.B., who is a great authority upon Sudanese matters, informs us that the natives believe that it came to the Sudan from the West, being introduced by the Khalifa's people who moved from the far west of the Sudan to Omdurman when the Khalifa became powerful.

We have in vain searched the old medical and other records of the Sudan and those of El Sheikh Mohammed Ebn Omar El Tounsy concerning Darfour and have failed to find traces of any disease at all comparable with this complaint. Nor is there any reference to it in the work written some two hundred years ago by Mohammed Wad Defallah and intended as a kind of medical guide for the people of the Sudan. It is true that some works refer to vague epidemics which killed many people, but there is nothing specific which might be interpretated to indicate the presence of epidemic cerebrospinal meningitis.

Notwithstanding this we have asked ourselves the question as to whether the real home of the disease may not be Central Africa, from which it may have passed to Egypt, from whence it may have been conveyed to Europe by the French soldiers of Napoleon's Expedition acting as carriers, and so to America; but this is merely a question which we have been unable to answer. It originated by our noting the frequency and endemicity of the disease in regions of Central Africa where but few Europeans had travelled, and was supported by Butler's observations quoted above.

Be this as it may, the earliest definite record of its occurrence in the Sudan is contained in the first report of these Laboratories when Balfour noted that it was known to occur sporadically and epidemically and that it had caused some forty deaths in Omdurman in 1899, while he and Ensor obtained Weichselbaum's organism from the cerebrospinal fluid of a typical case occurring in a Sudanese native, the diagnosis being made both morphologically and culturally.

In 1906 Nedwill described epidemics occurring in Dongola Province during the months of June, July and August of the previous year, and also at Atbara during the same months of 1906.

The disease, however, does not appear to have been very prevalent, because it is not mentioned by Balfour in his second report, while in the third published in 1908 he says that only four cases have come under his notice since 1904, and in his fourth report he only makes two brief references to it on pages 254 and 280. In order, therefore, to try to find out the more modern distribution of the disease we applied to the heads of the Medical Departments of the Egyptian Army and of the Sudan Government.

By the kindness of Lieutenant-Colonel Carroll, R.A.M.C., P.M.O., Egyptian Army, we are able to state that there are no records with regard to that Army as to epidemic cerebrospinal meningitis prior to the year 1884, but since then the following cases have been noted:—

EGYPTIAN ARMY.

Cerebrospinal Meningitis.

Year	Admissions	Deaths	Remarks
1884			
1885			
1886	*Nil*	*Nil*	
1887			
1888			
1889	18	8	
1890	2	1	These figures refer to Egypt only.
1891	2	1	
1892	—	—	
1893	1	1	
1894	*Nil*	*Nil*	
1895			
1896	*Nil*	*Nil*	Advance on the Sudan, begun from Wadi Halfa.
1897			
1898	33	16	This is the date of the occupation of the Sudan, and the figures refer to Egypt and the Sudan.
1899	113	47	
1900	3	2	
1901	1	1	
1902	*Nil*	*Nil*	
1903			
1904	1	1	
1905	1	1	
1906	*Nil*	*Nil*	
1907			
1908	8	4	
1909	6	2	
1910	10	2	
1911	2	—	
1912	1	—	
1913	6	4	
1914	19	17	
1915	52	42	

By the kindness of Dr. Crispin, Acting Director of the Sudan Medical Department, we were able to obtain an idea of the distribution of the disease among the civil population during the year 1915. The figures do not represent anything like the number of cases which actually occurred but merely those reported.

Province	Cases	Deaths
White Nile	1,488	1,130
Dongola	60	40
Berber	3	—
Halfa	2	—
Khartoum	About 300	?
Bahr-el-Ghazal	No numbers available	Probably 74 per cent.
Blue Nile and Sennar	1,500	1,200
Kordofan	441	351
Kassala	Very many, but no actual figures available.	

With regard to our own experience, we have met with cases in greatly increasing numbers in 1913, 1914, and 1915, in which year Captain Archibald, R.A.M.C., Pathologist to these Laboratories, forwarded a valuable report upon the cases he had found in the villages of Mafaza and the neighbourhood.

He drew special attention to the importance of over-crowding, had ventilation and lack of light in the village huts, and suggested that the causal organism required passage through an intermediate host, be it man, animal, or hiting insect, before it attained its maximum virulence. He also pointed out that zones of infection had cases of the disease as their centres.

This concludes the known history of the disease in the Sudan, and one cannot hut ask the question, whence came this disease into the Sudan? Was it introduced by the Turks in their expedition during the early years of the nineteenth century or by stray travellers, or was it a disease which spread from Central Africa to the Sudan and Egypt, and so to Europe and the rest of the world? These questions cannot at present be answered, but they are worthy of consideration.

The *native treatment* for the disease, according to Bimbashi Hassan Effendi Zaki, is by incisions into the back of the neck combined with the use of purgatives made up of "Sanamakka" (senna) and "Ardeb" (tamarind), while "Garad" (the pods of Acacia arabica) powder is strewn all over the body. Ardeb is also drunk and Garad fried and eaten. The diet given consists of sour milk and "Madidah" (flour made from dura).

Etiology.—The causal organism has, as is usual, been sought for in the cerebrospinal fluid during the early stages of acute attacks.

Among the hundreds of examinations which we have made during the last three years, only once have we met with any organism other than a frankly Gram-negative diplococcus, but on that one occasion we obtained a Gram-negative—Gram-positive diplococcus, and as this organism was obtained in pure culture from the cerebrospinal fluid and from the peripheral blood of a fulminating case of cerebrospinal meningitis during life, and also obtained in sections of the choroid plexus and the exudate on the brain after death, we were forced to conclude that it was the etiological factor.

We are therefore compelled to divide the consideration of the germs found to be associated with the disease in the Anglo-Egyptian Sudan into:—

(1) The Gram-negative coccus.

(2) The Gram-negative—Gram-positive coccus.

(1) *The Gram-negative Coccus.*—When the cerebrospinal fluid is removed from a case of epidemic cerebrospinal meningitis it is very rarely clear, on the contrary, it is in the great majority of cases more or less turbid and contains, when examined, quite fresh, at the bedside of the patient, and in a case of average severity, 28,100 cells (fig. 8) per cubic millimetre, while the white cells in the patient's blood examined at the same time numbered 9,450 per cubic millimetre.

When these cerebrospinal cells are differentiated by staining reagents they are found to consist of:—

Polymorphonuclear leucocytes	98·0 per cent.	
Mononuclear leucocytes	2·0 ,,	

which resembles counts on other patients which average 96·8 per cent. for the former and 3·2 per cent. for the latter.

This differential count may with advantage be compared with that of the white blood cells taken at the same time, which was as follows:—

Polymorphonuclear leucocytes	93·7 per cent.	
Mononuclear leucocytes	3·9 per cent.	5·7 ,,
Large lymphocytes	1·8 ,,	
Small lymphocytes	0·6 ,,	

When the polymorphonuclear leucocytes of the blood in an early case were more carefully examined they were found to contain about 1 coccus per 100 of these leucocytes (fig. 3). These cocci when cultivated and tested on sugars were found to be the true meningococcus. Free cocci were also observed in the blood film in the proportion of 1 per 350 white blood cells, but they were absent from the aseptically collected urine.

When the polymorphonuclear leucocytes of the cerebrospinal fluid of cases of the disease are examined in Gram-stained specimens they will be observed to contain few (figs. 7 and 8) or many (fig. 9) non-encapsulated Gram-negative diplococci, which in the case wherein the other counts were made numbered 144 cocci per 100 polymorphonuclear leucocytes, but the organisms may be much more numerous than this and may be seen not merely in the cells but lying free in the liquor.

Rarely in quickly fatal cases we have noted the cerebrospinal fluid to be quite clear; in these circumstances it contains, in our experience, many free organisms and but few polymorphonuclear cells in which meningococci can also be seen.

Usually the cocci in the cells are to be seen clearly, but not infrequently they may be observed to be in a semi-digested condition (*vide* fig. 9), and if but few are present and if they are all in this condition then bacteriological diagnosis becomes most difficult, as cultures are often negative and injections into monkeys are also without effect.

This state of affairs is usually met with in warm weather, and especially if the fluid has been exposed to the effects of the atmosphere in its journey to the laboratory, or, more rarely, if the case is on the high road to recovery.

The organism found in the cells and fluid usually measures about 1 micron in diameter. It is entirely Gram-negative and does not alter its characters after one and a half years of laboratory life.

Biological Characters.—This Gram-negative coccus is an obligatory aerobe and flourishes best at 37° C. upon media containing much proteid and some simple sugar, as for example glucose ascitic agar. As derived from the human body its life at first is precarious, but it can be trained to a saprophytic existence upon laboratory media. Its growth at 40° C. is slow and usually it dies at 50° C., while no growth occurs at 22° C.

Cultural Characters. — If the deposit from the cerebrospinal fluid mentioned above is sown upon Buchanan's medium in tubes and incubated for twenty-four hours at 37° C., growth takes place in the larger percentage of cases and is in the form of all

red, loosely attached, glistening colonies, while the fluid at the bottom of the tube shows a yellow fluorescence. If these colonies are examined they will be observed to consist of Gram-negative diplococci.

Many other organisms give rise to red colonies on Buchanan's medium, but they are usually Gram-positive or bacillary forms and are therefore easily separable, and this fact makes this medium very suitable for use in searching for carriers, at all events in the Sudan.

If a portion of a colony of the nature described above is sown upon nasgar and cultivated for twenty-four to forty-eight hours at 37° C. very typical isolated colonies will appear. These are greyish-white, smooth and glistening as viewed by reflected light (fig. 11), but when seen by transmitted light appear to consist of a yellowish centre surrounded by a greyish translucent zone. The edges of the colonies are clear cut. On microscopical examination these colonies are seen to be composed of cocci completely Gram-negative.

If the cerebrospinal fluid is uncontaminated, it may be sown directly upon milk agar, ascitic agar, or nasgar, but if contaminated, as is sometimes the case, it is advisable to start with Buchanan's medium. If the culture on nasgar is not pure it is advisable to make ascitic agar plates, and in tropical climates to inoculate the liquid medium in the test-tube before pouring it into the Petri dish, thereby obviating some of the contaminations so apt to lead to mistakes with this organism when the poured plate is inoculated by smearing.

In the ascitic agar plates colonies resembling those described above can be examined, and if pure and consisting solely of Gram-negative diplococci may be utilized for further work.

Here, perhaps, we may mention a fallacy apt to occur when looking for carriers, and this is the presence of a Gram-positive streptococcus often in the form of a diplococcus, which lies hidden away in the depth of an apparently typical colony. This or a like accident may possibly account for some of the discordant results obtained by various workers on the meningococcus.

From this plate, or from the other media mentioned above, a small portion of a given colony is picked off and either sown directly upon an ordinary agar slant or upon a blood serum (especially a Loeffler) slant and then a large quantity is inoculated upon an agar slant from which subcultures are made.

Primary growths can also be obtained in ascitic and serum broths from which subcultures can be made.

We have tried a large number of ordinary, extraordinary and new media, solid and liquid and at all events in Khartoum we are not able to find a really good substitute for agar slants for its preservative use, unless indeed it be the gonococcal maize starch medium, the composition of which is :—

> Beef infusion as for broth.
> Add agar to make 1·5 to 1·75 per cent.
> Cook, clarify and filter.
> Neutralize. Reaction 0·2 to 0·5 per cent. acid to phenolphthalein. Add 10 grm. maize starch per litre.

We had great hopes of a medium made from the umbilical cord and therefore containing a certain amount of mucin, but it was not better than ordinary agar for preservative purposes, although the organism grew moderately well upon it.

The meningococcus can be subcultured in broth and peptone water, in which it causes general turbidity, while on agar-agar and glycerine agar it produces greyish-white colonies or a similar more or less translucent glistening film. We have never observed any pigment formation in an investigation of three years' duration.

Biochemical Reactions.—At first the carbohydrate media tested were the old 1 per cent. peptone media, and acidity without gas formation was obtained constantly with glucose and very often with maltose. Sometimes fructose, galactose or arabinose gave acidity, but we were acquainted with the researches of Elser and Huntoon, who drew attention to the work of Lobry de Bruyn and Van Ekenstein, that heat acting in the presence of small quantities of alkali upon fructose (lævulose) produces glucose, which explains their own experiments with this sugar as sterilized by different methods of heating and also explains why we have from time to time obtained both qualitatively and quantitatively a positive reaction for fermentation with this sugar.

They explain similar results obtained with galactose as being due to its hydrolysis with the formation of acid which ceases at ice-chest temperature but which appears to continue when exposed to incubator temperatures.

Dextrin, according to Maquenne, even when said to be chemically pure, may contain small quantities of maltose and glucose sufficient to produce slight acidity at times.

We have now and then met with acidity in galactose and fructose, but not in dextrin, in small amounts both quantitatively and qualitatively and have rejected these reactions as not being due to the organism, as we are compelled to use three separate sterilizations for sugars because the method recommended by Elser and Huntoon does not appear to be satisfactory in this dusty hot climate.

The qualitative carbohydrate reactions which we consider typical of the Anglo-Egyptian Sudan strains, controls being used, are :—

Acidity without gas in :—

Monosaccharides.—*Hexose :* Glucose ; *Pentose :* Arabinose (at times only).

Disaccharide.—Maltose in more than half the examinations.

Neither acid nor gas in :—

Monosaccharides.—*Hexoses :* Fructose and galactose ; *Pentoses :* Arabinose (at times), xylose and rhamnose.

Disaccharides.—Lactose and saccharose.

Trisaccharide.—Raffinose.

Polysaccharides.—Dextrin, inulin, amylum and glycogen.

Glucosides.—Amygdalin, salicin, helicin and phlorhizin.

Alcohols.—*Trihydric :* Glycerol ; *Tetrahydric :* Erythrol ; *Pentahydric :* Adonitol ; *Hexahydric :* Dulcitol, mannitol and sorbitol.

Phenol.—Hexahydric: Inosite.

The quantitative determinations have been conducted in exactly the same way as was detailed by one of us with Haddad and later with Atiyah for streptococci and need not be referred to here except to invite attention to the references given at the end of this paper.

The results show that the Sudanese meningococcal strains which we have met with are capable of being classified into:—

(*A*) *Common Types:*—

(I) Fermenters of *glucose* only.

(II) Fermenters of *glucose and maltose.*

(III) Fermenters of *glucose, maltose and arabinose.*

(*B*) *Rare Type:*—

(IV) *Fermenters of glucose and arabinose.*

We will now briefly give results of the quantitative determination.

(I) *Fermenters of Glucose Only.*—The following is an average of strains belonging to early subcultures unfortunately when arabinose was no longer available:—

Monosaccharides	Hexoses	Glucose	0·5
		Fructose	0·0
		Galactose	0·0
	Pentose	Rhamnose	0·0
Disaccharides		Maltose	0·0
		Lactose	0·0
		Saccharose	0·0
Trisaccharide		Raffinose	0·0
Polysaccharides		Dextrin	0·0
		Inulin	0·0
Glucoside		Salicin	0·0
Alcohols		Dulcitol	0·0
		Mannitol	0·0

(II) *Fermenters of Glucose and Maltose.*—These are exemplified in the following table:—

Monosaccharides	Hexoses	Glucose	0·4
		Fructose	0·0
		Galactose	0·0
	Pentose	Arabinose	0·0
Disaccharides		Maltose	0·7
		Lactose	0·0
		Saccharose	0·0
Trisaccharide		Raffinose	0·0
Polysaccharides		Dextrin	0·0
		Inulin	0·0
Glucoside		Salicin	0·0
Alcohols		Dulcitol	0·0
		Mannitol	0·0

(III) *Fermenters of Glucose, Maltose and Arabinose.*—An average of recently-grown strains belonging to Group (III) is as follows:—

Monosaccharides	Hexoses	Glucose	0·6
		Fructose	0·0
		Galactose	0·0
	Pentose	Arabinose	0·5
Disaccharides		Maltose	1·1
		Lactose	0·0
		Saccharose	0·0
Trisaccharide		Raffinose	0·0
Polysaccharides		Dextrin	0·0
		Inulin	0·0
Glucoside		Salicin	0·0
Alcohols		Dulcitol	0·0
		Mannitol	0·0

With regard to this reaction in arabinose it may be mentioned that it appeared in certain strains grown at one and the same time with other strains belonging to Group (II) and on the same batch of media under exactly similar conditions and titrated at the same time by the same people, and against the same $\frac{N}{20}$ KOH of which the above numbers indicate cubic centimetres.

We are therefore inclined to believe that the fermentation was brought about by the organism and was not due to other causes.

(IV) *Fermenters of Glucose and Arabinose.*—This rare strain has only been tested by us qualitatively and not quantitatively on the same carbohydrate media as in the other cases.

Age of Cultures.—We have investigated the point as to whether the strains alter their fermentative powers when grown for a time upon artificial media and the result is shown in the following table:—

Classification		Names	Group II, aged 4 months	Group III, aged 19 months
Monosaccharides	Hexoses	Glucose	0·3	0·3
		Fructose	0·0	0·0
		Galactose	0·0	0·0
	Pentose	Arabinose	0·0	0·5
Disaccharides		Maltose	0·2	0·3
		Lactose	0·0	0·0
		Saccharose	0·0	0·0
Trisaccharide		Raffinose	0·0	0·0
Polysaccharides		Dextrin	0·0	0·0
		Inulin	0·0	0·0
Glucoside		Salicin	0·0	0·0
Alcohols		Dulcitol	0·0	0·0
		Mannitol	0·0	0·0

It will thus be seen that neither Groups (II) nor (III) alter at all with age of growth on artificial media, except that the fermentative power is somewhat less.

Other Reactions.—Our strains did not reduce *neutral red* when grown aerobically therein, neither did they alter *litmus milk*, nor were they hæmolytic when tested by North's method. They did not produce *sulphuretted hydrogen* as tested by growth in lead acetate broth, nor *indol*, nor did they reduce *nitrates*, while the *Voges-Proskauer* test was negative. They were not destroyed by *bile salts.*

Comparisons.—It is now useful to compare our results with the careful work performed by Elser and Huntoon with regard to the sugars glucose and maltose which are the only two which they found to be fermented regularly.

Age of strain	Names		Elser and Huntoon	Sudan strains
Recent	Glucose	Lowest	0·1	0·3
		Highest	0·4	0·7
	Maltose	Lowest	0·1	0·1
		Highest	1·4	1·3
Old	Glucose	Average	0·83	0·30
	Maltose	Average	1·00	0·25

Our recent strains therefore behaved in much the same way as Elser and Huntoon's, but, on keeping, our strains lost more fermentative power than theirs. It seems to us that the non-fermentation of maltose in Type (I) is merely a suppression such as is often met with in streptococci and is probably merely temporary.

The fermentation of arabinose in Types (III) and (IV) is also probably merely an attempt at an additional character and hence variable and at the present of no importance similar to the fermentation of inulin by streptococci.

We therefore have no hesitation in stating our belief that our strains belong to that group of which the type is the organism named *Diplococcus intracellularis* Weichselbaum 1887 (synonyms: *Neisseria weichselbaumii* Trevisan 1889, *Streptococcus intracellularis* Lehmann and Neumann 1896), but concerning its classification and nomenclature we shall have some remarks to make below.

Serum Reactions.—In this paper we do not deal with the subject of differentiation of strains by specific immune sera of high titre but merely keep to sera derived from patients.

The agglutination and absorption of patient's sera tested against heterologous meningococci has sometimes been successful, giving agglutination up to 1 in 50 dilutions and partial agglutination at higher rates, and absorption tests have sometimes appeared satisfactory and at others the results have been negative.

These tests have been repeated microscopically and macroscopically with living and dead organisms recently obtained, and in old cultures.

Complement fixation has sometimes been positive and sometimes negative with heterologous organisms.

The net result of this work is to show that we are dealing with either different organisms or with different strains of the same organism.

We therefore leave the whole consideration of serum reactions other than opsonins for a future communication, and we will at present confine our remarks to these bodies because they appear to us to be of far greater practical importance from the point of view of treatment and prophylaxis, and we will begin with those found in the blood of untreated cases, the results concerning which are set forth in the following table:—

TABLE I.—Blood Serum Opsonic Index of Untreated Cases. Number of Leucocytes counted, 50.

Number of case	Serum unheated			Serum heated to 60° C. for twelve minutes		
	Total cocci in leucocytes	Leucocytic index	Opsonic index	Total cocci in leucocytes	Leucocytic index	Opsonic index
I ..	6	0·1	0.5 ..	0	–	–
II ..	5	0·1	0·5 ..	0	–	–
III ..	7	0·1	0·5 ..	0	–	–
IV ..	6	0·1	0·5 ..	1	–	–
Control ..	11	0·2	1·0 ..	0	–	–

The four cases considered in this table included two adults and two children, each group being divisible into one male and one female.

We therefore believe that although the number investigated is small it indicates that the opsonic index of an untreated case is likely to be found to be low when first seen.

The opsonic index calculated by using the cerebrospinal fluid instead of the blood serum in untreated cases is shown in the following table:—

TABLE II.—Cerebrospinal Fluid Opsonic Index of Untreated Cases. Number of Leucocytes counted, 50.

Number of case	Fluid unheated			Fluid heated at 60° C. for twelve minutes		
	Total cocci in leucocytes	Leucocytic index	Opsonic index	Total cocci in leucocytes	Leucocytic index	Opsonic index
I ..	3	0·06	0·33 ..	0	–	–
II ..	2	0·04	0·22 ..	0	–	–
III ..	3	0·06	0·33 ..	1	–	–
Control ..	9	0·18	1·0 ..	0	–	–

This table shows that very few opsonins are present in the cerebrospinal fluid of normal persons and still less in those of untreated cases. Case II was fatal while the others were severe and only recovered after vaccine treatment.

With regard to the heating of the blood serum and cerebrospinal fluid to 60° C. for twelve minutes the reasons for this will be discussed later in this paper, and at present it is merely noted that both the normal and the immune opsonins (bacteriotropins) are very low in the unheated fluids and that such phagocytosis as does take place is due to the thermolabile normal opsonins which are destroyed by heating at 60° C. for twelve minutes, and hence the disappearance of the phagocytosis in the heated serum and cerebrospinal fluid.

Pathogenicity.—We propose to consider the question of the pathogenicity of the Gram-negative cocci under two headings, viz., that found in inoculated animals and that occurring in man.

(*I*) *Animals.*

We have performed experiments on animals with strains I, II, and IV mentioned above.

Strain I.—With regard to this strain it appeared to be of interest to know whether it could reproduce in a monkey a disease simulating cerebrospinal meningitis in man.

We inoculated the complete contents of a twenty-four hours' agar slant subcultured from an ascitic agar colony freshly grown from the cerebrospinal fluid of a typical case of cerebrospinal meningitis intraspinally into the lumbar region of a monkey *Lasiopyga callitrichus* (I. Geoffrey 1857) with the following results:—

Date	Time	Remarks
28.12.13 ..	2.30 p.m. ..	Inoculation.
	7.30 p.m. ..	Monkey apparently normal; ate its food properly.
29.12.13 ..	10.30 a.m. ..	Monkey ill; sits on elevated plate with head down on its legs and back curved.
	7.30 p.m. ..	Monkey unable to sit or stand. If propped up falls over and lies on its side. Can move all its limbs but was in a state of stupor.
30.12.13 ..	5 a.m. ..	Died about this time.

Duration of life after infection about thirty-seven and a half hours. *Post-mortem* examination showed that the brain and spinal cord were intensely congested and that the cerebrospinal fluid contained a marked increase of polymorphonuclear leucocytes in which typical Gram-negative diplococci could be seen as well as lying freely in the liquor. No subcultures

were made as the post-mortem took place some five hours after death.

Strain II.—As a number of observers had produced a disease in monkeys analogous with that found in man by injecting subdurally the typical meningococcus, which would correspond with our Strain II, we have not repeated these experiments, but as it appeared to us to be of the utmost importance to know what other animals could be experimentally infected we have tried goats and donkeys.

With regard to the goat only Councilman, Mallory and Wright, so far as we know, have claimed to produce a disease resembling the human type by injections of the meningococcus.

We have inoculated these animals subdurally after trephining the cranium, into the spinal canal, intravenously and intranasally, but all our experiments were negative. This is a matter of no small importance in the Anglo-Egyptian Sudan because the goat practically lives with the people and if it could be definitely proved that these animals were susceptible to the virus then suspicion would at once rest upon them as possible carriers of the disease.

As there was a native rumour that donkeys suffered in the Sudan from a watery discharge from the nose at times, repeated attempts were made to infect these animals with the meningococcus but without producing any pathological effects and without the organism being capable of recovery from the nose by bacteriological methods some days after intranasal infection. We have also inoculated a donkey intradurally with negative results.

White mice were readily killed by intraperitoneal injections and the germs could be recovered from the heart blood.

Strain IV.—We have experimented with a strain of Group (IV), i.e., Fermenters of glucose and arabinose, as follows :—

A large, strong, male monkey *Erythrocebus pyrrhonotus* (Hemprich and Ehrenberg 1838) was injected intraspinally with the complete growth of one agar slant aged twenty-four hours obtained from the original ascitic agar tube inoculated directly with the cerebrospinal fluid containing a strain of meningococcus which, qualitatively tested, fermented glucose and arabinose but not maltose.

Date	Time	Remarks
17.7.13 ..	2 p.m. ..	Monkey injected intraspinally in the lumbar region.
	6 p.m. ..	Monkey with a peculiar anxious appearance.
18.7.13 ..	7 a.m. ..	Unwilling to remain on the elevated plate. Walks on all fours. Twitches slightly in the legs. Refuses food.
	10 a.m. ..	Failure of power in legs beginning.
	2 p.m. ..	Less power in the legs; has to support itself with its paws. Lethargic.
	6 p.m. ..	Very lethargic; roused with difficulty; not able to stand but can sit upright.
19.7.13 ..	6.30 a.m. ..	Completely comatose; respirations hurried.
	6.45 a.m. ..	Died.

Duration of life after injection forty hours and forty-five minutes.

Post-mortem at 7 a.m. showed that the brain and spinal cord were intensely congested and inflamed and that the cerebrospinal fluid was clear and that there was no increase in the cellular content but it contained enormous numbers of Gram-negative diplococci morphologically resembling the meningococcus.

Cultures.—These Gram-negative diplococci were obtained in pure culture and resembled in all details the original growth on ascitic agar, glycerine agar, agar-agar, and were grown without alteration for five successive generations.

Biochemical Reactions.—The organism was tested on all the carbohydrate media mentioned above and fermented glucose well, while arabinose was slightly affected.

Filterable Virus.—In order to test the theory as to the presence of a filterable virus we selected a monkey *Lasiopyga callitrichus*, a species shown by one of the above experiments to be susceptible to infection, and having filtered through the usual Pasteur - Chamberland filter some perfectly fresh cerebrospinal fluid obtained during life from a very severe and rapidly fatal case of the disease, we injected it intraspinally with absolutely negative results.

Intravenous, intraperitoneal, and subcutaneous injections of monkeys, in our hands, have all been negative as have all attempts at infection via the nose. Chilling the animal prior to or after injections also appears to be useless.

A point of considerable practical importance is that though we have been able to infect monkeys with early subcultures, we have failed to do so with later subcultures of the same strain. This prevented us experimenting with cultures derived from carriers as they require several subcultures before being obtained in a pure condition.

Deductions. — From the above experiments we conclude that our Strains I and IV behave exactly like the true meningococcus in causing experimental cerebrospinal meningitis. Moreover, the two infections appear to us to resemble very closely the fulminating type of the disease such as we met with among some Nyam-Nyams resident in Omdurman.

We also conclude that Strains I and IV are merely variants of the true meningococcus, and this being so *a fortiori* Strain III is also only a variant.

We have been unable to find any evidence of a filterable virus.

(*II*) *Man.*

Leaving the subject of experimental animals we turn to inquire into the infection as seen in man, and we have asked ourselves the following questions :—

I. Is the organism always present in the nasopharynx of patients ?

II. Does the patient tend to rid himself of the germ ?

III. How is this effected ?

IV. Do attendants become carriers ?

V. If so, why do they not acquire the disease ?

VI. Are carriers common in European and native

communities under the existing circumstances of an epidemic on the increase year by year?

VII. What is the distribution of the germ in man?

VIII. How does it leave the body?

IX. Does it live outside the animal body?

X. Where does it enter the body?

XI. Why does the disease develop in some people and not in others?

XII. Is there any evidence as to the presence of aggressins?

Patients.—As long ago as 1901 Albrecht and Ghon showed that the meningococcus was present in the naso-pharynx of patients suffering from cerebrospinal meningitis, and this appears to be true of every case from which we have obtained carefully taken swabs. Ledingham and Arkwright in 1912 gathered together much valuable information which tended to show that, in the great majority of such cases, the germs disappeared from the naso-pharynx after the third week of the illness and the opsonic indices given below for vaccine treatment would probably explain this self-cleansing.

Certainly with this treatment we usually find the naso-pharynx to be without meningococci as soon as the patient is ready to leave the hospital and we think that this is due to the increase in protective agencies as demonstrated by the rise of the opsonic index.

Attendants.—We have examined the naso-pharynx of the attendants upon cases of the disease and find that the meningococcus is usually present in some or all, but we have not worked out the strains fully in many cases and all in which we have done so have belonged to Group (II), the fermenters of glucose and maltose, with average carbohydrate quantitative results as follows:—

Monosaccharides	Hexoses	Glucose	0·3
		Fructose	0·0
	Pentose	Galactose	0·0
		Rhamnose	0·0
Disaccharides		Maltose	0·5
		Lactose	0·0
		Saccharose	0·0
Trisaccharide		Raffinose	0·0
Polysaccharides		Dextrin	0·0
		Inulin	0·0
Glucosides		Salicin	0·0
Alcohols		Dulcitol	0·0
		Mannitol	0·0

We now asked ourselves the reason why these people did not become infected, and in order to answer the question we studied the blood serum opsonic index with the following results:—

TABLE III.—Blood Serum Opsonic Index of Attendants on Cases. Number of Leucocytes counted, 50.

Number of carriers	Serum unheated			Serum heated to 60° C. for twelve minutes		
	Total cocci in leuco-cytes	Leuco-cytes index	Opsonic index	Total cocci in leuco-cytes	Leuco-cytes index	Opsonic index
I	37	0·7	3·5	10	0·2	0·2
II	62	1·2	6·0	12	0·2	0·2
III	39	0·7	3·5	11	0·2	0·2
IV	58	1·1	5·5	10	0·2	0·2
V	43	0·8	4·0	10	0·2	0·2
VI	50	1·0	5·0	10	0·2	0·2
VII	42	0·8	4·0	15	0·3	0·3
Control	11	0·2	1·0	0	0·0	0·0

If this table is compared with that showing the Opsonic Index of Untreated Cases the following is observed:—

TABLE IV.

		Untreated cases	Attendants
Serum unheated	Total cocci in leucocytes	6	47
	Leucocytic index	0·1	0·9
	Opsonic index	0·5	4·7
Serum heated to 60° C. for twelve minutes	Total cocci in leucocytes	0	11
	Leucocytic index	0	0·2
	Opsonic index	0	0·2

In other words the leucocytic and opsonic indices are distinctly higher in the attendants than in the untreated cases, which we believe indicates that auto-vaccination in suitable persons produces a body reaction against the organism. Hence the reason why the attendants did not become cases, hence the reason why temporary carriers tend to cleanse themselves, and hence the value of nasal disinfection of these people as the organism is speedily destroyed, as it was in the cases of all the attendants in question.

In the cases, on the other hand, the resistance is low and hence the invasion of the body by the germ.

The ready infection of the naso-pharynx of attendants points to the dangers of overcrowding and had ventilation when a carrier lives with uninfected people, while the opsonic index in our opinion helps to explain the incidence of the disease on recruits for armies and among the soldiers living under stress of work, overcrowding, and at times insufficient food, though the two latter factors have almost disappeared in the present war.

We may therefore conclude that the coccus in the throat of these attendants produced an increased number of normal opsonins and bacteriotropins in all of them, but not in equal amount, and it is interesting to note that some of these attendants who had few bacteriotropins had high normal opsonins, the result being that in the unheated serum their leucocytic and opsonic indices were relatively higher than the others.

Communities.—We have also investigated certain communities which were not obviously associated with cases of the disease, but were living in the neighbourhood of such cases, and as a good example we quote the following study of some British troops stationed at the time in Khartoum.

Class	Examined	Carriers	Percentage
Native servants	186	6	3·2
Regimental officers	25	5	20·0
Men of a foot regiment	548	53	9·6
Royal Garrison Artillery	59	16	27·0
Royal Army Medical Corps	16	0	0·0
Army Service Corps	11	6	54·5
Army Ordnance Department	1	0	0·0
Military Police	1	0	0·0
	847	86	10·1

No actual case of epidemic cerebrospinal meningitis had occurred among these troops, but a few cases had occurred at the time in Khartoum.

The 10 per cent. result may be compared with the figures of von Lingelsheim, 15 per cent.; Buchanan,

26·3 per cent.; Bruns and Hohn, 14·7 per cent.; Bochalli, 8·6 per cent.; Hasslauers, 10 per cent., as quoted by Ledingham and Arkwright.

The organism isolated from the above carriers behaved like a typical meningococcus, and belonged to our Group (1) in that it fermented glucose only and not maltose or arabinose. The serum of one of these carriers was tested against the glucose fermenting strain at the time in Khartoum, and was found to agglutinate this completely in thirty minutes in a dilution of 1 in 50.

At another time two or three cases of cerebrospinal meningitis had occurred in a local jail which contained only long-sentence prisoners, of whom we examined between 200 and 300 bacteriologically, with the result that we found 20 per cent. to be carriers of a meningococcus belonging to our second group, i.e., a fermenter of glucose and maltose. Among these we found one persistent carrier in whose naso-pharynx the organism lasted for three months despite all kinds of medication, but at that time we had not made the vaccine which will be mentioned below.

Distribution in the Body.—So far we have only recovered the germ from the peripheral blood of early cases in which it was absent twenty-four hours later, and we are prepared to believe that blood infection takes place at an early stage of the disease, and is quickly lost.

We have so far not met with the germ as tested culturally and biochemically in other parts of the body except in the naso-pharynx, the peripheral blood, and the cerebrospinal nervous system.

Portals of Exit.—We are only acquainted with one portal of exit, viz., the nose, as we have so far not met with the germ in the urine.

Viability.—Like all other investigators we have been struck with the low vitality of the meningococcus. It will not grow at 22° C., nor much above 40° C.

It is easily killed; for example, if cerebrospinal fluid be sent from Omdurman to Khartoum in a test tube exposed unprotected to the light and heat of a Sudan summer, the chances of any growths being obtained appears, as a rule, to be small.

The optimum temperature appears to be 37° C.

These points, together with the experiments performed by Elser and Huntoon and other observers, are against prolonged existence of the germ outside the body of an animal, and are in favour of direct infections from man to man, but they do not exclude infection from an animal to man.

Entrance.—Judging by the attendants, infection would appear to take place by the nose, but, as we have seen, this by no means indicates that the germ will enter the tissues, as it may live in the naso-pharynx, and apparently also in the nasal sinuses, without giving rise to the disease, and simply producing the ordinary or the periodic carrier.

We have, however, found Gram-negative diplococci lying in lymph spaces below the epithelium of the mucous membrane of the ethmoid cells (fig. 1), and we have also found diplococci in abundance around a vessel of the same mucosa (fig. 2) which was derived from a fulminating case of cerebrospinal meningitis, and this, together with the researches of other observers who have grown the organism from the sphenoidal sinus, appears to us to indicate that the entrance into the tissues is via the nasal mucosa. We have also demonstrated the organism in the circulating blood, and therefore it is probable that the accumulation around the vessel in the mucosa indicates a focus of proliferation from which the blood becomes infected.

One important point to note is that the nasal mucosa shows no signs of inflammation or of any reaction against the organism.

Especially is it to be noted that phagocytes are remarkably absent, although we met with one apparently choked with degenerating diplococci.

This method of entrance explains the infection of crowded and ill-ventilated harimat lines of Sudanese regiments and the poorer parts of towns.

Infection.—It appears to us that the reason why some people become infected while others do not is correlated with the non-resistance or resistance of the body against the germ, as set forth in the tables of opsonins for untreated cases and attendants given above.

We are supported in this view by examination of a limited community of Nyam-Nyams living under very insanitary conditions in Omdurman.

Five out of fourteen having died one after the other of fulminating cerebrospinal meningitis, the opsonins of four of these people were examined with the following results:—

TABLE V.

Names	Total cocci in leucocytes	Leucocytic index	Opsonic index
Nyam-Nyam I	6 ..	0·1 ..	0·5
Nyam-Nyam II	6 ..	0·1 ..	0·5
Nyam-Nyam III	6 ..	0·1 ..	0·5
Nyam-Nyam IV	3 ..	0·06 ..	0·3
Control	11 ..	0·2 ..	1·0

It will be observed from a study of the above table that I, II, and III show the same leucocytic and opsonic indices as the untreated cases, while IV is lower than even the cases.

We therefore conclude that the reason why this community was so susceptible was because it had such low bodily resistance as exemplified by the lack of opsonins.

We therefore conclude that infection and fulminating infection is a question either of the strain of the organism or of lack of resistance which may be caused by insufficient food, over exertion, or the lack of inherited tendency to resist the particular organism.

Hence the tendency to infect the native, and not the white man, in the Tropics and to fall on the poor and not the well-to-do native. Hence also the reason why the poor European in the Tropics may at times be infected.

Hence also one of the reasons why soldiers in training may become infected, because although they may have abundant food still they suffer from unusual exertion, and are also often over-crowded.

Aggressins.—We have only once investigated the subject of the presence or absence of aggressins or

virulins with regard to the meningococcus when we found them to be absent, but we are of the opinion that we applied too severe a test, and therefore leave the consideration of this subject to a future communication.

Deduction.—We believe that our investigations show that all patients, if carefully examined, have the meningococcus in some part of their nose, and we believe the nasal sinuses are important sites, and that the organism can be demonstrated readily in the naso-pharynx.

We believe that our experiments show that the most important portal of exit is from the nose, and that attendants can become carriers, though they do not develop the disease, because of autovaccination, which may perhaps clear the majority from the organism in due time. In the meanwhile they are sources of infection.

We also believe that the above figures show that at times of epidemics carriers are common even in communities not especially connected with a case of illness.

We also consider that, so far, our experiments have failed to bring forward evidence incriminating animals as possible carriers, though it appears to us that further research is required on this important point. As we leave it at present, man alone is proved to be the spreader of the disease.

We invite attention to the bearing of our deductions upon the important secondary causes of over-crowding and bad ventilation as directly aiding the spread of the organisms from man to man.

We also especially ask the consideration of the importance of such secondary causes as poor or insufficient food and too much exertion as being likely to prevent the production of the protective substances such as opsonins.

Classification.—Turning now to the consideration of the systemic position of the Gram-negative coccus, it is obvious that the meningococcus belongs to Zopf's family *Coccaceæ* as improved by Migula.

This family was divided in 1905 by Winslow and Rogers into two subfamilies: Paracoccaceæ and Metacoccaceæ, but Buchanan has pointed out that these names are not in accord with Article 23 of the International Rules of Nomenclature, and that it would be better to consider the two divisions of the family as tribes rather than subfamilies. The family *Cocaceæ*, therefore, is divided as follows:—

A. Parasitic on plants and animals, often growing best anaerobically, but frequently with difficulty and in small amount or even not at all on artificial media; in pairs or chains, generally but not always staining by Gram and often producing acidity in glucose and lactose media, and when pigmented generally white or orange	Tribe I *Streptococceæ* Trevisan 1889 emendavit Winslow and Rogers 1905.
B. Facultative parasites or saphrocytes growing best under aerobic conditions and well on artificial media; in cell groups, packets or zoogloea masses and often Gram-negative, and when pigmented usually yellow or red	Tribe II *Micrococceæ* Trevisan 1889 emendavit Winslow and Rogers 1905.

As the meningococcus is a parasite which grows with difficulty and in small amount on artificial media, and is in pairs while it ferments glucose, it agrees with the *Streptococceæ*, even though it does not grow anaerobically and is Gram-negative. It does not appear to be worth while to create a new tribe for these slight differences.

The tribe Streptococceæ is divided by Winslow and Rogers as follows:

(A) Saprophytes in chains in zoogloea masses. Pigment absent	*Ascococcus* Cohn 1875.
(B) Parasites in pairs, chains or irregular groups but not in zoogloea masses.	
(I) Pigment generally absent. In pairs or chains. Growth meagre.	
(a) Usually in encapsulated pairs forming acid in glucose, lactose, saccharose and inulin. Hæmolysis usually absent. Characteristic group serum reactions	*Diplococcus* Weichselbaum 1886 emendavit Winslow and Rogers 1905
(b) In short or long chains or pairs, forming a large quantity of acid in fermented sugars. Hæmolysis present or absent. Without characteristic group serum reactions	*Streptococcus* Rosenbach 1884 emendavit Winslow and Rogers 1905
(II) Pigment present. In irregular groups or in non-capsulated groups of fours. Growth fair to good.	
(a) Orange pigment	*Aurococcus* Winslow and Rogers 1905
(b) White pigment	*Albococcus* Winslow and Rogers 1905

Winslow and Rogers classified the meningococcus with the genus Diplococcus, but this is obviously incorrect, because it is not in encapsulated pairs, it does not form acid in lactose, saccharose, or inulin. Moreover, it is Gram-negative, and, indeed, altogether a different kind of an organism from a diplococcus.

Before the genus Diplococcus was formed by Weichselbaum for his pneumococcus, Trevisan as far back as 1885 had realized that the gonococcus was the type of a genus "*Neisseria*" which he defined. This definition, as quoted by himself and de Toni in 1889, read as follows:—

"Cocci primitus globosi indivisi, aetate proveeta in coccos duos biscoctiformiter geminos, latere fratrem versus plus minus complanato, utrinque ad polos isthmis filamentosis tenuissimis insimul nexos, scissi, numquam in turmas racemiformitor consociati. Endosporae microsomae, in coccis normalibus obvenientes."

The type species appears to have been *Neisseria gonorrhœæ* Trevisan 1885, and *N. weichselbaumii* Trevisan was added when he wrote his *I. genere e le specie delle Batteraceæ* in 1889, and which he and Toni in the same year defined as follows:—

"Coccis biscoctiformiter geminis, hyalinis, interdum glomerulos minutos efficientibus, intracellularibus.

"Hab. in exsudatis *meningitidis cerebro-spinalis*. Omnibus coloribus anilinae optime tingitur, non autem methodo Gramii. Cuniculis, muribus canibusque inoculatus, post 36-48 horas mortem causat."

It appears to us that Trevisan's genus is good, and we are supported in this by Buchanan's remarks.

We would therefore separate the gonococcus and meningococcus with their allies from the genus Diplococcus, and retain them under the heading *Neisseria*.

The genus *Diplococcus* would remain as defined above, and would have as its type species *Diplococcus pneumoniæ*, Weichselbaum 1886, while the genus Neisseria, Trevisan 1885, would be defined as follows:—

Streptococceæ.—Growing best, and often only aerobically with or without pigment formation, usually present in pairs without a true capsule, and in exudates usually intracellular, and readily decolorized by Gram's method of staining.

Primary cultures grow poorly on usual laboratory media, but best on solid media, especially those containing glucose or blood serum. No lysis with bile. Ferment carbohydrates usually with but slight acid production.

Synonym.—Micrococcus Hallier 1866 pro parte, *Diplococcus* Weichselbaum 1887 pro parte.

Type Species.—Neisseria gonorrhœæ (Bumm 1885).

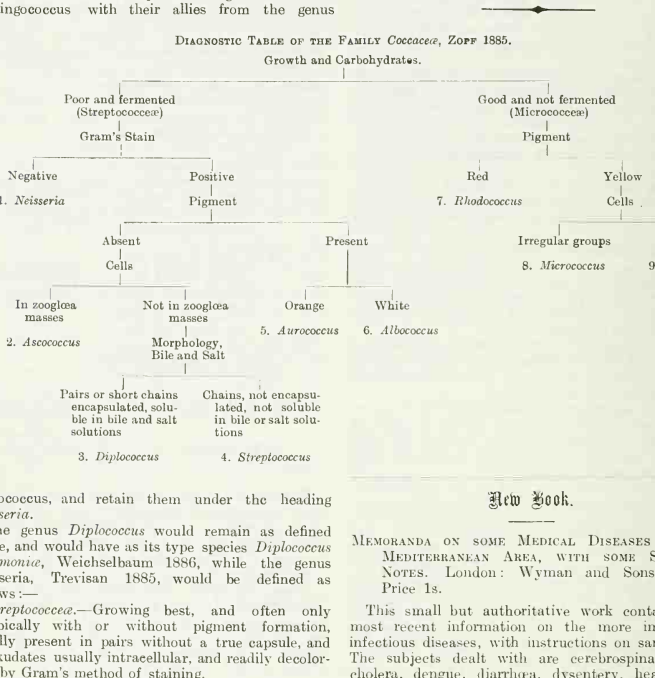
At this point it may perhaps be as well to note the *Micrococcus catarrhalis* Pfeiffer and *Micrococcus cinereus* v. Lingelsheim belong to the genus *Micrococcus*, and not to *Neisseria*.

The recognition of the various genera included in Zopf's family *Coccaceæ* can be determined by a study of the diagnostic table given below.

(*To be continued.*)

NOTE.—The illustrations will be published with the conclusion of the paper.

DIAGNOSTIC TABLE OF THE FAMILY *Coccaceæ*, ZOPF 1885.



New Book.

MEMORANDA ON SOME MEDICAL DISEASES IN THE MEDITERRANEAN AREA, WITH SOME SANITARY NOTES. London: Wyman and Sons. 1916. Price 1s.

This small but authoritative work contains the most recent information on the more important infectious diseases, with instructions on sanitation. The subjects dealt with are cerebrospinal fever, cholera, dengue, diarrhœa, dysentery, heatstroke, hepatic abscess, insect pests, jaundice, malaria, Oriental sore, paratyphoid, phlebotomus fever, plague, relapsing fever, sanitary notes, typhus fever, undulant fever. The reference to each disease is facilitated by separate consideration of etiology, symptoms, complications, diagnosis, prophylaxis, and treatment. This is the most useful and handy book on infectious diseases for practitioners and administrators in the Tropics, both those who have previous experience and those who for the first time devote attention to this most important subject.

Original Communication.

PRELIMINARY REMARKS UPON EPIDEMIC CEREBROSPINAL MENINGITIS AS SEEN IN THE ANGLO-EGYPTIAN SUDAN.

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(*Concluded from page* 116.)

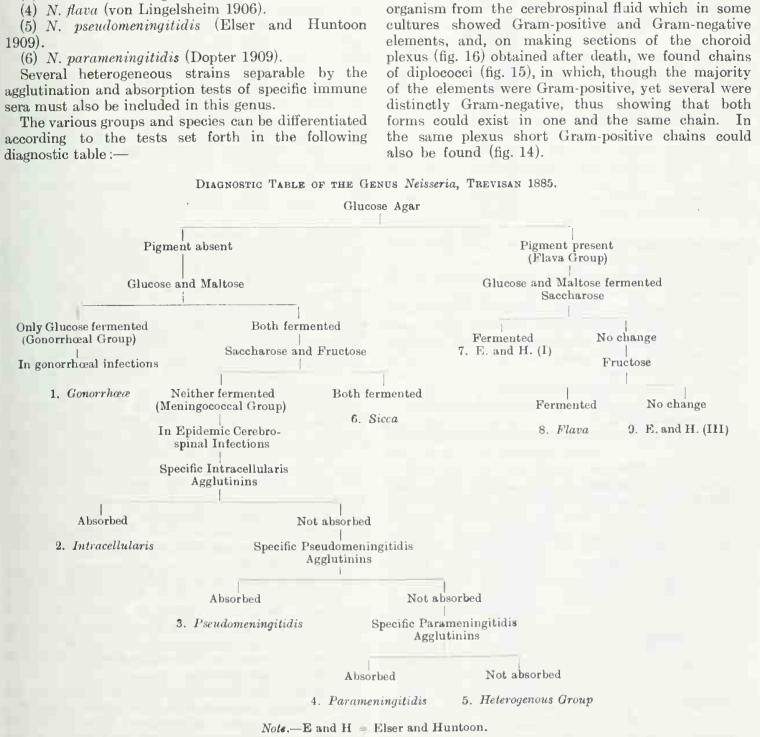
The genus Neisseria includes the following species:—

(1) *N. gonorrhœæ* (Bumm 1885).
(2) *N. intracellularis* (Weichselbaum 1887).
(3) *N. sicca* (von Lingelsheim 1906).
(4) *N. flava* (von Lingelsheim 1906).
(5) *N. pseudomeningitidis* (Elser and Huntoon 1909).
(6) *N. parameningitidis* (Dopter 1909).

Several heterogeneous strains separable by the agglutination and absorption tests of specific immune sera must also be included in this genus.

The various groups and species can be differentiated according to the tests set forth in the following diagnostic table:—

Diagnostic Table of the Genus *Neisseria*, Trevisan 1885.



Note.—E and H = Elser and Huntoon.

(*II*) *Gram-negative — Gram-positive Coccus.* — As already stated once, we received a cerebrospinal fluid from a case of fulminating cerebrospinal meningitis, which, though quite clear, had a peculiar greenish tinge which we had never before or since observed.

When this fluid was examined, it was seen to contain a number of Gram-negative as well as many Gram-positive diplococci (fig. 13), some of the latter being arranged in streptococcal chains (fig. 12).

On centrifuging, a few polymorphonuclear leucocytes were obtained containing some diplococci, and seven hours later the cerebrospinal fluid became quite turbid, and contained many leucocytes.

The same organism was also obtained from the peripheral blood.

At first we thought that we were dealing with a double infection of a Gram-negative and a Gram-positive organism, but we grew a Gram-positive organism from the cerebrospinal fluid which in some cultures showed Gram-positive and Gram-negative elements, and, on making sections of the choroid plexus (fig. 16) obtained after death, we found chains of diplococci (fig. 15), in which, though the majority of the elements were Gram-positive, yet several were distinctly Gram-negative, thus showing that both forms could exist in one and the same chain. In the same plexus short Gram-positive chains could also be found (fig. 14).

The exudation on the external aspect of the cerebral hemisphere is shown in fig. 17, while fig. 18 shows the cocci in the exudate. The intestines were quite healthy.

We obtained no growths from this case except the Gram-positive diplococci, which were often arranged in non-encapsulated chains. This coccus differed from the meningococcus in being slightly larger and in giving a slight growth at 22° C., while its colonies on ascitic agar agreed with von Lingelsheim's description of those produced by *D. crassus*, being small and greyish white, and when viewed by transmitted light and examined by a lens appearing somewhat brownish and granular. It can grow, but not well, under anaerobic conditions.

The carbohydrate reactions were as follows. It produced acid, but not gas, in :—

Monosaccharides.—Hexoses: Glucose, fructose and galactose; *Pentose: Rhamnose* (slightly only).

Disaccharides.—Maltose, lactose, and saccharose.

Trisaccharide.—Raffinose.

Alcohol.—Glycerol.

It formed neither acid nor gas in :—

Polysaccharides.—Dextrin, inulin, and amylum.

Glucoside.—Salicin.

Alcohols.—Erythrol, adonitol, dulcitol, and mannitol (as a rule).

Phenol.—Inosite.

Quantitatively examined, its reactions determined in the usual way with $\frac{N}{50}$ KOH were as follows :—

Classification	Names	Reagent	Cerebro-spinal meningitis	Nasopharynx of a contact	Tonsillitis	*D. crassus* according to von Lingelsheim
Monosaccharides	Hexoses	Glucose	1·6	1·8	2·3	A
		Fructose	1·3	2·0	1·7	A
		Galactose	1·9	2·1	1·5	A
	Pentose	Arabinose or Rhamnose	0·9	0·5	0·5	..
Disaccharides	..	Maltose	1·2	2·9	1·1	A
	..	Lactose	1·8	1·8	1·7	A
	..	Saccharose	2·5	3·0	1·5	A
Trisaccharide	..	Raffinose	2·2	2·0	0·0	..
Polysaccharides	..	Dextrin	0·0	0·0	0·0	0
	..	Inulin	0·4	0·5	0·1	0
	..	Amylum	0·0	0·3	..	..
Glucoside	..	Salicin	0·3	1·2	4·8	..
Alcohols	..	Glycerol	1·5	0·8	..	..
	..	Erythrol	0·4	0·0	..	..
	..	Adonitol	0·1	0·0	..	..
	..	Dulcitol	0·1	0·1	0·0	0
	..	Mannitol	0·0	0·0	0·0	0
Phenol	..	Inosite	0·2	0·0	..	..

Classification	Names	Reagent	
Monosaccharides	Hexoses	Glucose	1·6
		Fructose	1·3
		Galactose	1·9
	Pentose	Rhamnose	0·9
Disaccharides	..	Maltose	1·2
	..	Lactose	1·8
	..	Saccharose	2·5
Trisaccharide	..	Raffinose	2·2
Polysaccharides	..	Dextrin	0·0
	..	Inulin	0·4
	..	Amylin	0·0
Glucoside	..	Salicin	0·3
Alcohols	..	Glycerol	1·5
	..	Erythrol	0·4
	..	Adonitol	0·1
	..	Dulcitol	0·1
	..	Mannitol	0·0
Phenol	..	Inosite	0·2

Other Reactions.—It produced acid and clot in milk, but was not hæmolytic, nor did it produce indol, give the Voges-Proskauer reaction, or reduce nitrates.

Carriers.—As already stated, we have obtained the same organism from the naso-pharynx in several persons who were healthy, and either the same or closely allied organisms from two cases of tonsillitis, the only marked differences being the fermentation of salicin, which may or may not be important, and in the cases of tonsillitis the non-fermentation of raffinose, which, however, may be only a suppression, and we give the following comparative table of the biochemical reactions :—

Classification.—The above organism agrees with all the described characters of *Diplococcus crassus* von Lingelsheim, but we have tried other reactions against which, as far as we know, *D. crassus* has never been tested, and therefore we are not in a position to know whether this organism does or does not give these tests. At all events, as matters stand at present, our organism is indistinguishable from *D. crassus*, and therefore we assume that both are the same.

But the further classification of *D. crassus* is very difficult, as it is both Gram-negative and Gram-positive in the human body and in some cultures; it exists in chains and in diplococcal form, and does not possess a capsule, and does not undergo lysis with bile salts. These characters separate it from the genus *Diplococcus*, as defined above. It is also separable from the genus *Neisseria* in that it is more commonly Gram-positive than Gram-negative, but in its general behaviour with sugars it rather inclines to the Neisseria group.

It appears to us to be a half-way house between a true Streptococcus and a true Neisseria, and personally we are inclined to classify it as a streptococcus, but we leave it at present with its original name of *Diplococcus crassus*, as we are not prepared to discuss the diplococcus group in detail in the present communication.

Remarks.—We first recognized *D. crassus* in the Sudan nearly three years ago while examining swabs of the naso-pharynx of contacts of cerebrospinal meningitis from Omdurman when we found it twice.

We have also twice recognized it in cases of tonsillitis in Khartoum.

It is therefore an organism known to exist in the Sudan, but was it the causal agent in the above case of cerebrospinal meningitis or was it only a complication?

It cannot well be called a terminal infection, as the patient had only been ill a few hours and lived for some twenty-four hours after we obtained the samples of cerebrospinal fluid, &c.

It does not appear to be likely that it is an intestinal organism which has crept into the blood via the intestines as they appeared quite normal.

It cannot be a contamination, as it was obtained from the cerebrospinal fluid and blood during life, and after death it was found in the choroid plexus and the exudate on the brain.

The Gram-positive and Gram-negative elements can be seen in the preparation from the human body and in some of the cultures, and are parts of the same organism, as they can be seen forming part of the same chain in the choroid plexus.

When we first saw the Gram-positive and Gram-negative elements in the cerebrospinal fluid, we thought that we were dealing with a double infection, but neither from that fluid nor from the blood did we obtain the meningococcus or any other organism except *D. crassus*, in which the Gram-positive elements so much preponderate, and in which the sugar reactions are so different from those of the meningococcus.

We therefore conclude that as no other organism could be found to account for the meningitis, and as this germ was present in abundance in an acutely fatal attack, it must be the causal agent.

We further believe that this case lends support to Jaeger's contention that this organism, like the pneumococcus, can cause a rare case or a few cases of cerebrospinal meningitis, which in their symptoms resemble the epidemic cerebrospinal meningitis which is commonly caused by the meningococcus.

Perhaps it may be found to be commoner than we suppose if looked for, and perhaps it accounts for the repeated statements that the meningococcus is partially Gram-negative and partially Gram-positive, which the true meningococcus certainly is not.

At present in the Sudan it must be extremely rare, and will not be further considered in this paper.

Causal Relationship.—That the meningococcus is the true cause of cerebrospinal meningitis appears probable because:—

(1) We have found it in all the cases of the true epidemic disease which we have examined.

(2) It can be obtained in pure culture from such cases.

(3) These pure cultures can cause a disease resembling that of man in monkeys.

(4) It can be obtained in pure culture from such experimental monkeys.

(5) The sera of persons suffering from the disease can agglutinate and give positive complement fixation with meningococci obtained from other patients.

(6) It produces a protective mechanism in carriers which is missing in susceptible persons.

(7) As will be shown below, vaccine treatment can in suitable cases increase the opsonins in patients which is associated with improvement of the clinical symptoms.

This, of course, does not prevent other organisms from time to time causing sporadic attacks of cerebrospinal meningitis.

Pathology.—We have demonstrated above how common the meningococcus is in the naso-pharynx of patients and their attendants, and we have also shown that it can be seen lying in lymph spaces under the epithelium of the mucosa lining the ethmoidal cells (fig. 1) in a case of fulminating cerebrospinal meningitis.

We have also shown that there is no inflammatory reaction in that mucous membrane and we have seen but few polymorphonuclear cells in the sections which we have studied and only one containing Gram-negative particles which might have been digested organisms.

We have, however, noted a number of diplococci (fig. 2) lying in lymph spaces around a vessel associated with larger forms, and it appeared to us that possibly this was a site wherein the cocci grew and increased in numbers, and possibly from there infected the blood stream, as we, in addition to numerous observers, have demonstrated the presence of the organism in the blood in early stages of the disease (*vide* fig. 3). But it is interesting to note that even in those cases in which we have readily obtained the meningococcus from the blood stream, we have been unable to isolate it from the urine.

The organism, though present in the early stages of an attack of moderate severity, is absent therefrom twenty-four hours later, while the meningeal symptoms are not better but worse.

As it is to be found in the cerebrospinal fluid of these cases, it is obvious that it most probably passes from the blood into this fluid. According to general belief the cerebrospinal fluid is secreted by the gland-like choroid plexuses of the brain of which those of the lateral ventricles are the most important.

On investigating this plexus in the fulminating case mentioned above, it was found to be intensely congested (fig. 5) while the ventricular fluid, instead of being clear, was distinctly turbid.

When this choroid plexus was sectionized a small number of Gram-negative diplococci lying singly could be seen in the lymph spaces. Fig. 4 represents one such diplococcus and was by no means the best we saw, but the difficulties of obtaining really good representations of Gram-negative diplococci in Gram-stained preparations are very considerable, hence the poorness of the representation. This choroid plexus also contained a considerable effusion of polymorphonuclear cells.

It is evident that the diplococcus makes no long stay in the choroid plexus, but it appears to us to be, at all events, one route from the blood to the cerebrospinal fluid.

We also examined the Pacchionian bodies and found them to contain large numbers of polymorphonuclear cells, plasma cells, and connective tissue cells. Gram-negative diplococci were to be found lying in

the lymph spaces and also phagocyted in the polymorphonuclear cells (fig. 10). In addition to the polymorphonuclear cells, lymphocytes and other cells may be noted, thus demonstrating a reaction on the part of the tissue against the organism. This is the first time that this condition of the Pacchionian body has been described as far as we know.

If, as is often believed, the Pacchionian bodies pass cerebrospinal fluid from the subarachnoid spaces back to the blood, it is reasonable to suppose that meningococci would be found therein and that the bodies would become inflamed and that possibly by this means the circulation of the cerebrospinal fluid might be impeded and the pressure increased.

We have also examined the blood-vessels in the brain tissue and are inclined to think that there is some dilatation of the perivascular lymph sheaths, but it is not marked, and we have failed to find the meningococcus in these spaces.

This increase in pressure of the cerebrospinal fluid is often considerable, and as is well known, is correlated with the symptoms of headache, pains, &c., hence the great value of repeated and systematic removal of the fluid by lumbar puncture.

We are, therefore, of the opinion that the meningococcus enters the body via the mucosa of the nose and its connected sinuses, and in suitable cases in which the resistance of the body, as demonstrated by the opsonins is low, it grows in this mucosa and then, passing into the blood stream, enters the cerebrospinal fluid via the choroid plexuses, and perhaps via other vascular parts of the brain and spinal cord. As Elser and Huntoon first pointed out, it appears to have a special affinity for the cerebrospinal fluid (which may possibly be in some way connected with the lack of opsonins and other like substances therein), as it quickly leaves the blood and enters that liquid in uncomplicated cases, and it appears to us that the special liability of children to this and other epidemic diseases may also be associated with a relative lack of protective substances owing to the energies of the body being occupied with growth. Once in the cerebrospinal fluid it has the opportunity of inflaming the surfaces of the brain and spinal cord and causing damage by its toxins and by the increase of cerebrospinal pressure which may be in some way associated with the inflammation of the Pacchionian bodies as well as with increased production of fluid.

Examination of the figures shown in Plate II, as well as our remarks given above, show that in all probability *Diplococcus crassus* enters by the same route as the meningococcus and behaves in much the same way.

We may state that like Elser and Huntoon we have sectionized the sphenoid from its brain to its cell surface and have failed to find any evidence supporting the view that this is the route by which the meningococcus passes from the nose to the brain.

Bacteriological Diagnosis.—In order to effect a diagnosis in a tropical country like the Sudan, arrangements must be made so that specimens can be sent to the laboratory from stations several days distant therefrom.

In order to meet this difficulty we have devised a travelling bacteriological box which it is difficult to place other than in one position, and by means of this we are able to send suitable media to distant places.

The information which we desire to obtain is as follows: (1) What is the germ causing the illness? (2) Is it present in the peripheral blood? (3) Is it present in the urine? (4) Is it present in the nasopharynx of the cases and the contacts? (5) Who are the carriers? (6) Does it cause illness other than cerebrospinal meningitis? (7) Is it present in animals?

To enable these points to be investigated we have sent circulars to the Principal Medical Officer, Egyptian Army, and the Director-General, Sudan Medical Department, for transmission to their officers, of which the following is an extract:—

"You will receive:—

(1) *Broth Flasks.*

(*a*) *Aseptically* inoculate one with a quantity of *cerebrospinal fluid* by allowing this fluid to flow from the needle inserted into the spinal canal directly into the flask, but excluding the first few drops, which may be contaminated. The quantity of cerebrospinal fluid should be as large as you think desirable in the interest of the patient and the size of the flask, *i.e.*, the flask should always have an empty air space at the top to prevent as much contamination of the cotton wool as possible.

(*b*) Inoculate a second blood flask with 1 c.c. *of the peripheral blood* taken from a vein.

(*c*) Inoculate a third flask with urine removed aseptically by a sterile catheter, after washing the external genitalia. The urine must flow directly from the catheter into the flask.

(2) *Buchanan's Medium Tubes.*

Post-nasal swabs must be taken. These are not swabs from the throat or the nose but from the back of the nose, and obtained by inserting the swab (after bending the wire at an obtuse angle) through the mouth and up behind the soft palate. Do not let the swab touch the tongue or the sides of the mouth. Straighten the wire and inoculate one tube of Buchanan's (the red) medium by rubbing the swab gently upon its surface.

(3) *Glass Slide Smears.*

Make smears on the usual microscopical slides of:—

(*a*) The deposit of clear or some of the thick cerebrospinal fluid as for malarial blood slides.

(*b*) Peripheral blood as for malaria.

Allow to dry, and fix both by dipping in strong alcohol or equal parts of alcohol and ether for about five minutes and then allowing to dry.

(4) *Blood Capsules.*

As for the usual agglutination test.

(5) *Contacts.*

Post-nasal swabs (as described in Section 2) should be taken from contacts.

(6) *Peculiar Fevers.*

In epidemics of cerebrospinal meningitis, inoculated blood flasks and post-nasal swabs should be sent to the laboratories from cases of unrecognized types of fever.

(7) *Nasal Catarrh.*

In epidemics, cases of nasal catarrh should be investigated by means of nasal swabs, Buchanan's tubes and microscopical smears.

(8) *Animals.*

The occurrence of any disease resembling cerebrospinal meningitis in animals, especially in horses, mules and donkeys, should be reported at once. In case of epidemics all domestic animals should be examined to see whether any suffer from nasal discharge."

We use glucose broth for the cerebrospinal fluid and the urine and plain broth for the blood, and as

the temperature in the box during transit is more than 25° C. the organisms are alive when they reach the laboratory and twenty-four to forty-eight hours in the incubator restores their growth.

If the blood capsules containing serum have to travel any great distance, it is necessary to separate the serum from the blood by some form of centrifuging, even if it is merely swinging on a string. The part containing the serum is separated from that containing the blood and resealed.

When these instructions are properly carried out, not merely is a diagnosis effected, but a considerable amount of information is obtained, which is used to combat the outbreak.

This method was evolved because we found that the meningococci broke up and disappeared in the fluid, even when sent but a short distance in the very hot weather, and it was only possible to make a guess at the diagnosis, as the turbid fluid contained polymorphonuclear leucocytes but (if carefully collected) showed no visible germs, was sterile on cultivation and did not infect monkeys.

The same method clears up fulminating cases in which the cerebrospinal fluid is fairly clear though full of organisms.

In cases more or less cured in which the fluid is sterile, the only possible method of arriving at a diagnosis is by Nonne's test and a differential cytological count of the deposit of the cerebrospinal fluid as shown above.

Practically we have only met with two diagnostic difficulties as regards the Sudan, and these are the differentiation of the disease from the *meningitic form of pernicious malaria* and from *tetanus* and both of these are very easily separated as the cerebrospinal fluid is clear and sterile while there is no increase in the cells and, generally, a complete absence of polymorphonuclear leucocytes and in addition the peripheral blood in the case of malaria shows, as a rule, an abundance of parasites.

Cerebrospinal meningitis is sometimes remarkably like *typhus fever*, but the retraction of the head, Kernig's sign, and the turbid cerebrospinal fluid with its bacteriological findings easily differentiate the two. Moreover, a rash is, in our experience very rare in cerebrospinal meningitis in the Sudan, which disease can be easily differentiated from *septicæmic plague* by the retraction of the head, Kernig's sign, and the bacteriological examination of the blood and cerebrospinal fluid.

As regards the *diagnosis of carriers* we have trusted largely to Buchanan's medium as modified to suit the conditions of the Sudan by Mr. Marshall, senior bacteriological laboratory assistant in these laboratories. We examine such completely red colonies as are discrete and shiny, and if we find them to be composed of Gram-negative diplococci we transfer them to ascitic agar on which they may or may not grow pure; in the latter case they are plated out in ascitic agar and a strain obtained from one single pure colony. The pure strain is then inoculated on to two tubes of glucose ascitic agar or nasgar, one of which is incubated at 37° C., while the other is placed in a cool incubator at a temperature varying from 20° C. to 22° C. If a growth occur on the 37° C. and not on the 20° C. to 22° C., this is tested quantitatively with carbohydrate media. Further examination belongs to the serological work, which is left for a future paper.

Bacteriological Treatment.—The aim of all treatment is to kill the causal organism, neutralize and eliminate its products and restore the injured body to health.

As the causal organism lies embedded in the nasal mucous membrane and in the exudate on the brain in addition to other sites, it is obvious that some remedy which will find its way into the blood stream and so to every part of the body is advisable, while in addition some form of local treatment which can be readily applied to the brain and spinal cord must be necessary in severe cases.

These ends might he accomplished by medicines, but so far no drug has been found which meets the case.

Our study of the ætiology has impressed us with the idea that the carrier does not fall a victim to the disease if his opsonic index, and hence his resistance against the organism, is high, while on the other hand the victim of the complaint has a very low opsonic index, and hence a very low resistance. If this is admitted then obviously one of the two points to he aimed at is to raise the resistance of the body so as to enable it to rid itself of the organism and to neutralize its products.

It is evident that one of the best methods of doing this must be by vaccines, but it must also be evident that if they are to he successful they must be polyvalent and require time to act and a body condition suitable for reaction to the treatment. In other words, it is not possible to expect results in fulminating infections, in very bad bodily conditions, nor in cases which when first seen are in an obviously dying condition, although there is no harm in trying because, in one instace, the opsonic index in an apparently hopeless case showed that the patient was not as ill as was thought and a quick recovery was made under vaccine therapy.

At first we began treatment by means of commercial serum therapy, but after a prolonged trial we were reluctantly compelled to own that whatever use it might he in other countries it was not markedly beneficial in the Sudan, even in large doses and different varieties of preparation. Yet this form of treament may prove to he of the greatest value in cases unsuitable for vaccine therapy if a polyvalent serum is prepared with the strains of the meningococci which cause disease in the Sudan, but this subject belongs to a future paper.

We then combined commercial serum treatment with that of a vaccine prepared from organisms killed hy heating to 60° C. for one hour, and this appeared to be so much hetter that we decided to try vaccines alone and this we did with organisms killed by heating first to 58° C. and later to 56° C. for forty-five minutes.

Sixteen cases, apparently hopeless and of average severity, were so treated, with a result that ten recovered and six died.

This encouraged us to improve the vaccine, which

we now prepare in polyvalent form by killing the organisms by heating at 50° C. for twenty minutes. Often, but not always, the germs are killed, but the sterility is completed by the addition of 0·2 per cent. lysol.

We tried this vaccine upon ourselves in doses of 1 million, 5 millions, 100 millions and 250 millions without bad effects.

We then started to treat cases, and there can be no doubt that at first we gave too small doses, and we now administer it as follows :—

To an adult we give 200 millions as the first dose and follow this up in a couple of days with 500 millions, which is repeated if required. It is a mistake to give too large doses, but it is equally a mistake to give too small.

The treatment of children varies according to the size of the child and averages about 50 millions for the first dose and 100 millions for the second and higher if required later.

In order to ascertain what was happening in the patients' bodies while being treated in this way we investigated the opsonic index of the blood serum with the results set forth in the following table :—

in the vaccine treated cases they were one-sixth of the same total.

We also studied the opsonins present in the cerebrospinal fluid of these treated cases with the following results :—

TABLE VIII.—Cerebrospinal Fluid Opsonic Index in Treated Cases.

Number of Leucocytes counted, 50.

Number of cases	Fluid unheated: Total cocci in leucocytes	Fluid unheated: Leucocytic index	Fluid unheated: Opsonic index	Fluid heated to 60° C. for twelve minutes: Total cocci in leucocytes	Fluid heated to 60° C. for twelve minutes: Leucocytic index	Fluid heated to 60° C. for twelve minutes: Opsonic index	Remarks
I ..	7	0·14	0·7 ..	2	0·04	0·04 ..	Improving.
II ..	3	0·06	0·3 ..	1	0·02	0·02 ..	Improving.
Control ..	9	0·18	1·0 ..	0	0	0 ..	..

The only points of interest are the smallness of the amount of the total opsonins and the presence of a trace of bacteriotropins in the fluids, the latter being absent in the control and in these untreated

TABLE VI.—Blood Serum Opsnic Index of Treated Cases.

Number of Leucocytes counted, 50.

Number of cases	Serum unheated: Total cocci in leucocytes	Serum unheated: Leucocytic index	Serum unheated: Opsonic index	Serum heated to 60° C. for twelve minutes: Total cocci in leucocytes	Serum heated to 60° C. for twelve minutes: Leucocytic index	Serum heated to 60° C. for twelve minutes: Opsonic index	Examination of peripheral blood	Remarks on cases
I ..	55 ..	1·1 ..	5·5 ..	12 ..	0·2 ..	0·2 ..	Sterile ..	Usual severity.
II ..	66 ..	1·3 ..	6·5 ..	5 ..	0·1 ..	0·1 ..	Gram-negative cocci ..	Very severe case.
III ..	64 ..	1·2 ..	6·0 ..	13 ..	0·2 ..	0·2 ..	Sterile ..	Usual severity.
IV ..	56 ..	1·1 ..	5·5 ..	10 ..	0·2 ..	0·2 ..	Sterile ..	Usual severity.
Control ..	11 ..	0·2 ..	1·0 ..	0 ..	0·0 ..	0·0 ..	.. ..	..

These cases had been treated by a locally-made polyvalent vaccine killed at 50° C., and subsequently all completely recovered. The leucocytic index is reduced to one-fifth by heating the serum except in II, a bad case in which it is reduced to one-twelfth. In this case Gram-negative cocci were obtained in pure culture from the blood on the second day of the illness but not subsequently. The urine was examined in all four cases and was found to be free from organisms.

A comparison can now be made between the opsonic indices of untreated cases, of temporary carriers who speedily cleared themselves of the germ with the aid of slight disinfection and of cases which received vaccine therapy.

The blood serum results are set forth in the following table :—

TABLE VII.

Varieties	Serum unheated: Cocci in leucocytes	Serum unheated: Leucocytic index	Serum unheated: Opsonic index	Serum heated to 60° C. for twelve minutes: Cocci in leucocytes	Serum heated to 60° C. for twelve minutes: Leucocytic index	Serum heated to 60° C. for twelve minutes: Opsonic index	Remark
Untreated cases ..	6	0·1	0·5 ..	0	0	0	.. Includes one fatal case.
Temporary carriers ..	47	0·9	4·7 ..	11	0·2	0·2	.. Attendants on cases.
Vaccine treated cases ..	60	1·2	6·0 ..	10	0·2	0·2	.. All recovered.

The bacteriotropins in the temporary carriers were therefore one-quarter of the total opsonins, while

cases. It will also be noted that the amount of total opsonins present in the cases is less than the control, and hence the normal opsonins present are much lower than in the control.

We have now recorded observations upon the opsonins seen in the unheated and heated blood serum of untreated cases, carriers, and treated cases of the disease as well as upon those of the unheated and heated cerebrospinal fluid, and it is now necessary to review these results.

Four factors are combined in the formation of an opsonic index, viz. : the leucocytes, the patient's serum, the control serum and the organism, to which might be added the personal equation which we have tried to render as little variable as possible.

We have endeavoured to exclude the leucocytic influence by always using the cells from the same man, and the control serum influence by also using serum from the same man in which the opsonic index was reduced to a minimum by heating to 60° C. for twelve minutes; we have also attempted to minimize the influence of the organism by only using allied strains. We therefore have, as far as

we know, only one variable unit, viz., *the patient's serum.*

If the table showing the opsonic index of untreated cases he examined (Table I) it will be noted that the cocci ingested and the leucocytic indices are distinctly below those of the control and that the opsonic index is low, while the effect of heating the serum to 60° C. for twelve minutes is to minimize or destroy the influence of the opsonins, and the same remarks hold good for the table (Table II) showing the cerebrospinal fluid opsonic index of these cases.

When, however, the blood serum opsonic index table of the attendants (Table III) upon the cases is examined, it is at once seen that the cocci ingested and the leucocytic indices are much greater than those of the control, while the difference between the opsonic index of these people and that of the untreated cases is most marked.

Therefore there can he no douht that there were more opsonins in the unheated blood of these people than in the control and still more than in that of the untreated cases, and this seems to us to he the explanation why none of these attendants, though they were all infected with the meningococcus, acquired the disease, as we believe that the autogenous vaccine produced by the nasal infection in these cases raised their resistance above the normal, whereas in the untreated cases the resistance was much below normal, and hence the flourishing condition of the disease, while with regard to the control, the low leucocytic index, to our mind, indicates a tendency to infection.

If we now examine that portion of the table which shows the effect of heat upon the sera of the attendants, we note that instead of the opsonic influences being reduced to a minimum or destroyed, as was the case in untreated cases and controls, there is still a fair quantity of opsonins left, roughly one-third to one-sixth of those found in the unheated sera.

We used this method of heating the sera and cerebrospinal fluids to 60° C. for twelve minutes because Wright and Douglas in 1902 had shown that the opsonic power of normal blood fluids was but little impaired by heat until temperatures above 50° C. were employed, but that when heated to 60° C. it was reduced to a minimum. They also showed that in immune serum the opsonins were not merely increased, but were much more resistant to heat. In other words there were two sets of bodies, viz., normal opsonins and immune opsonins, which latter were called bacteriotropins by Neufeld and Rimpau.

Later researches have tended to show tbat both normal and immune opsonins are qualitatively but not quantitatively alike, as they both consist of a thermostahle specific sensitizer or amhoceptor and a thermolabile alexin or complement. The quantitative differences are, however, marked in that the immune serum contains so many thermostable bacteriotropins that phagocytosis is merely diminished by heating the serum to 60° C. for twelve minutes.

In normal scrum, on the other hand, there are so few or these thermostable bacteriotropins that they require the presence of alexins or complements to produce marked phagocytosis. Hence heating to 60° C. for twelve minutes almost, but not entirely, destroys their phagocytic influence.

Applying these observations to the opsonins of the attendants we note that the thermostable bacteriotropins have risen from zero to hetween one-third to one-sixth of the total opsonins, which leaves from two-thirds to five-sixths still to be accounted for. This remainder should consist solely of thermolabile complement, the actual increase of which can be judged by deducting the value of the control from the two-thirds to five-sixths left after the removal of the thermostable bacteriotropins, when there is a remainder of no less than between one-half to two-thirds of the original.

But complement is not supposed to be specific, nevertheless it has increased if the above theories are correct. If, on the other hand, as Neufeld helieves, the normal opsonins and the bacteriotropins are distinct entities, then both migbt be increased as a result of vaccination. Be this as it may, the protective mechanism of these attendants was raised and they did not acquire the disease.

Turning now to the tables of the treated cases it will be observed that, like the attendants, the numbers of cocci ingested, the leucocytic index and the opsonic index of the unheated serum and of the cerebrospinal fluid have risen considerably above normal and *a fortiori* above those of the untreated cases and even above those of the blood serum of the temporary carriers or attendants.

We therefore suggest that vaccine therapy has raised the resistance of these people and that their recovery may, in part at least, be assigned to this therapeutic agent.

When we examined the heated serum we noted that the bacteriotropins amounted roughly to one-fifth of the total opsonins except in the very severe cases, where they only amounted to one-twelfth at the time that the indices were calculated.

When the cerebrospinal indices of the treated cases are compared with those of the untreated cases, there is seen to be a slight rise in the total opsonins as well as in the bacteriotropins, so that even in this fluid there is a slight increase, which, however, may not he due to the vaccine but to the mechanical punctures made in removing the fluid as is shown by experiments on the anterior chamber of the eye.

We next inquired as to what was happening to the leucocytes in the cerebrospinal fluid of treated cases, and this is shown in the following table:—

LEUCOCYTES IN THE CEREBROSPINAL FLUID.

Case	Acute untreated	Convalescent treated	Normal
Polymorpho-nuclears	96·8 per cent.	22·8 per cent.	0
Large mono-nuclears	2·8 ,,	0·0 ,,	0
Small mono-nuclears	0·4 ,,	77·2 ,,	Nearly 100 per cent.
Eosinophiles	0·0	0·0	0
Basophiles	0·0	0·0	0
Number of cells	Very numerous	Much reduced	1—5 per cubic mill.
Cocci in fifty cells	72	0	0
Cultures	Meningococcus grows	Sterile	Sterile.

These figures appear to us to indicate an attempt to return to the normal condition.

The next point which we investigated was the change produced in the blood before and after treatment by vaccine therapy. The result may be exemplified by a little girl who had signs of old malaria, as, indeed, most natives have.

Kind of cell	Untreated	Treated
Polymorphonuclear leucocytes ..	83·4 ..	65·0
Mononuclear cells	16·4 ..	32·4
Small lymphocytes	00·0 ..	2·4
Eosinophiles	0·2 ..	0·2

The blood count in the untreated condition of this girl may, with advantage, be compared with that given at the beginning of the section on ætiology which is from a case uncomplicated by malaria or any protozoal infection.

The above table shows that treatment is followed hy a reduction of the polymorphonuclear leucocytes to normal, while the increase of the mononuclears at the expense of the small lymphocytes is explained by the malarial infection.

There is, however, one great adjuvant to the vaccine or indeed to any other kind of treatment, and this is the regularly repeated withdrawal of fluid from the spinal canal, which enables fresh fluid to be poured out by the choroid plexuses and removes the old fluid while it does not deprive the patient of any autogenic protective substance because the opsonic index of the cerebrospinal fluid is nil and apparently is not markedly improved by vaccine therapy, while the mechanical flushing of the diseased cord and brain with freshly poured-out fluid appears to be beneficial, and so is the diminution of cerebrospinal pressure.

Another most important adjuvant is to combine with this treatment good food, good hygienic conditions and good nursing, thus enabling the body of the patient to react to the vaccine, and with this must be associated the treatment of complications, such as malaria, diarrhœa or dysentery, which tend to lower the patient's bodily health and defeat the treatment.

It is a serious mistake to imagine that a patient can be cured by a few injections of vaccine without associating therewith a careful study of every organ of his body every day and without combating such bad signs and symptoms as may be discovered by appropriate means.

Deductions.—We are of the opinion that a combination of polyvalent vaccine therapy with systematic removal of fluid by lumbar puncture, and with good food, nursing, and hygienic conditions, and with symptomatic treatment, is worthy of a serious trial.

Serum treatment, *if prepared with the strains prevalent in the locality*, will probably be most useful in combination with this treatment and in cases not suitable for vaccine therapy, but we defer the consideration of this until a future paper.

Prophylaxis.—As far as we know at present man alone is the natural habitat of the meningococcus in the form of the persistent carrier who does not clear himself of the germ. From this source unsusceptible persons may become carriers, while susceptible persons can become infected with the disease, and they in their turn can pass the germ to their attendants, who become temporary and perhaps persistent carriers. In this way a carrier may spread the disease from place to place or may form the centre of an infected area, as may also a case.

The first duty of prophylaxis is, therefore, to search for and find the cases and the carriers and to isolate them till free from the germ in their nasal cavities.

The diagnosis of the case and of the carrier has already been discussed and now we come to the question of the clearing of the carrier. Luckily they, as a rule, cleanse themselves and we believe that they do this hy means of the auto-vaccination to which we have invited attention above, but there are some that do not and in any case it is desirable to expedite this cleansing process in order that they may cease to be potential centres of infection. It is obvious that a study of the opsonic index of a persistent carrier would be most interesting, but this we have been unable to make.

The important point with reference to carriers is that we have found Gram-negative diplococci in the mucosa of the ethmoidal cells, while Emhleton and Peters have found the meningococcus in the sphenoidal sinus in cases of the disease. If this occurs in the carrier it would explain this continued presence of the germ despite nasal disinfection and would also explain the occurrence of the so-called periodical carrier in whom the germs may only at times descend into the nose from the connected cells.

Nasal disinfection can do no harm and will do good in those cases in which the germs live solely in the naso-pharynx, but it will be perfectly obvious that nasal disinfection unaided by auto-vaccination will not clear the nasal sinuses. On the other hand, it appears to us likely that auto-vaccination is an important factor in the true cleansing of many carriers, and it also appeared to us to be useful to try the effect of vaccination on carriers who still showed the germ after seven days' nasal disinfection, and this we have done in eight of such carriers, with the result that after one injection of 5 millions of a polyvalent vaccine killed at 50° C., three appeared to be bacteriologically clear while the five others were cleared by another dose of 50 millions. Moreover, after dealing with these carriers the local epidemic died away.

We are well aware that the use of vaccine for this purpose has been said to be unsuccessful and, moreover, it has been believed that it ought to be unsuccessful, because there is no interaction between the organism and the tissues of the host. Our findings, on the other hand, open up a more hopeful view and though we are far from believing that the few results we bring forward should be considered as proving the value of vaccine, still we do believe that we have submitted a case for the more extended trial of this prophylactic measure. We have also attempted to protect a highly susceptible small community by the same vaccine.

A small community of fourteen Nyam-Nyams were residing together in Omdurman when the recent small epidemic broke out. They lived under highly insanitary conditions and certain of them probably

did not receive very good food. Five of them died one after the other from the fulminating type of the disease and the opsonic indices of the remainder were calculated in order to try to find out the reason for this sudden mortality.

The result was as follows :—

TABLE IX.—Nyam-Nyam Blood Serum Opsonic Index.

Fifty leucocytes counted.

Names	Total cocci in leucocytes	Leucocytic index	Opsonic index
Average of unvaccinated Nyam-Nyams	6	0·1	0·5
Control	11	0·2	1·0

This showed that these people possessed a resistance lower than that of the ordinary person and resembling closely that of an untreated case and, therefore, afforded an excellent soil for the growth of the germ. They were then removed to sanitary quarters and were given good food, but they became exceedingly alarmed, they saw the ghosts of their departed friends, they heard strange music and, indeed, they were most miserable!

Some received 5 millions of the vaccine while others did not. One died of fulminating cerebro-spinal meningitis forty-eight hours after receiving the vaccine, and two others bad fever and looked as though they were going to develop an attack, which seemed to indicate that a negative phase had been produced at this time. At the end of a week after vaccination the opsonic index was calculated again.

TABLE X.

Class	Total cocci in leucocytes	Leucocytic index	Opsonic index
Vaccinated ..	25	0·50	2·50
Unvaccinated ..	3	0·06	0·26

The vaccinated had therefore improved, but the unvaccinated had diminished in opsonic value.

They were then given 50 millions of the vaccine and in the meanwhile they became more cheerful and the effect of good food and hygiene began to tell and they all appeared in excellent health when the opsonic index was again taken at the end of a week with the following results:—

TABLE XI.

Class	Total cocci in leucocytes	Leucocytic index	Opsonic index
Vaccinated ..	48	0·96	4·5
Unvaccinated ..	13	0·26	1·3

Finally they received 100 millions of the vaccine while they continued to live under good conditions of food and hygiene and a complete absence of overwork. At the end of a week, when they all appeared to be in excellent health and spirits their opsonic index was again tested with the results shown below :—

TABLE XII.

Class	Total cocci in leucocytes	Leucocytic index	Opsonic index
Vaccinated ..	78	1·56	7·8
Unvaccinated ..	26	0·52	2·6

It will be seen that the effects of good food and hygiene are still making themselves felt upon the unvaccinated, but the vaccine has also produced its effect above and beyond this.

In order to note whether the index of 2·6 reached by the unvaccinated was abnormal, we tested an apparently healthy native living under fairly good conditions, and found that the total number of cocci in fifty of his leucocytes amounted to twenty-seven, thus making his leucocytic index 0·54, and his opsonic index 2·7, which agreed very closely with figures for the unvaccinated Nyam-Nyams after three weeks of rest and good living.

It thus appears that the good food and good hygienic conditions had increased the opsonins in these people, while vaccination had still further benefited them.

It seems from this small experiment that prophylactic vaccine may be of value, and we propose to try it on an increasing scale during the coming epidemic season, though the presence of the probable negative phase mentioned above makes an epidemic season the worst possible time for prophylactic vaccine ; still it is quite impossible to get people to agree to take precautionary measures before they see the danger around them. The vaccine produced no bad local or general effect either in ourselves, in Sudanese natives, or in Nyam-Nyams.

To summarize, we are basing our prophylaxis in the Sudan upon :—

(1) Search for cases, which are isolated and not allowed to leave the hospital until bacteriologically free from the germ, while attendants are examined for the germ and treated therefor.

(2) Systematic search for carriers. This we think is most valuable, as the carrier when found is isolated and treated.

(3) Disinfection of the nose of the general population, which was most successful last year, together with encouragement for them to be vaccinated with a polyvalent vaccine killed at 50° C., and given in doses of 5, 50, and 100 millions at the intervals of one week. We are not, as yet, convinced of the necessity of raising the prophylactic dose to 250 millions.

(4) The prevention of overcrowding and bad ventilation in infected areas, together with the cleansing and disinfection of huts and clothing, as the Sudanese native is continually expectorating in a most profuse manner in his hut and on to his clothing, and though we have no belief in the conveyance of the germ except from man to man, we believe that these disinfecting measures are good, while we have already emphasized the importance of overcrowding, bad ventilation, poor and insufficient food, and over-exertion, as secondary causal agents.

Conclusions.—In ending this note we desire to lay stress upon the fact that it deals with merely a preliminary investigation in which we have attempted to find out some points about the disease as seen in the Sudan, with the view of coping with its increasing severity therein.

The results of this preliminary work may be tabulated as follows :—

(1) The important causal agent is *Neisseria intracellularis* (Weichselbaum 1887), and only on one

occasion have we found *Diplococcus crassus* von Lingelsheim 1906 acting in this capacity, and so far no other organism.

(2) As far as our researches have gone only *man* has been found to be the host of *Neisseria intracellularis*, and he acts in this capacity as *the true carrier* of the germ, and as such does not acquire the disease because of an *immunity* conferred by auto-vaccination.

(3) In order to acquire the disease two factors at least are required, viz.:—

(*a*) Infection with *Neisseria intracellularis*.

(*b*) *Lack of* capability on the part of the body to produce the necessary *immunity*.

The infection takes place from the nose of a carrier or a case to the nose of an uninfected person, and is favoured by overcrowding and bad ventilation. The lack of power to produce the necessary immunity is favoured by poor and insufficient food, bad hygienic conditions, and over-exertion.

(4) In susceptible persons the germ passes into the mucous membrane of the nose and of its connected cells, and multiplies therein, and then entering the blood-stream forms in the early days of the disease a bacteriæmia. Normally, however, it does not long remain in the blood-stream and therefore normally does not produce a septicæmia, which when present should be considered as a complication. Apparently the organism is strongly attracted to the cerebro-spinal fluid, into which it quickly passes via the choroid plexus of the lateral ventricle and perhaps other vascular structures of the brain and spinal cord and so causes the disease.

The reason why the cocci as a rule do not pass in relays day after day from the mucous membrane of the nose into the blood is because the patient is either dead or the resistance is raised in a short time, but if this resistance again becomes lowered it is possible that relays may again pass from the nose and in this way a relapse or recurrent attack ensues.

(5) The rare various strains of *Neisseria intracellularis* and to be successful in treatment a *polyvalent serum and a polyvalent vaccine made from local strains* are necessary. Vaccine alone will cure many cases, hut requires time to act, which may not be available, and hence the value of the serum in such cases, especially when followed by subsequent vaccine therapy.

(6) Prophylaxis depends upon:—

(*a*) The search for, isolation of, and treatment of cases and carriers, and here vaccine therapy is of use in helping to cleanse cases and carriers.

(*b*) The increase of the immunity of the general population which can probably he done by prophylactic vaccination in doses of 5, 50, and 100 millions, but further experience is required of this when given on a large scale. There is little douht that a negative phase is produced, at all events at times, in the first stages of this vaccination, and this may possibly be aggravated by fear, poor or insufficient food and bad hygiene. It also appears to us that vaccine prophylaxis ought to be tried on a large scale, as it causes no general or local symptoms if the germs are killed at 50° C., and the vaccine is aseptic and isotonic with the fluids of the body, and if the site of injection is the subcutaneous tissue just below the angle of the scapula, which in our opinion is the best place for prophylactic and other subcutaneous injections.

(7) There are a great many questions with regard to epidemic cerebrospinal meningitis which are at present unsolved, and one of the most important appears to he the question as to whether any animal or animals act as hosts of the germ.

Acknowledgments.—It gives us much pleasure to acknowledge the kind help which we have received during the preparation of this paper from Dr. Christopherson, Director of the Khartoum and Omdurman Civil Hospitals, Dr. Bousfield, Medical Officer of Health, Khartoum and Omdurman, Dr. Atizah, Medical Officer in charge of the Omdurman Civil Hospital, as well as the kind criticisms and suggestions which Captain Archibald, R.A.M.C., Pathologist to these laboratories, has kindly given us.

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ILLUSTRATIONS.

PLATE I.

Neisseria intracellularis (Weichselbaum 1887).

FIG. 1.—Gram-negative diplococcus lying in a lymph space below the epithelium of the mucous membrane lining an ethmoidal cell, from a case of fulminating cerebrospinal meningitis. × 1,000 diameters. Photomicrograph.

FIG. 2.—Diplococci lying around a vessel in the same tissue as fig. 1. They were seen in three consecutive sections. × 1,000 diameters. Photomicrograph.

FIG. 3.—Meningococcus in a polymorphonuclear leucocyte of the peripheral blood from a case of medium severity and in a very early stage of the disease. The blood taken at the same time as this smear was proved culturally and biochemically to contain the meningococcus. × 1,400 diameters. Photomicrograph.

FIG. 4.—Gram-negative diplococcus lying in the choroid plexus of the lateral ventricle of the brain in the same case as figs. 1 and 2. × 1,000 diameters. Photomicrograph.

FIG. 5.—The choroid plexus of the lateral ventricle in which the Gram-negative diplococcus depicted in fig. 4 was found. Reduced. Photograph.

FIG. 6.—The external aspect in the brain from the same case in figs. 1, 2, 4 and 5, showing congestion and commencing exudation. Reduced. Photograph.

FIG. 7.—Polymorphonuclear cell in the cerebrospinal fluid of a case of medium severity stained by Gram's method to show the meningococci. × 1,400 diameters. Photomicrograph.

FIG. 8.—Cerebrospinal fluid from a case of moderate severity. Note the meningococci. × 1,000 diameters. Photomicrograph.

FIG. 9.—A similar cell to that depicted in fig. 7, but showing the digestion of the meningococci. × 1,400 diameters. Photomicrograph.

FIG. 10.—A Gram-negative diplococcus lying in a lymph space in a Pacchionian body from the same case as figs. 1, 2, 4, 5 and 6. In this specimen there were polymorphonuclear cells full of phagocyted diplococci. × 1,200 diameters. Photomicrograph.

FIG. 11.—A meningococcal colony grown for forty-eight hours upon ascitic agar in a Petri dish. × 5 diameters. Photograph.

PLATE II.

Diplococcus crassus von Lingelsheim 1906.

FIG. 12.—The organism in the cerebrospinal fluid showing a short Gram-positive chain. × 1,400 diameters. Photomicrograph.

FIG. 13.—Cerebrospinal fluid from a case of fulminating cerebrospinal meningitis showing Gram-positive-Gram-negative diplococci. Note the absence of cells. × 1,400 diameters. Photomicrograph.

FIG. 14.—Short Gram-positive chain in the choroid plexus of the same case as figs. 12 and 13. × 1,400 diameters. Photomicrograph.

FIG. 15.—Gram-positive-Gram-negative chain of diplococci in the choroid plexus of the lateral ventricle of the brain in the same case as that from which figs. 12, 13 and 14 were procured. × 1,400 diameters. Photomicrograph.

FIG. 16.—Choroid plexus of the lateral ventricle in the same case as that from which figs. 12 to 15 were obtained. Reduced. Photograph.

FIG. 17.—External surface of the brain in the same case as fig. 16, showing the exudate. Reduced. Photograph.

FIG. 18.—Gram-positive diplococci in the exudate depicted in fig. 17. × 1,000 diameters. Photomicrograph.

Abstract.

A PUZZLING INFECTION.

THE Budapest correspondent of the *Journal of the American Medical Association* (April 1) reports at Balassa-Gyarmat, a large provincial town, a puzzling endemic condition. In January of this year a wounded soldier was admitted to the military hospital. He had been wounded in the right shoulder nine days before admission. At the end of the same month he began to have fever, without the origin of the fever being discovered. The man suddenly became bedridden and died. *Post-mortem* examination revealed the presence of a liver abscess, which had ruptured into the pleural cavity; otherwise there were no pathologic changes. During the first fortnight in February there were six similar cases with four deaths. The bacteriologic examination revealed the presence of a hitherto unknown anaerobic bacillus, which was present in quantities in the pus of the liver abscess. No other pyogenic organisms were found. The organism grew in pure

culture. Inoculating a rabbit with it produced liver abscesses. In a few instances, abscesses appeared in the muscles and bone marrow of the experimental animals. As all the affected soldiers have been wounded ones, perhaps the infection was brought into the hospital by the first soldier. Probably this new infection will be observed in other places.

Drugs and Appliances.

"TABLOID" BRAND MEDICAL EQUIPMENT, No. 363.

(For the treatment of cholera by transfusion.)

This equipment, introduced by Burroughs Wellcome and Co., is specially intended for treatment of cholera by the intravenous injection of saline solution—the method originated by Sir Leonard Rogers.

The outfit reveals the high state of perfection to which Burroughs Wellcome and Co. have raised the production of medicine chests and cases. It is compact, every available inch of space being used to the best advantage. It weighs only 15 lb.—a consideration when transport from place to place is necessary. It comprises a complete set of instruments, apparatus and medicaments for:—

(1) Ascertaining pressure and specific gravity of the blood and body temperature.

(2) Performing intravenous, intraperitoneal and subcutaneous infusion of hypertonic saline, rectal infusion of normal (isotonic) saline, and hypodermic injection of "Infundin" (pituitary [infundibular] Extract), &c.

(3) Preparation, boiling and adjustment of flow and temperature of saline solution.

(4) Sterilization of instruments and apparatus.

(5) Sterilization of operator's hands and site of injection.

(6) Closing and dressing site of injection.

(7) Oral treatment with keratin-coated "Tabloid" calcium permanganate and potassium permanganate.

"SOAMIN."

(Sodium para-aminophenylarsonate.)

"Soamin" is an organic arsenical compound. The medicinal value of the inorganic salts of arsenic is well known, but the organic salts possess the advantage that they make it possible to administer arsenic safely in much larger quantities, since they are much less toxic. The therapeutic utility of arsenic is thus greatly extended. "Soamin," although containing 22·8 per cent. of arsenium (As.), has only one-fortieth the toxicity of arsenious acid. It is soluble in three parts of water at body temperature, and in five parts at 60° F., giving a neutral solution which can be sterilized by boiling for five minutes without undergoing decomposition.

An interesting series of cases of cerebrospinal meningitis in which "Soamin" was used successfully has been reported recently. Many cases of cerebrospinal fever have now been treated with "Soamin" with very favourable results. It has also been used with success in the treatment of syphilis and of several tropical diseases, conspicuous amongst which are pellagra, kala-azar, and trypanosomiasis. In trypanosomiasis, both human (sleeping sickness) and animal (surra, nagana, &c.), it has been found valuable, and it is widely used in Uganda and other territories where the condition is prevalent.

"Soamin" affords a valuable method of administering arsenic in anæmic conditions. It has a markedly beneficial effect in improving the condition of the blood, and, in addition, possesses a tonic action. Among other conditions in which it has been used with beneficial effects are interstitial keratitis, locomotor ataxy, relapsing fever, and leprosy.

"Soamin" is issued in bottles of 5 grm. (gr. 77) and 30 grm. (gr. 463) for hypodermic or intramuscular injection, and as "Tabloid Soamin" gr. 1 (·065 grm.) and gr. 3 (0·194 grm.) for oral administration.

"LAXAMEL."

That particular form of constipation which is caused by a deficiency of lubricating materials in the bowel is now usually treated by the administration of paraffin. The quality of the paraffin used is a matter of great importance, because inferior qualities do not, as a rule, possess the correct viscosity and contain mineral impurities liable to set up gastric irritation. A paraffin of exceptional quality of the correct viscosity and conforming to the standard laid down in recent investigations published in the medical press, such as "Paroleine," is to be preferred.

Notwithstanding the tasteless and odourless properties of "Paroleine," however, some people find difficulty in taking it as a fluid, and in response to the demand for a semi-solid preparation, Burroughs Wellcome and Co. have introduced "Laxamel."

"Laxamel" contains approximately 80 per cent. of "Paroleine," and is inviting in appearance. Its aroma and palatability are all that can be desired. It is efficient in action and does not saponify in its passage through the intestines.

It is a useful agent in the constipation of invalids and aged people, and may be employed to advantage in the treatment of constipation in children, who take it readily. It is finding favour also among obstetricians, as it can be administered to mothers without in the least affecting the nursing baby; but it is not so well suited for diabetic patients as "Paroleine."

Issued in glass pots, its style of packing makes it quite suitable for use in the Tropics.

Original Communications.

NOTE ON EXPERIMENTS ON POLYNEURITIS IN PIGEONS.

By A. Breinl.

(From the Australian Institute of Tropical Medicine.)

Townsville.

Beriberi is a disease in which, in spite of its wide distribution, conclusive evidence as to its etiology has not been obtained. As early as 1897 Eijkman and Grijns, who studied the disease in Java, suggested that a prolonged one-sided diet, consisting of rice only, might give rise to the disease. This assumption was strengthened by Eijkman's observations that pigeons and fowls fed exclusively on rice developed symptoms which resembled in many respects those of beriberi in man, namely, a polyneuritis mostly affecting the nerves of the legs.

Elaborate series of experiments, especially those of Strong in Manila, brought further proof for the rice theory of beriberi. These observations naturally lent additional support to the opinion that the polyneuritis in fowls was essentially the same as beriberi in man and led to a still more careful investigation of this condition, resulting in Funk's isolation of the vitamines, chemical substances isolated from the rice polishings, which cured pigeons, even when in the most advanced stage of the polyneuritis disease, and he created thus a new group of diseases due to deficiency in diet, the "deficiency diseases."[1]

When considering the more recent and early statistics of beriberi one is forced to the conclusion that the *rice diet* plays an important factor in the etiology of this disease. On the other hand, there are undoubted cases on record where patients have developed the typical symptoms of beriberi without rice having entered into their dietary, and Manson[2] remarks that "It is just possible that the conditions brought about by this deficiency merely predisposes to, or is necessary for the operation of something else, perhaps an unknown germ, which in the absence of this deficiency would remain inoperative, even if introduced."

Most of the early observers pointed out that beriberi is a place-born disease, and is apt to recur again and again amongst individuals living in a certain building and its neighbourhood.

A hospital in Northern Brazil may be quoted as an example which came under the author's observation, where every case who did not leave the institution within a few weeks of his arrival contracted beriberi in a severe form and many died, although they lived on a mixed diet.

Furthermore, it seems just probable that in different countries different diseases have been classed under the name of beriberi. The diagnosis in a fully developed case with the tropical neuritis and the heart symptoms, or in an advanced dropsical case, is comparatively easy. But anybody with experience amongst Eastern races, notably Chinese, will readily recall a number of cases of partial paralysis of the legs running a very chronic course, which do not show any heart symptoms, and are usually diagnosed as beriberi by process of exclusion. Quite a number of such cases have been seen amongst Chinamen entering the Townsville Hospital.

Amongst the coloured races employed in the pearl fishing industry in and around Thursday Island, beriberi has been fairly prevalent, and likewise a great number of similar cases without heart symptoms occurred, besides cases with the typical symptoms well developed.

Some time ago McCarrison[3] published the results of some experiments on polyneuritis in pigeons which, if correct, tend to bring forth a new aspect. He obtained cultures from the organs of six pigeons suffering from experimental polyneuritis resembling hog cholera. Sub-inoculations of this bacterium into rabbits, fowls and pigeons, according to him, produced in 67·8 per cent. within nine days symptoms which were indistinguishable clinically from polyneuritis gallinarum.

Previous to McCarrison's publication, experiments had been undertaken here to prove or disprove whether the polyneuritis of pigeons was infectious and whether birds kept in cages where a few successive lots had died of polyneuritis and were fed on normal food would contract the disease. Careful notes were kept in order to see whether pigeons in "infected" cages and fed exclusively on rice showed a shortening of the period which elapsed between the beginning of the experiment and the first appearance of paralytic symptoms. It had been noticed in our first tentative experiments that the feeding on highly polished rice had to be continued for a longer average period than recorded in the various publications.

After McCarrison's publication cultures were made of the heart blood and organs of pigeons in which the paralytic symptoms were well developed, on broth, agar, and Sabouraud's medium.

In our experiments the same methods were used as described by Funk and others; pigeons were fed on highly polished rice. For the first four to five days the pigeons eat the rice well; after this period the birds refused to eat and had to be fed artificially by means of a funnel and a glass rod. For a medium-sized pigeon about 20 grammes of rice were fed twice daily. Generally three pigeons of approximately the same size were put into a wooden cage and were kept there until their death. The cages were only dry cleaned with a brush without using water or any disinfectant. After one of the pigeons had died a new set of three were placed in the same cage; at the same time controls were kept in new cages. In one instance five consecutive lots were kept in the same cage.

[1] Funk: "Die Vitamine," Wiesbaden, 1914.

[2] Manson: "Tropical Diseases," London, 1914.

[3] McCarrison. "A Contribution to the Study of Experimental Beriberi," *The Indian Journal of Medical Research*, vol. ii, No. 1, 1914.

The results are tabulated in Table I.

The table shows that the length of period between the beginning of the feeding on rice and the first appearance of paralytic symptoms was variable, and did not become shortened to any appreciable extent in the successive batches kept in the "infected" cage. Likewise, the death did not occur any sooner in the fifth batch than in the first. None of the normal pigeons kept in an "infected" cage and fed on normal food ever developed the disease.

TABLE I.

No. of experiment		Paralysis appeared after days	Death after days	Weight at the commencement	Weight before death
Cage No. 1.					
87	A	20	24	185 gr.	160 gr.
	B	20	36	325 ,,	237 ,,
92	A	18	19	295 ,,	205 ,,
	B	9	16	305 ,,	250 ,,
	C	14	15	—	—
107	A	Died of intercurrent disease.			
	B	17	19	250 gr.	210 ,,
	C	20	21	320 ,,	255 ,,
112	A	14	16	330 ,,	290 ,,
	B	15	21	320 ,,	290 ,,
	C	27	29	305 ,,	220 ,,
120	A	33	34	250 ,,	220 ,,
	B	24	25	265 ,,	210 ,,
	C	19	24	280 ,,	215 ,,
Cage No. 2.					
88	B	26	30	260 ,,	220 ,,
	C	40	41	320 ,,	258 ,,
	D	57	63	300 ,,	160 ,,
	F	33	46	295 ,,	195 ,,
105	A	Died of intercurrent disease.			
	B	26	28	280 gr.	205 ,,
	C	39	41	290 ,,	230 ,,
114	A	23	29	270 ,,	185 ,,
	B	23	24	300 ,,	240 ,,
	C	20	24	350 ,,	280 ,,
Cage No. 3.					
96	A	20	21	305 ,,	260 ,,
	B	31	32	260 ,,	180 ,,
	C	46	52	290 ,,	170 ,,
110	A	11	12	250 ,,	—
	B	—	—	—	—
	C	18	20	250 ,,	240 ,,
Cage No. 4.					
106	A	16	17	250 ,,	235 ,,
	B	24	26	305 ,,	245 ,,
	C	21	23	275 ,,	255 ,,
111	A	14	16	315 ,,	280 ,,
	B	—	—	—	—
	C	—	—	—	—
118	A				
	B				
	C	22	27	280 ,,	215 ,,
121	A	33	34	310 ,,	260 ,,
	B	20	21	250 ,,	220 ,,
Cage No. 5.					
108	A	21	23	270 ,,	250 ,,
	B	12	13	330 ,,	280 ,,
	C				
Cage No. 6.					
109	B	26	28	280 ,,	250 ,,
	C	19	24	265 ,,	220 ,,
115	A	25	33	295 ,,	220 ,,
	B	19	20	310 ,,	280 ,,
	C	25	35	280 ,,	170 ,,

The bacteriological cultures of heartblood and liver of twelve paralytic pigeons remained in the majority of cases sterile, although the tubes were kept in the incubator for three weeks. The growth which appeared in a few tubes had to be considered as contamination.

ANKYLOSTOMIASIS: DIAGNOSIS AND TREATMENT.

By R. D. KEITH, M.A., M.B., Ch.B.

Principal King Edward VII Medical School, Singapore, Straits Settlements.

MOST medical men in the Tropics who have had much experience of ankylostomiasis realize its importance as a cause of ill-health, loss of labour, and lack of efficiency. Occasionally, however, the assertion is met with that many natives who harbour the ova of the ankylostome in their stools show no symptoms, and that, therefore, the disease is not of vital importance. Whether these "carriers" are as efficient workers as they would have been had they not been infected is doubtful, but in any case they are a source of infection all the more dangerous in a labour force if unsuspected, and this may be a reason for the difficulty experienced on estates and in mines of preventing the spread of the disease.

From a practical point of view the prevention of ankylostomiasis is of the utmost importance. Most Colonial Governments have distributed instructions to managers and doctors of estates and mines for combating the spread of the disease, but in spite of this it still continues to lessen the value of labour forces. The labourers themselves, especially Indians, often render all efforts to eradicate the disease futile owing to their persistently dirty habits leading to constant pollution of the soil. Systematic examination of the stools of all coolies at regular intervals and the administration of anthelmintics to all those in whom ova are found, combined with rigorous and systematic hygienic measures, should be sufficient if the coolies can be properly superintended and disciplined.

At an early stage in the disease any of the anthelmintics usually recommended will prove efficient. Some recommend one, some another, but in early cases in which the percentage of hæmoglobin is high any of them are serviceable.[1] In later cases with grave anæmia, oil of chenopodium, which is strongly recommended by Schüffner and Vervoot,[2] is the best. The writer has found it more efficient than any of the others in obstinate cases and gives it in 30-minim doses in the form of an emulsion every hour for three hours on an empty stomach, following the last dose in an hour by

[1] R. D. Keith, M.D., "The Treatment of Ankylostomiasis." *Lancet*, October 18, 1913, p. 1117.

[2] Schüffner and Vervoot, *Archiv für Schiffs- und Tropen Hyg.*, 1914, Bd. 18, H. 4, S. 142.

PLATE I.

NEISSERIA INTRACELLULARIS (WEICHSELBAUM 1887).

FIG. 1.

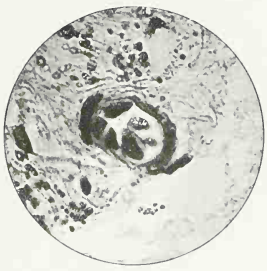

FIG. 2.

FIG. 3.

FIG. 4.

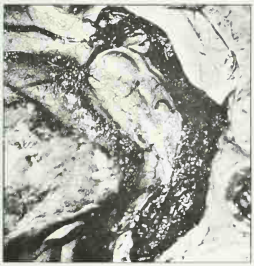

FIG. 5.

FIG. 10.

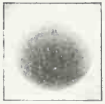

FIG. 11.

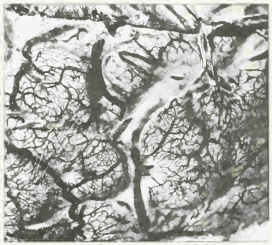

FIG. 6.

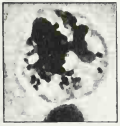

FIG. 7.

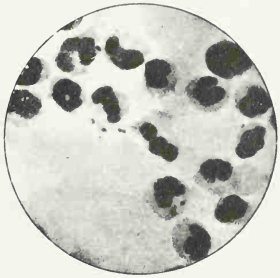

FIG. 8.

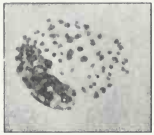

FIG. 9.

To illustrate "Preliminary Remarks upon Epidemic Cerebrospinal Meningitis as seen in the Anglo-Egyptian Sudan." By ALBERT J. CHALMERS, M.D., F.R.C.S., D.P.H., and Captain W. R. O'FARRELL, R.A.M.C.

PLATE II.

DIPLOCOCCUS CRASSUS VON LINGELSHEIM 1906.

FIG. 12.

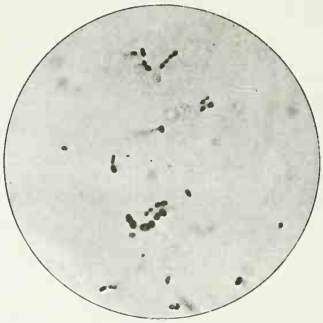

FIG. 13.

FIG. 14.

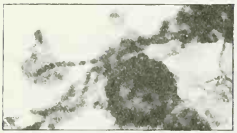

FIG. 15.

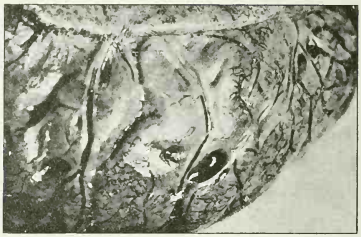

FIG. 17.

FIG. 16.

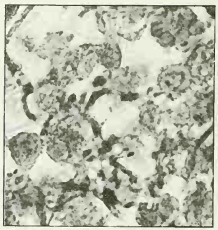

FIG. 18.

To illustrate "Preliminary Remarks upon Epidemic Cerebrospinal Meningitis as seen in the Anglo-Egyptian Sudan." By ALBERT J. CHALMERS, M.D., F.R.C.S., D.P.H., and Captain W. R. O'FARRELL, R.A.M.C.

2 oz. of black draught. The usual dose is 16 minims every hour, but 30 minims produces no bad effect. Wendlandt[3] has recommended that it be not given where there is albumin in the urine. It is dear, and, when not given on sugar or with syrup, rather nauseous, but it is very efficient. Day[4] does not recommend it, but employs a mixture of thymol and beta-naphthol. In Malaya, Java and Sumatra oil of chenopodium has been much used and with great success. It is an ethereal oil obtained from an American plant resembling the cabbage. Archibald[5] has recommended an autogenous coliform vaccine and the writer tried in thirty cases a vaccine made from the triturated bodies of adult worms which had been placed alive in absolute alcohol. After trituration in a glass mortar the mass was evaporated almost to dryness and made into an emulsion with normal saline solution. This method of treatment had no good effect. In a few cases itching, vomiting and an urticarial rash came on about an hour after subcutaneous injection of approximately four worms, and, in some cases, there was a severe local reaction, but there was no evidence of any considerable degree of toxicity.

Quadri[6] also came to this conclusion and the writer has not found a watery extract to have any effect on a guinea-pig, nor, beyond causing a very slight fall of blood-pressure, in a monkey when injected intravenously.

Some stress has been laid on examination of the fæces for dead worms after the administration of the anthelmintic (Schüffner and Vervoot, *loc. cit.*), but of much more importance is the absence or persistence of ova in the stools. Various methods, of which that of Johnson[7] is an example, have been recommended for increasing the accuracy of examination of fæces, but for practical purposes the ordinary method is quite sufficient.

In very severe cases of a chronic type, in which, according to Day, the marrow has become exhausted and atrophic, difficulty will be experienced in improving the percentage of hæmoglobin, and Day recommends the administration of iron and arsenic, the latter to be given hypodermically in bad cases. As a rule, with a good diet, the weight and percentage of hæmoglobin go up without any drugs, but no doubt in many cases iron and arsenic will be found of service. A very useful diet for Chinese and Tamil coolies suffering from the effects of the disease consists of bread 1 lb., milk 2 pints, sugar 2 oz., two eggs, and four bananas daily.

From the point of view of those interested in the practical and economic aspects of ankylostomiasis, treatment and prevention are of the utmost importance. There are, however, several matters of considerable interest of a more theoretical nature. It is generally agreed that the anæmia of the disease is due to repeated small hæmorrhages and not to a toxin. It has been suggested that there is a septic condition of the intestinal mucosa established which prevents the absorption of iron, but there is not much to support this, nor is there any proof that the presence of larvæ in the tissues causes the later symptoms, but, according to Looss, certain pulmonary symptoms are attributable to them. M. Weinberg has stated[8] that there is some evidence of a toxin causing destruction of the intestinal epithelium. Gehdini[9] has stated that by means of the complement-deviation method he has found antibodies in the blood of ankylostomiasis patients. Those specially interested in this subject should consult the monograph of Looss.[10]

[3] Wendlandt, *Archiv für Schiffs- und Tropen Hyg.*, Bd. 18, H. 8, S. 292.

[4] Day, H. B., "Treatment of Ankylostome Anæmia," *Lancet*, July 11, 1914, p. 82.

[5] Archibald, R. G., *Trop. Diseases Bull.*, vol. ii, No. 8, p. 416; JOURNAL OF TROPICAL MEDICINE AND HYGIENE, September 1, 1913, vol. xvi, No. 17, pp. 260-262.

[6] Quadri, *Centralb. für Bakt.*, Ref., Bd. 59, No. 10, p. 310.

[7] Johnson, L. F., *Trop. Diseases Bull.*, vol. i, No. 12, p. 697; *Texas State Journ. of Med.*, March, 1913, vol. viii, No. 11, pp. 303-305.

How much Milk do Infants require? (Feer, *Mediz. Klin.*, February 20).—The prevailing high prices of provisions have had one good effect in that overfeeding of infants is less common. Last summer not one child with alimentary intoxication was brought to his children's clinic. For both young and old, the dictary has been reduced to the indispensable minimum, and this is greatly to the advantage of infants. Pediatrists are inclined to restrict more and more the amount of milk given bottle-fed babies. Czerny does not allow over a quart a day for children a year old of normal size, and only 800 grm. for smaller children. Feer gives even less, not allowing more than 600 grm. a day by the end of the first year, and much reducing this proportion after this. His experience has shown that the children thrive better on this than on the larger amounts of milk. He gives sugar almost from the first, rapidly increasing to 20 or 30 grm. a day, keeping this up till the seventh month with only from 350 to 500 grm. milk. Starch is given after the first month, increasing from 15 to 30 grm. in the form of rice or oatmeal gruel; at the sixth month a little meat broth and fresh vegetables, mashed very fine and soft, giving up to three or five tablespoonfuls by the end of the year. Fruit juices or crushed fruits he gives from the fourth month onward. In the second year he gives less milk, and in the third only 200 grm. during the day. It is more trouble to feed an infant in this way by the teaspoon than to give it the bottle, but it will thrive better and be less liable to develop rachitis. With already developed rachitis, the proportion of milk is reduced still more. Wild animals and the children of savage races get no milk beyond the mother's lactation.

[8] Weinberg, *Centralb. für Bakt.*, Bd. 59, H. 2, S. 40.

[9] Gehdini, see "Kolle und Wassermann's Handbuch," Ergänzungsband, ii, S. 517.

[10] Looss, "Records of the School of Medicine," Cairo, 1911, vol. iv.

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THE JOURNAL OF

Tropical Medicine and Hygiene

JUNE 1, 1916.

THE SOLDIER'S DRESS.

THE PUTTEE.

A SUBJECT under discussion at the moment in military circles is the advantage and disadvantage of the puttee. The pros and cons. are brought forward by each side with vehemence, and, as usual, there is much to be said on both sides. The puttee was first used amongst our soldiers in India, the British soldier copying it from his Indian comrade; and from India the puttee was adopted by the authorities in Britain as part of the war kit of British soldiers.

In a warm climate the puttee is an excellent means of protecting the legs and ankles from bites and stings of insects of many kinds, from leech bites in swampy districts, and from sand getting into the boots, also as a support to the legs in long marches and as a prevention against varicose veins.

That the puttee prevents tiredness of the calf muscles is strongly believed by Indian soldiers; and to one accustomed to puttees their absence is felt acutely. Against the use of the puttee it is argued, that when applied tightly the superficial veins are compressed and the blood is driven to the deep veins, thereby causing congestion of the muscles, which are therefore hampered in their activity. The congested veins further cause swelling of the feet, discomfort of the toes, and render chafing and blistering of the feet inevitable. In the trenches in Northern Europe exercise is reduced to a minimum, and the obstruction of the circulation leads in winter to "trench" feet, frost-bite, or even gangrene. All these statements have justification, and one comes to the conclusion that in a northern climate there is not the same necessity for the use of puttees as in the Tropics, and that in trench fighting they have, in many instances, detrimental effects. In trench work in wet weather it must also be remembered that a wet puttee causes the bandage to tighten, whereby the circulation is still more hampered and impeded, with corresponding detrimental effects.

For R.A.M.C. bearers the puttee is less likely to prove detrimental, as these men are not condemned to stand in trenches, and it must be remembered that a puttee may be used as a bandage in case of necessity when regulation bandages are not available and improvising methods have to be relied upon.

For the Red Cross Men's Detachment the writer chose puttees advisedly, as their work is essentially improvising, and the puttee can be used as a bandage for maintaining splints in position, and with puttees an improvised bed for an improvised stretcher of, say, long pitch-fork handles, &c., can be made.

BRACES.

The modern brace as used in civilian life is also, unfortunately, that supplied by the authorities to the soldier. By the modern brace is meant the brace which is joined behind by "machinery" of sorts, which carries the "divide" up to near the back of the neck, and then, parting company, the braces are carried across the shoulders and down the front to the trouser buttons. This brace has only been in existence some thirty years, for those worn by our fathers and grandfathers were not joined behind, but separate braces which crossed each other behind but were not joined in any way. The parting of the joined braces at the back of the neck causes a drag on the shoulders and neck which, especially in short men and young lads, causes the head to be poked forwards, the shoulders to be rounded, the chest

to be "hollow," and the pelvis to be correspondingly advanced. This is an inevitable consequence, and is known to anyone who has given a thought to the matter. But from the medical point of view the joined brace has a further drawback. It cannot be used as a strap, or bandage, or tourniquet in the case of wounds or accidents. By slipping off one brace when the natural (or separate) brace is worn, a soldier can use it as a tourniquet when he or his neighbour is wounded; whereas with the joined brace this is impossible. Every soldier in the German army *was* taught how to use his (separate) brace as a tourniquet. I use the term "was" advisedly, for it would seem that even German authorities have succumbed to the use of the joined or unnatural brace, so that chances of saving life on the battlefield are as little provided for in their army as in our own. With the modern German authorities, however, who regard their infantry soldier as mere "cannon fodder," this neglect is not to be wondered at, but with all our national regard for our soldiers it would seem that we are in the same category, for we do not supply our soldiers with a brace which can be turned into a tourniquet, with the sword or the bayonet in its sheath to twist and tighten it. All the Red Cross men are advised to wear separate braces, so that they can always spare one brace whereby hæmorrhage can be controlled, a sprained ankle supported, or a splint secured to a broken limb.

The Tunic.

The old question of the buttoned-up and tightly fitting tunic of the soldier and the open-necked and loose-fittting blouse of the sailor is ever before us. Which is the better garb for field work there is no question; but it requires a strong man to alter the stiff garment in which the soldier is habited to the rational dress of the sailor. Yet the soldier's kit has changed with time, and let us even hope that it may once again be so by and by. In Stuart and Georgian times the soldier's dress was resplendent: an open-fronted and tailed coat with open waistcoat, a scarf of lace or knitted work, facings and buttons galore, with knee breeches, stockings and smart shoes, whilst a three-cornered hat completed a picture of dandyness which puts in the shade even the gala dress of our modern soldiers.

This passed away fairly quickly when the colonel of the regiment was given so much to feed, clothe, and equip his regiment. He found that open waistcoats and tunic implied much washing of scarves and shirts, so he first removed the waistcoat as unnecessary and then buttoned the coat up to the chin; the long tails were removed from the coat; trousers supplanted white duck breeches, as a great saving in stockings and washing was thereby accomplished. The cost of washing and clothing was reduced to a minimum, and the colonel was able to save substantial sums by the economy. Then matters were changed, the State took over the soldiers' keep and clothing and the colonel's "pickings" were done away with, so that from being a money-making appointment the coloneley of a regiment has come to the pass that its holder is probably the poorest man in the regiment, as tradition still holds that he is a Crœsus by his earnings and he is bled accordingly for money to maintain this, that, and the other comfort or entertainment for the men of the battalion. The stock—the villainously uncomfortable stock—disappeared shortly after the Crimean War; so that as changes have even been known to occur in the soldier's dress in the past, there is hope for the future. It is a great step that officers are now allowed an open front to their tunics; the same reform will extend to the soldier in the ranks as hygienic and physiological truths penetrate official circles.

The Kilt.

The kilt as a dress for the soldier is extending beyond the Scottish Highland regiments, for a number of regiments from Canada, the Cape and Australasia have adopted the dress. The testimony in favour of the kilt is forthcoming from many authorities; and Englishmen—Cockneys even—who have served in kilted regiments become enthusiastic as to its hygienic qualities. The great point made by such men is the covering to the abdomen which the thickness of the kilt gives. The pleats around the top of the kilt give a warmth and support to the abdomen amounting to about one inch or more in thickness, with the well-known result that the men in Highland regiments suffer less from chill and bowel troubles than the soldiers in trousers. This was well recognized in the South African War—and, indeed, in the present trench warfare in France.

Boots.

It looks well-nigh hopeless to tackle the question of ready-made boots for Army wear. Yet in the Peninsular and later wars soldiers wore hand-made boots, for the reason that the machine-made boot was then unknown. Nowadays the boots are no longer made to fit the feet, but the wearer has to make his feet fit the shoemaker's boot—a totally different condition of affairs, and one which leads to much misery to the wearer and a lesser capacity for long marches on the part of the soldier. So long as the public are content to make their feet fit the makers' boots and shoes, so long will walking exercise fall out of fashion, and travelling by machine-impelled vehicles—cycles and motors—supplant walking, to the detriment of the physique of the people. To walk in ready-made shoes or boots is often a misery, and always detrimental to the pleasure of walking.

J. C.

Paratyphosus B *Injection of Lymph Glands.*—In the *Journ. Infectious Diseases*, April, C. L. Cole describes a case of multiple lymphadenitis caused by an infection with *Bacillus paratyphosus* B, and, so far as could be ascertained, the disease developed without a preliminary manifestation of a typhoid-like, gastro-enteric, or cholera-like type of infection.

Annotations.

Vaccination of Entire Populace in Galicia.—According to the *Klin.-Therap. Wochenschrift* the entire populace in Galicia is being vaccinated. The work is being done by students from the Universities of Cracow and Lemberg. Lectures have been stopped for six weeks, and the students started on the task on March 7. The expense is calculated at about £20,000. The students are lodged free and paid 10s. a day each.

Contribution to the Pathology of Obstructive Œdema of the Lung (Y. Matsuoka, *Journ. Pathology and Bacteriology*, xx, 53).—Stoppage of the heart occurs rapidly, because the metabolism in the heart is unable to provide the necessary energy for its contractions. When there is danger of cardiac failure inhalation of oxygen is indicated. And as there is great difficulty for sufficient oxygen to pass from the œdematous lungs to the blood, preliminary venesection is necessary unless extraneous circumstances contra-indicate.

Treatment of Snake-bite.—In a paper on "Studies on the Treatment of Snake-bite: the Present Position of Antivenene Therapy" (*Indian Journal of Medical Research*, October, 1915) Captain H. W. Acton and Captain R. Knowles, I.M.S., suggest that the general line of procedure should be as follows: (1) Apply a firm ligature immediately. (2) Impregnate the whole area of the bite with a hypodermic injection of a strong solution of gold chloride. (3) Inject from 100 to 200 c.c. of antivenene intravenously, if the biting snake be suspected to have been a cobra or Russell's viper. If symptoms of venom intoxication come on, further and even larger injections of antivenene should be given intravenously. With sera concentrated ten times, a dose of 20 to 60 c.c. should save every case of cobra bite.

Œdema among Prisoners of War (Jürgens, *Berlin. klin. Woch.*, February 28).—The conditions in concentration camps of prisoners of war demonstrate that typhus, relapsing fever, and other infectious diseases have nothing to do with the œdema. This is a deficiency disease, like beriberi, and develops only in those on a too one-sided or inadequate diet. When the men were first taken prisoners they had been suffering from privations, and when they reached the camp they were enfeebled, and many came down with imported camp diseases. The œdema that developed during convalescence was for a long time regarded as part of the infectious syndrome, but this was a mistake. The œdema results from a metabolic upset from dietary deficiency, and wherever this was recognized and a more varied diet provided, the œdema subsided or its appearance was averted. The first symptoms are progressive weakness and lassitude, an apathetic aspect, flabby, yellowish skin and pale mucous membranes; then suddenly the face and lips swell and there may be symptoms suggesting scorbutus, with serious bowel trouble. In some of the camps the disease did not present the full syndrome until the men were set to work. This upset the precarious balance, and from 10 to 20 per cent. of the men then developed at once the œdema and pains in the legs. The œdema was most prevalent among the camps of Russian prisoners, but in two camps with British, French, and Russians all were undernourished and were weak when brought in, and many showed symptoms of the œdema disease. In these camps the British suffered most from it, the French least. The latter received numerous packages from home which kept their diet varied. In the two mixed camps cited, no typhus or relapsing fever developed at any time, notwithstanding the prevalence of lice and that œdema was common at first until the necessity was realized for providing a better balanced diet.

Induced Fever in Gonorrhœal Complications.—Müller and Weiss (*Wiener klin. Woch.*, March 2) became convinced that the efficacy of vaccine therapy of gonorrhœa depended mainly on the febrile reaction which it induced. The benefit was most apparent the more intense the febrile reaction, and the benefit was apparent, as a rule, before there could have been time for antibodies to have developed. They report the results of treatment of any non-specific alien albumin by injection in forty cases; milk was used in some and sodium nucleinate in others, injected intramuscularly. The brilliant therapeutic effect fully equalled and usually surpassed that of intravenous vaccine therapy. The gonorrhœal epididymitis, arthritis, prostatitis, or urethritis promptly retrogressed, with prompt subsidence of pain and other disturbances.

Further Experimentation in Animals with Monilia commonly found in Sprue.—B. K. Ashford (*American Journal of Medical Sciences*, April) describes a new species of monilia from Porto Rico. From careful cultural and morphological investigations it is pathogenic for laboratory animals by hypodermic inoculations. When recovered from a patient with sprue and promptly injected into certain laboratory animals, it generally produces their rapid death from a mycotic septicæmia. When grown for a long time and frequently transplanted, the same organism which rapidly killed soon after isolation from a sprue patient seems to partially or completely lose its virulence. This virulence may be recovered by passage through susceptible animals, and even reach such a point as to sicken or kill these animals by continued feeding.

Abstracts.

INFECTION IN TYPHOID.[1]

Contact infection is the most common mode in the distribution of typhoid. Different students of epidemiology in widely distant lands agree in this, and even go so far as to place practically the same estimate on the number of cases originating in this manner. About 60 per cent. of all cases of typhoid are believed to be due to contact infection. The board of medical officers in 1898 placed the percentage of contact cases at 62·80, while Drigalski gives it for Germany as 64·7. These conclusions seem to have been reached quite independently, inasmuch as the German makes no mention of the American studies which were conducted nine years before his. Formerly, it was supposed that typhoid is mostly water-borne; the board of officers began their investigations possessed fully of this view, but their studies convinced them that this is an error, and first furnished indisputable evidence that contact is the most important factor in the distribution of typhoid.

AUSTRALIA AND YELLOW FEVER.

The Quarantine Service of the Commonwealth of Australia, Service Publication 6, discusses yellow fever, the possibility of its introduction into Australia as the result of changes in routes of ocean travel due to the opening of the Panama Canal, and the conditions favouring its spread in Australia. Foci of infection exist on the Pacific coast of Central and South America, in the Caribbean region, and in the United States. The stringent regulations of the health and quarantine authorities in the Panama Canal zone make it an unlikely source of infection. The towns on the coast of Mexico, Central America, and South America as far south as Chile, particularly Guayaquil, where the disease is still endemic, are believed to be constant sources of trouble which may reach to Australia. A number of places on the Caribbean Sea are also to be regarded as foci. Even New Orleans, in the opinion of Major James, who visited that city in 1912 and made an official report (*Indian Journal of Medical Research*, October, 1913) on "The Protection of India from Yellow Fever," is not exempted as a focus of yellow fever dangerous to shipping to the Orient. Major James says that though great improvement in conditions had been made in New Orleans since the epidemic of yellow fever in 1905, when 437 deaths and 3,403 cases occurred, still, in 1912, at the time of his visit, on account of lack of funds and other reasons, no continuous, systematic preventive work had been kept up, and he had been informed by officials that during the summer months mosquitoes, including the yellow fever mosquito, were plentiful. With such conditions in a highly organized community in the United States, it was felt that there were great dangers from other less well protected places in the islands of the Caribbean Sea and the northern and Atlantic coasts of South America. The danger of the introduction of the disease into Australia from the endemic foci, it is said, must be recognized and precautionary measures taken to prevent it. Among these measures would be the stationing of sanitarians as outposts at Panama and in the Pacific Islands for observation and transmission to the home country of intelligence concerning outbreaks of the disease. In Australia efforts should be directed to the reduction of mosquito sources.

CONTROL OF HOOKWORM DISEASE.[1]

The plan adopted by the Pacific Mail Steamship Company was to examine all cases in Hong Kong and to treat those found infected by the ship surgeon while *en route*. Thymol was used, the dose for an adult being 20 gr. hourly for four doses, or 80 gr. during the morning. 1½ oz. of castor oil were given the night preceding the course of treatment, and 1 oz. of Epsom salts two hours before, and again one hour after the administration of the thymol. Castor oil was repeated the night preceding the next course of treatment, but was not given on a day during which thymol had been taken. After two courses, or four days' treatment, examination of the stool was made, and patients found cured were dismissed from further treatment or given an additional course of two days. In the uncured cases the courses of treatment and the re-examinations were continued until San Francisco was reached. Over 500 patients had been treated with no untoward results in any. Over 60 per cent. of the Chinese examined in Hong Kong were found to harbour hookworm. The total number of cases treated aboard ship was 1,776. The number not cured on arrival at San Francisco was fifty-five, or 3 per cent. Some patients took as much as 1,720 gr. of thymol in a period of twenty-six days.

There was practically no effect on the urine in the great majority of cases, and in the others it is only transitory. The greatest effect is on the intestinal tract, and even here it is, as a rule, but slight and transitory. Loss of weight from the repeated purging was the only ill-effect that the majority of patients showed after a strenuous course of treatment. Of the 1,776 patients treated, one died of uræmia. He had suffered from kidney disease four years previously. There were several cases of collapse, but none were serious, and all these patients resumed treatment later; that is, on subsequent days. Vomiting frequently occurred, as often from the salts as from the thymol. In one or two patients the drug was discontinued on this account, and chloroform and eucalyptus used. In one patient an intestinal hæmorrhage was reported, which was not serious, and a few days later treatment was resumed without ill-effects.

[1] *Journ. Amer. Med. Assoc.*, April 19, 1916.

Journ. Amer. Med. Assoc., April 29, 1916.

A CASE OF PANCREATIC INSUFFICIENCY.

E. J. Spriggs reports (*Quarterly Journal of Medicine*, vol. ix, No. 33) the clinical notes and detailed laboratory examination of a patient, a man aged 60, complaining of wasting, muscular weakness, thirst, glycosuria, and of very bulky motions, after passage of which he was obliged to lie down for some time.

Twenty-five years ago the patient had several attacks of violent pain in the epigastrium, attributed to indigestion. Some years later he had four or five attacks of a different nature, at intervals of from one and a half to two years, which proved to be due to appendicitis. The diseased appendix was removed thirteen years ago, in 1901. He remained well until four years ago (1910), when he suffered from loose, bulky motions. In 1911 pustules appeared about the body and were treated with a vaccine; since then sugar has been found intermittently, being absent even when large quantities of starchy food were taken, particularly when the patient had a rest and change.

He was under observation for twenty-one weeks, in five periods extending over eighteen months. The urine and fæces were analysed for sixty-four days and compared with the intake of food. Trypsin was not detected in the fæces. Diastase was present in the urine in normal amount. Reduction of unassimilable fat in the food reduced the fæces from 1,200 grm. to 800 grm. per day. An average of 302 of fat (higher than any known record) per day was lost in the motions on admission. From 25 to 59 per cent. of the caloric energy was thus lost. The proportion of fat in the food lost in the fæces varied from 55 to 59 per cent. Emulsified fat of milk was much better absorbed than the fat of butter, meat, or cod-liver oil. The percentage ahsorbed was less when a large quantity of fat was taken. The proportion of total fæcal fatty acids and soap was rather more than normal, the average of fifty-four days being 87 per cent. Variations in the quantity and nature of the fat did not affect fat splitting appreciably. Nearly half the nitrogen of the food appeared in the fæces. Sugar in the urine at first disappeared with suitable food, but each time the patient came under treatment a longer period on a restricted diet was required before the urine became sugar free. In the intervals unsuitable food was taken. There was no acidosis. All ferments, except fresh pancreas and trypsogen, irritated the intestinal tract. Trypsogen improved absorption of fat. Pancreas improved the absorption of nitrogen.

MODERN BREAD AND DEFICIENCY DISEASES.[1]

Pellagra has been added to the list of diseases caused by the absence from the diet of substances which, while necessary to metabolism, are not included in the ordinary list of proteins, carbohydrates, fats, and inorganic salts. In this list are several diseases differing markedly in their manifestations. It is therefore reasonable to suppose that the substances whose absence from the diet causes these diseases are not identical. It is by no means certain that these substances are even members of the same or of a related class, although it has become usual to refer to them as vitamines. Beriberi has been definitely attributed to the absence from an unbalanced rice diet of certain vitamines which are contained in the coatings of rice grains, but which are removed in the process of polishing. Whether there is any similar cause in the case of pellagra is still unknown. Modern methods of milling maize (corn) and wheat flour remove the bulk of the vitamines. Two facts of importance follow. First, the introduction of the highly milled flours has coincided with the great increase in the cost of such articles of diet as eggs, meat, and milk. There has, therefore, been an increase in the proportion of flour consumed by the poorer classes and a decrease in the proportion of other articles which might have eked out its dietetic deficiencies. Second, the peculiarities of dough made from highly milled flours have caused the extension of the use of baking powders in the preparation of bread. It is a common practice in some places to use plain sodium bicarbonate as a baking powder. This substance, disengaging carbon dioxide at the temperature of baking, leaves the alkaline carbonate in the bread; the sodium carbonate in such circumstances destroys the vitamines. This is not the case when the practice is followed of combining the use of sodium bicarbonate with that of buttermilk or of tartaric acid, which, by neutralizing the alkali, protects the vitamines. The investigations have not yet been carried far enough to determine whether these new and associated conditions, the use of highly milled flours and of sodium bicarbonate, have any causal relation with the extension of pellagra. The experimental evidence merely shows that as far as the production of disease is concerned, the case of corn bread and bicarbonate baking powder is similar to that of polished rice. In both instances polyneuritis develops when these foods are fed to fowls in an unbalanced diet.

[1] Abstracted from *Journ. Amer. Med. Assoc.*, April 22, 1916.

WHAT IS A VITAMINE?

The term "deficiency disease" is being applied to nutritive disorders caused by the continued absence from the diet of a suitable supply of substances which, while necessary to the metabolism, are not identical with the familiar nutrient sources of energy or the inorganic salts supposed to be essential for physiologic functions. The first to point out the importance of such substances for nutrition was doubtless F. Gowland Hopkins, of the University of Cambridge, England. The name "vitamine" was applied to them by Casimir Funk.

As was pointed out recently in these columns,[1] however, it is by no means certain that these substances are even members of the same or of a related class, although it has become usual to refer to them as vitamines.

It is not unlikely—to speak conservatively—that there are at least two "determinants" in the nutrition of growth. McCollum and Kennedy[2] have offered a most appropriate criticism of the current careless use of words.

Hopkins introduced the term "accessory" for substances of unknown chemical character, found in milk, which render the addition of small amounts of milk to rations consisting otherwise of purified food substances effective in promoting growth. The term "accessory" carries with it the idea of a subordinate *rôle*, and in this sense has been employed by writers on dietetics as synonymous with "condiment."

McCollum and Kennedy accordingly suggest "the desirability of discontinuing the use of the term 'vitamine,' and the substitution of the term 'fat-soluble A' and 'water-soluble B' for the two classes of unknown substances concerned in inducing growth." They maintain that these decidedly inelegant and clumsy terms have the merit of not attributing extravagant values to these bodies, and they differentiate between the substances or groups of substances only with respect to their solubility relations, which is the only basis of differentiation at present known. These terms have the additional advantage that further letters may readily be introduced as investigation progresses, provided there proves to be more than a single representative of each class, and also that they will automatically fall into disuse when we come to possess definite knowledge of their chemical nature. The coining of words and the multiplication of designations will inevitably bring into the domain of nutrition study a profusion of names and a confusion of ideas such as those with which immunity investigation has continually struggled.

DECREASE OF TYPHOID FEVER IN LARGE CITIES.[3]

THERE are few events in the history of disease prevention so striking as the decline in typhoid fever that has taken place in the last three decades throughout the civilized world. In 1880 the typhoid rate in Berlin was 47, in Paris 90, in New York 31, and in Boston 42. Recognition of the share played by water in the dissemination of this disease led to numerous attempts to improve water supplies, and for various reasons these improvements were carried out in several European countries earlier and more completely than in the United States. The result was that in the latter part of the nineteenth century and for the first decade of the twentieth the typhoid rates in the leading capitals of Europe were much lower than in American cities of the same rank.

The discovery of a cheap method of purification is of great importance. The city of Milwaukee is an example of a community that was not sufficiently moved by the argument of a long-continued high typhoid rate to undertake the construction of a filtration plant, but was quick to take advantage of the relatively cheap chlorination method. In point of fact, the typhoid reduction in cities like Milwaukee, Detroit, and Buffalo has been one of the outstanding facts of sanitary progress in this country in the past few years.

The diminution of milk-borne typhoid has been quite as striking as that of the water-borne. Inspection of dairy farms may perhaps have had something to do with this, but there is reason to believe that the main factor has been the decrease in the consumption of raw milk. The growing use of heated milk—boiled or pasteurized—has gone far to diminish the amount of milk-borne typhoid to the level of that in European countries, where, as is well known, the use of unheated milk has long been relatively rare.

There is no doubt that the discovery of the existence of typhoid carriers and the measures taken to control their activities have had some share in the general reduction of the disease, but it must be remembered that the number of carriers is automatically reduced by any diminution in the amount of milk-borne and water-borne disease, and that the proportion of contact typhoid in the past has been comparatively slight. It is now clear that the principal factors in the dissemination of typhoid in the large cities of the United States have been polluted water and contaminated raw milk.

The degree of typhoid reduction that has been effected in a few years, presumably by the partial elimination of these chief causes, may be best appreciated from the data presented in a summary of typhoid in fifty-seven large American cities:—

	Total population (57 cities) estimated by U.S. Census Bureau methods	Typhoid deaths	Typhoid death-rate per 100,000
1910 ...	20,996,035 ...	4,114 ...	19·59
1911 ...	21,545,014 ...	3,391 ...	15·74
1912 ...	22,093,993 ...	2,775 ...	12·56
1913 ...	22,642,972 ...	2,892 ...	12·77
1914 ...	23,191,951 ...	2,408 ...	10·38
1915 ...	23,621,302 ...	2,045 ...	8·65

	Deaths from typhoid per 100,000 population		Average 1911-1915	Average 1906-1910
	1915	1914		
Chicago ...	5·4	7·1 ...	8·2 ...	15·8
Boston ...	5·5	9·1 ...	8·0 ...	16·0
New York ...	6·0	6·2 ...	8·0 ...	13·5
Philadelphia	6·6	7·4 ...	11·2 ...	11·7
St. Louis ...	7·0	11·1 ...	12·1 ...	14·7
Cleveland ...	7·8	8·3	10·0 ...	12·7
Detroit ...	12·8	13·0 ...	18·1 ...	21·1
Baltimore ...	21·9	22·4 ...	23·7 ...	35·1
Pittsburg ...	24·7	13·8 ...	18·7 ...	65·0

[1] "Modern Bread and Deficiency Diseases," editorial, *Journ. Amer. Med. Assoc.*, April 22, 1916, p. 1314; THE JOURNAL OF TROPICAL MEDICINE AND HYGIENE. *See* also p. 136 of this Journal.

[2] McCollum, E. V., and Kenoedy, Cornelia: "The Dietary Factors Operating in the Production of Polyneuritis," *Journ. Biol. Chem.*, 1916, xxiv, p. 491.

[3] Abstracted from the *Journ. Amer. Med. Assoc.*, May 6, 1916.

It is there shown that the typhoid rate in a population of over 20,000,000 declined from 19·59 in 1910 to 8·65 in 1915! It may be questioned whether a population of this size has ever shown in so brief a period such a sweeping typhoid reduction.

FACTS ABOUT THE BEHAVIOUR OF THYMOL IN THE BODY.[1]

In connection with the treatment of hookworm disease and comparable forms of intestinal infection with parasitic invaders, considerable prominence has been given to the use of thymol (methylisopropylphenol), a phenol derivative obtained commercially from oil of ajowan, and occurs in some other volatile oils. Thymol is an antiseptic comparable in many ways to phenol and the cresols, but it is less soluble in water, and for this reason has been supposed to be absorbed with greater difficulty from the alimentary tract. The latter assumption has made it seem more valuable as an antiseptic for use in the gastro-intestinal tube because of the protection from direct intoxication by the drug thereby afforded to the organism as a whole while the parasite is being destroyed. Owing to the solubility of thymol in oils, it has repeatedly been urged that when the drug is used, fatty substances should be avoided in the diet in order to avert undue absorption of the large doses required for anthelmintic effects. One might expect that a compound with these properties would reappear in considerable quantities in the fæces after its administration by oral paths. Investigations have shown, however, that only insignificant amounts of ingested thymol are excreted in this way. This would indicate that thymol is almost completely absorbed from the alimentary tract, and must therefore be oxidized in the body or excreted in the urine. It has long been known that absorbed thymol may reappear in the urine as a glycuronate, just as other alcoholic derivatives combine with glycuronic acid in the metabolism. A careful study of the fate of thymol gave promise of disclosing the mechanism of its action on hookworms, and consequently of indicating the path to be followed in developing drugs of greater potency and safety than thymol. Even now it is being urged that the oil of chenopodium or oil of wormseed be thus employed. The supply of thymol is said to be extremely limited at present, and the oil of chenopodium is regarded as generally safer.

Less than 50 per cent. of the thymol administered either to experimental animals or to human patients who received the thymol treatment for hookworms reappears in the urine. This result, in connection with the previously mentioned experiments on the determination of thymol in the fæces, shows that of the thymol administered, from one-half to two-thirds is apparently destroyed or fixed in the body. A similar fate is suggested for compounds of related type, such as the simpler phenols. No satisfactory explanation has as yet been found for this apparent disappearance of administered phenols. With respect to the fraction that is not re-excreted as glycuronate, it has been surmised that it may be temporarily fixed by the tissues or eliminated by volatilization with the expired air. This is mere conjecture without any supporting evidence. From a practical standpoint there is significance in finding that the simultaneous administration of olive oil with thymol apparently caused very slight, if any, effect on the percentage of excreted drug. It is a question, therefore, whether oils really increase the amount of absorption or only the rate.

[1] Abstract of editorial, *Journ. Amer. Med. Assoc.*, March 4, 1916.

THE AVOCADO—A NUTRITIVE FRUIT.[1]

In the dietary of many, if not most, fruits have won a place quite out of proportion to any nutritive value which these plant products can exhibit in terms of calories of actual foodstuffs. In practically all fruits in the fresh state the content of water is large, and what there is of true nutrients is derived for the most part from the carbohydrates present. In nearly all cases the sugars predominate, starch being present in the thoroughly ripe products only in small amounts. The content of nitrogenous material, estimated as protein, is low, amounting to as little as 0·2 per cent. in some cases, or as much as 2·5 per cent. in others. The stone fruits contain, on the average, less than 1 per cent. The banana forms an exception, to a certain degree, in that it is comparatively rich in actual nutritive substance equivalent to about 450 calories per pound of edible matter, a figure approached by the edible portions of grapes and pomegranates and exceeded by the less common persimmons. In contrast with such food values, equivalent weights of berries, melons, or even apples show insignificant figures.

From the foregoing it is evident that fruits are ordinarily added to the diet, not primarily because of their richness in energy-yielding or tissue-forming components, but rather because they supply other desired factors. According to one estimate from a large number of data from dietary studies representative of ordinary food habits in their respective localities, about 8 per cent. of the total cost of the food was due to fruits which supplied less than 3 per cent. of the total calories and less than 1 per cent. of the protein intake. Whatever the value of the fresh fruits in the ration, it cannot be measured primarily in quantitative terms of the ordinary foodstuffs. Desired flavour undoubtedly contributes something to the explanation of the widespread use. The mineral ingredients also have

[1] Abstracted from the *Journal of the American Medical Association*, March 18, 1916.

been charged with special value to account for the popularity of the fruits, and experiments have made it clear that many fruits possess a potential alkalinity which is utilized in neutralizing acids within the body. This is, of course, contrary to the current conception, which recognizes the presence of organic acids in the fruit juices in abundance, but fails to appreciate that when these are burned up in the organism they yield carbon dioxide, and that thus the surplus of base-forming elements will remain as bicarbonate when these foods are oxidized in the body. Through their organic acids, and in larger measure through their content of indigestible cellulose or "roughage," the fruits further exert a wholesome effect on the movements of the alimentary tract. This laxative property is especially valuable under the prevailing conditions of diet, in which there is a tendency towards the use of highly concentrated and completely digestible foods. The indefinite conception as to the real place of fruits in the dietary is expressed as follows: The dietetic value of fruit, aside from the actual nutrients which it contains, lies in its succulency—its minerals and organic acids. If gauged by its nutritive value alone, fruit would seem to be an expensive form of nourishment; but when its hygienic qualities are considered, its money value to the consumer is difficult to estimate. Some fruits carry more nourishment with their hygienic properties than others. Some contain minerals which are more valuable to the system or less commonly distributed than others. Therefore, while there are general properties which are common to all fruits, each has special properties which justify individual consideration.

There is a decided element of novelty, therefore, in an available fruit which departs from the conventional varieties by exhibiting a content of nutrients both unlike and greater than that of most species in common use. The avocado is a fruit characterized by containing a very large amount of oil, so that the only comparable product is the olive. The avocado tree belongs to the laurel family; its fruit varies in form from round to pear-shaped with a short or elongated neck, and in weight from a few ounces to 4 lb. or 5 lb. It contains a single large seed which is surrounded by yellowish, buttery flesh.

Analyses show how widely it differs from the average of fresh fruits and prove it to be worthy of serious consideration. The edible portion contains, on an average, less than 70 per cent. of water, 2 per cent. of protein, 7 per cent. of carbohydrate, 1·2 per cent. of mineral ingredients, and no less than 20 per cent. of fat. Some varieties have exhibited nearly 30 per cent of the latter ingredient. Olives do not exceed this. Such data, put into terms of energy units, show that the edible part of the avocado corresponds to about 75 per cent. of the fuel value of the cereals, and is not far from twice that noted for average lean meat. They explain, furthermore, why the flesh of the avocado has been termed a "vegetable butter." From the earliest records up to the present time the flesh of the avocado has been described as a natural mayonnaise, and is often eaten as taken from the fruit, without additional preparation.

The evidence for the dietary value of the avocado is still essentially empiric. Chemical analysis alone is by no means adequate to establish the right of a new food product to a permanent place in the national dietary. Although no metabolism experiments have been carried on in connection with the avocado, it is only fair to assume that this fruit is as easily digested as many others whose coefficients have been determined. Such data clearly prove that the fruits are quite thoroughly digested. Although the availability of the protein is less, the digestion coefficients of the carbohydrates compare favourably with those obtained for the mixed diet, while those of the oils and mineral matter are fully equal to them.

OBSERVATIONS ON THE CHEMICAL SYMPTOMS OF PELLAGRA.[1]

Certain facts in regard to the metabolism of persons suffering from the disease stand out clearly. These are the frequent occurrence of gastric anacidity and the presence of indicanuria. The anacidity so commonly found in pellagrins has usually been reported to be associated with an entire absence of pepsin or with only very small quantities of this enzyme in the gastric contents. Statistics now available for 139 cases of the disease show an absence of gastric hydrochloric acid in sixty-seven, or 48 per cent., and a deficiency of this acid in thirty-four cases, or 24 per cent.

A deficiency in the secretion of acid in the stomach is to be expected in most cases of pellagra of long standing. It is not possible yet to correlate the absence of free hydrochloric acid with any single clinical type of the disease. As a rule, when the gastric contents were of normal acidity, pepsin was present in reasonable amounts. On the other hand, a deficiency or absence of acid is all but invariably associated with a lack of pepsin. The absence of pepsin in such circumstances does not necessarily imply that the secreting cells have entirely lost the power to manufacture the enzyme. It may signify merely that the conditions produced by the failure of hydrochloric acid lead to the destruction of pepsin or pepsinogen as soon as it appears in the stomach. Administration of acid with the test meals invariably produced gastric contents which exhibited a notable peptic activity. The inclination, therefore, is to view the absence of pepsin in pellagra as a secondary effect, and to regard the gastric lesion as one which affects primarily the acid-producing mechanism alone. The condition of gastric anacidity, once established, appears to be very resistant to treatment, if indeed it is not quite irremediable. The failure of the

[1] Abstracted from *Journ. Amer. Med. Assoc.*, April 22, 1916.

secretion of acid is the consequence of some permanent anatomic lesion of the gastric mucous membrane.

The tendency for intestinal contents, including bile and pancreatic juice, to regurgitate into the stomach under circumstances in which the chyme is insufficiently acid to regulate the closure of the pylorus might be expected. In pellagrins the stomach from which free acid and pepsin are absent almost always contains trypsin, sometimes in very considerable concentration. The regurgitation is evidenced not only by the appearance of trypsin in the stomach, but frequently also by the presence there of bile. Trypsin was not to be expected, and was, in fact, not found, in the cases in which hydrochloric acid was given by mouth, or when gastric acidity was normal or increased. In some of these cases, to be sure, there was regurgitation, as shown by the presence of bile; but if, as is probable, pancreatic juice accompanied the bile, its trypsin would, of course, be rapidly destroyed in the normally constituted gastric secretion. The finding of trypsin shows that while the pathology of pellagra may involve the complete suppression of gastric digestion, the function of the pancreas is not appreciably affected. This would account for the circumstance that pellagrins are able, even in the entire absence of pepsin and hydrochloric acid, to utilize protein as well, or nearly as well, as healthy persons.

Indicanuria is a familiar accompaniment of a lack of hydrochloric acid in the stomach whereby bacterial changes are not inhibited by the normal antiseptic of the digestive tract at the outset of the alimentary processes. The presence of excessive amounts of indican in the urine associated with a high elimination of ethereal sulphates, when considered in connection with the abnormal amounts of indol and skatol in the fæces, points to some unusual bacterial conditions in the intestine. From the data at hand this putrefaction would appear to take place rather high up in the intestine. The indicanuria in some cases is neither frequent nor extreme. Furthermore, it seems here as if gastric efficiency were only one of the factors in determining the extent of indican formation. The character of the diet also appears to play a part. The pellagrin with diminished gastric acidity will always show an excessive indican output when his diet is animal; on a vegetable diet, indican may be absent, moderate, or high. Where the gastric acid secretion is normal a vegetable diet may fail to evoke an output of indican, though this may promptly appear on the diets containing meat. It is too early to explain the differences here pointed out. However, the medium offered by the intestinal contents during the vegetable regimen is certainly very different from that presented by a meat diet. This might, on the one hand, have the effect of so altering the intestinal flora that indol formers largely disappear; or, on the other, without causing any change in the species actually present, may so modify their biochemical activities that other than the familiar products of putrefaction are produced. In any event, a well-marked indicanuria shows a decided tendency to decline as the patient recovers from an acute attack of pellagra.

Reviews.

THE MEDICAL ANNUAL, 1916. Pp. 787 + cxii. John Wright and Sons, Bristol. Price 10s.

An annual in its thirty-fourth year is apt to be passed over as a book to be considered just the same as usual. On the contrary, although some of its features are old and permanent, yet the information is essentially new.

Fortunately, for ready reference and revision of all knowledge bearing on medicine the arrangement and format has nearly, if not quite, attained perfection, so that readers of a weekly journal—English, Continental, or American—can refresh their memory and fill the gaps in their knowledge. The book, in addition to a table of contents, has a general index, with more important articles printed in heavy type.

Part I consists of a review of therapeutic progress, first a dictionary of remedies, next radioactivity and electro-therapeutics.

Part II, a review of medical and surgical progress by so many contributors that little, if anything, of importance is omitted, and by useful cross references various aspects of all questions are presented to the reader. By arranging this, the most important part alphabetically in 581 pages, the field of progress can be studied as a whole and read through, or each subject studied separately.

Part III is devoted to naval and military surgery. Part IV to public health, including forensic medicine, State medicine, toxicology, and school hygiene; there is also a section dealing with income tax in relation to the medical profession by an ex-officer of the Income Tax Department. A sample of a professional revenue for a year is worth the study of those who contemplate practice. Patients' fees amount to £1,250, the expenses to £840, which includes an assistant, but no dispenser or secretary, leaving for income £410.

An interesting section is headed "The Editor's Table," dealing with new instruments and appliances, drugs, and dietetic articles. A list is given of books and new editions published in 1915—this looks somewhat lengthy, from the inclusion of works relating to the new 1914 British Pharmacopœia to nursing and first aid.

The list of medical institutions, homes, spas, &c., is kept up to date, indicating those temporarily in use as hospitals.

Enough has been said to justify the opinion that the "Medical Annual" is necessary for all who want to revive their knowledge and to secure the best work of medical reference.

To ensure prompt delivery, to prevent delay and unnecessary correspondence, a standing order should be given for its despatch immediately on publication.

Original Communications.

HUNGER SWELLING IN POLAND.

By Dr. B. Budzynski and K. Chelchowski.

(Abstract and comments by Dr. J. M. H. MacLeod.)

The following is an abstract of a paper read at the Medical Society at Sosnowiec, in Poland, in July, 1915. It is of interest in that it describes a series of 110 cases of a peculiar affection at present occurring among the inhabitants of certain towns in Poland as a result of the insufficiency and inadequacy of food caused by the German occupation. The name "hunger swelling" has been applied to it because the most characteristic feature is the presence of marked œdema recalling that met with in the dropsical type of beriberi.

All the patients suffering from this disease were in a state of semi-starvation, none of them having eaten meat for several months, and some not since the beginning of the War. The cases occurred almost exclusively among the poorest class of people, especially among the unemployed factory hands. As this class is naturally improvident, they were found with no savings to fall back on when the War broke out, and, in consequence of the famine prices ruling in the towns, were unable to obtain food except through charity. The staple diet of these people consisted of potatoes, supplemented by small quantities of soup doled out by charity kitchens, with bread, which was generally bad, only on certain days. The amount of potatoes eaten averaged as high as 5 lb. per head per day—a dietary which caused diarrhœa, and eventually led to most of the food being passed through the system undigested. Fats were practically unobtainable, and only the favoured few were able to get small quantities of milk, butter, or bacon. During Easter, when the consumption of meat is there regarded almost as a religious duty, families were considered lucky who were able to obtain one egg for two persons or ½ lb. of meat for the whole family.

Symptoms.

The most characteristic symptoms of this disease of malnutrition were œdema, debility and muscular weakness, intestinal disorders, mental depression, dimness of vision, disappearance of sexual impulses, and alterations in the blood and urine.

Œdema.—The œdema resembled that met with in kidney disease, although, as a rule, it began in the lower extremities. It might be confined to the lower limbs, but more often spread over the whole body, involving the face, and especially the eyelids, where it might be so great as to interfere with vision. It sometimes led to bursting of the skin with serous exudation, and so stretched the skin that pink scars like striæ gravidarum resulted from it. The swollen extremities usually felt cold to the patient, and were cold to the touch, and the swollen skin was definitely painful when pinched up between the fingers.

After one or two weeks in hospital the œdema might disappear; on the other hand, it might persist for months, and even recur after it had subsided. It usually disappeared from above downwards, the last place for it to go being the feet. With the disappearance of the œdema marked wasting was evident, the patients sometimes being reduced to mere "skin and bone." The wasting was usually associated with incontinence of both urine and fæces.

Skin.—The skin was, as a rule, dry and painful. In some cases lesions of impetigo, ecthymatous sores, or other evidences of secondary pyogenetic infection were present. In one or two instances dark pigmented patches were observed on the face, somewhat similar to the pigmentation of Addison's disease.

Debility.—The patients, as a rule, suffered from more or less marked muscular weakness. In the early stages this was seen in inability to work, exhaustion when working, or weakness in the legs after walking; in the more advanced cases the patients were unable to sit up in bed or to cross one swollen foot over the other without helping themselves with their hands, or to move about the room without staggering and steadying themselves by the bed or other support.

Nerve Symptoms.—The mental faculties were, as a rule, distinctly lowered, the patients being apathetic, unwilling to answer questions, depressed, and pessimistic. Several of them suffered from giddiness, and complained of ringing in the ears.

An almost constant symptom was hæmeralopia, or day-blindness, a symptom which generally preceded the œdema.

Blood.—The most marked alteration in the blood consisted in a reduction in the percentage of hæmoglobin (about 50 per cent.), and a corresponding reduction in the colour index. There was a diminution in the number of red blood corpuscles, which was not marked except in a few cases, and a definite increase in the number of white blood corpuscles which, in one case, reached 14,000 per cubic millimetre. This increase in the white blood cells was mainly due to an increase in the lymphocytes, which in a few instances were equal in number to, or even more numerous than, the polynuclear leucocytes. The polynuclears were usually somewhat reduced in number. Definite eosinophilia was almost constantly present, and in one case reached 16 per cent.

The blood was obtained for examination with extreme difficulty owing to the blood being greatly reduced in quantity.

Urine.—The urine was pale, like water, usually alkaline, and contained neither albumin nor sugar, except in one case, in which the glycosuria was found to have been present before the War. The amount of urine passed *per diem* varied greatly in different cases, but on the whole was increased, sometimes reaching 60 oz. and over even when the swelling was disappearing.

Course.

In mild cases, under the influence of a more generous dietary, recovery took place; in severe cases the disease was liable to go on to a fatal issue, and eight out of 110 cases died.

Post-mortem examinations were made in three cases, when the most constant features were found to be a diminution in the amount of blood and a reduction in the size of the liver.

Etiology.

The cause of the disease, according to the writers, was the bad potatoes, which formed the chief article of diet, and the lack of other food, especially the absence of fats.

Sex did not seem to have any influence on its etiology. As regards age, of the 110 patients fifty-one were children under 10, while twenty-eight were under 2 years. In two cases the disease appeared in women after childbirth.

Most of the cases responded to treatment on general principles with better food and the employment of tonics, such as iron and arsenic.

The writers considered that the disease could be mitigated, if not prevented, were the charitable institutions enabled to double or treble the amount of fat in the soup they supplied to the starving people, and to give them occasionally even small quantities of animal food.

NOTE ON *CULEX PIPIENS* BREEDING 66 FT. BELOW GROUND.

By Malcolm Evan MacGregor.

Wellcome Bureau of Scientific Research.

In June of last year the Underground Electric Railway Company reported that some of their workmen were being seriously attacked while working at night in a "dead end" of the Highgate Station, 66 ft. underground, by some biting insect.

On investigation it was found that the part of the "Tube" referred to was infested with large numbers of *C. pipiens*, and their breeding-place was traced to a "sump pit," or water tank, below the passenger platform. This tank collected the water that drained from the advertisement posters and platform when both were washed at night, and was about 10 ft. deep by 4 ft. square, and contained 3 ft. of water. A small opening led to it from the railway track, and the tank was covered by a heavy iron lid that sank flush with the platform, so that permanent darkness reigned within, not even broken by the electric lighting in the "Tube." Nevertheless, when the lid was removed a veritable swarm of mosquitoes flew upwards, and when samples of the contained water were taken by means of a long-handled ladle the number of larvæ and pupæ secured in this way rivalled tropical records. In fact, about half a pint of the water held over 400 larvæ and pupæ—an excellent gauge as to how severely the workmen must have been attacked.

The temperature of the "Tube" platform was not observed, but was probably not much higher than the outside atmospheric temperature, and it may even have been a few degrees less, but in the "dead end," or auxiliary section of the "Tube," where motors and carriages are stored, and which is not thoroughly flooded with fresh air by the pressure ventilation system, the temperature was as high as 90° F.

In this section the mosquitoes were particularly active, many of the workmen being very severely bitten, and I was told that the insects were only active at night, which is remarkable, since the "dead ends" are lit by electric lights in the same manner as other parts of the "Tube," and there is obviously no distinction by light and darkness between day and night in such a situation.

It was found that the mosquitoes in order to lay their eggs flew along the track and entered the "sump pit" by the opening previously mentioned.

Specimens of the imagos were captured, as well as the larvæ and pupæ, but the former died speedily when brought up to daylight. The larvæ and pupæ lived in my laboratory for a day or two, but many of these died also during that time, although a few completed their metamorphosis. They could not, however, be induced to suck blood, even when placed in small special cages and these were strapped to the arm of one of the laboratory assistants, being kept in that position overnight.

The railway company was advised to have the "dead end" fumigated by the Clayton Gas Apparatus, and to treat the water in the "sump pit" with Sanitas-okol. The latter measure only was adopted, but I hear satisfactorily abolished the insects.

A NEW HUMAN INTESTINAL FLAGELLATE IN THE ANGLO-EGYPTIAN SUDAN.

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AND

Wainö Peekola.

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Contents.—*Introductory—History—The Parasite—Classification—Octomitus and Giardia—Conclusions—References—Illustrations.*

Introductory.—For some time past we have been studying the intestinal flagellates found in man and animals in the Sudan. During the course of this investigation, which is not completed, we met with a parasite in man which we believe has so far not been described, and as much interest is at present being shown in these parasites, we venture to bring forward the following preliminary remarks.

History.—A European resident in the Sudan, having repeatedly suffered from attacks of diarrhœa, was instructed to collect his motions in sterile Petri dishes; this he did very carefully. Repeated examinations of these motions demonstrated the presence of a very few specimens of *Löschia coli*

(Lösch 1875) and large numbers of a fair-sized flagellate with which we are not concerned at present, and, at times, another small flagellate, the precise nature of which it was difficult to decide.

After being treated mildly on one or two occasions it was decided to deal with the infection more seriously, and he was given repeated doses of purgatives and intestinal disinfectants (salol). After one of these purgative doses, and when the larger flagellates had nearly disappeared from the motions, we found large numbers of the small flagellate in the fæces. Subsequent to this they disappeared and the diarrhœa ceased.

Parasite.—The small flagellate in question is fusiform, pear-shaped, or more rarely rounded in form, and measures about 5·6 to 6·0 microns in length by about 2·8 to 3·0 microns in its greatest breadth when killed by osmic acid vapour, fixed by Schaudinn's fluid and stained by iron-hæmatoxylin.

When examined in this stained condition it showed a circular clearly defined nucleus (fig. 1) measuring about 1·4 microns in transverse diameter,

Fig. 1.— × 3,600.

and lying near the junction of the anterior third with the posterior two-thirds of the body. This nucleus is bounded by a well-marked membrane which limits the homogeneous dark staining contents, in which there is often a centrally (fig. 3) or excentrically placed (fig. 2) karyosome.

In front of the nucleus and closely approximated to the anterior end of the body is a well-defined blepharoplast (fig. 2), which, though typically single, may have a secondary smaller blepharoplast (figs. 1 and 3) associated with it. No sign of a rhizoplast could be seen.

From this blepharoplast there arise six anteriorly directed flagella (fig. 1), though occasionally, as in fig. 2, one accidentally appears as though directed backwards. When there are two blepharoplasts, then three flagella arise from each (figs. 1 and 3).

These flagella vary considerably in length, being generally much longer than the body, but it is exceedingly difficult to be certain where they end, and in the specimens drawn only such portions, as could be clearly seen, are portrayed, though in other specimens the length was clearly much greater, in some instances quite three times the length of the parasite.

Directed backwards, and also arising from the blepharoplast or blepharoplasts, there are two chromatic lines which, diverging and running on either side of the nucleus (fig. 2), may or may not

Fig. 2.— × 2,000.

converge, but in either case end near the posterior margin of the body in very minute chromatic particles (figs. 2 and 3) which are generally very difficult to see. From each of these chromatic particles there arises a posteriorly directed flagellum.

The chromatic rods are obviously axostyles, and the little particles in which they end may be termed axoplasts, as no name appears so far to have been applied to them.

It is not often that the axostyles are seen together, as the parasite usually lies so that only one is visible, while the other is almost invisible (fig. 1), but at times they are seen as described above (fig. 2), or at other times when the parasite has shrunk into

Fig. 3.— × 2,000.

a rounded mass they may be observed crossing one another (fig. 3).

No cytostome has been observed, while the periplast is thin and without markings.

The cytoplasm is vacuolated with food vacuoles, but no chromatophores are visible, neither is the body distended with gelatinous or other substances.

So far we have not observed encystment or division.

Classification.—As the organism which we have described above possesses permanent flagella which serve as organs of locomotion and also help in the capture of food it belongs to the Protozoal Class named *Mastigophora* by Diesing in 1866, a term which has been more or less generally accepted in lieu of the name *Flagellata*, as suggested by Cohn in 1853 as being less liable to produce confusion.

The subdivision of this class is, at the present time, in a transitory state, because our knowledge of the structure of the adult forms, as well as that of the life-cycles, is rapidly being improved, although still very imperfect.

Diesing divided his Mastigophora into two tribes, *Mastigophora atrichosomata* and *Mastigophora trichosomata;* by the latter he meant the Ciliata, which were first definitely separated from the Flagellata in 1878 by Stein. The former remain to-day as the class *Mastigophora*, which may be divided into sub-classes as follows:—

A. Body inflated with gelatinous substance	Subclass 1 *Cystoflagellata* Haeckel 1873
B. Body not so inflated:—	
I. Periplast markedly thickened with two flagella which arise about the middle of the body and one of which is trailing, while the other runs transversely round the body ...	Subclass 2 *Dinoflagellata* Bütschli 1885
II. Periplast thin, with a variable number and arrangement of flagella	Subclass 3 *Euflagellata* Cohn 1887.

When the description of the parasite given above is compared with this table it will be seen that, as the body is not inflated with gelatinous substance, and as the periplast is thin, it belongs to Subclass 3, *Euflagellata* Cohn 1887.

The further division of this subclass is difficult; but the scheme suggested by Hartmann and Chagas may be followed, with the exception that Hartmann's order of the Binucleata may with advantage be included in the Protomonadina, with which is also incorporated Blochmann's Polymastigina.

The various orders may be recognized as follows:—

A. Chromatophores often present:— I. With cellulose envelope ...	Order 1 *Phytomonadina* Blochmann 1895
II. Without cellulose envelope:— *a.* Small forms without œsophagus or vacuole system	Order 2 *Chromomonadina* Klebs 1892.
b. Large forms with œsophagus and vacuole system	Order 3 *Euglenoidina* Bütschli 1884
B. Chromatophores absent:— I. Amœboid forms in which the food is captured by pseudopodia	Order 4 *Rhizomastigina* Bütschli 1884
II. Non-amœboid forms in which the food usually captured by flagella	Order 5 *Protomonadina* Blochmann 1895

As the parasite we are considering possesses no chromatophores and is non-amœboid while it uses its flagella to capture its food it belongs to the *Protomonadina*.

Several observers have suggested the propriety of emphasizing the importance of a tendency to bilateral symmetry as seen in some of the species belonging to this order. Using Hartmann and Chagas' nomenclature and applying this principle two sub-orders may be recognized as follows:—

A. No tendency to bilateral symmetry *in undividing forms*. Flagella 1-5, in addition to which an undulating membrane may be present	Suborder 1 *Monozoa* Hartmann and Chagas 1911
B. More or less tendency to bilateral symmetry *in undividing forms*, as shown by the arrangement of the flagella, by the duplication of the axostyle, sometimes of the nucleus and more rarely of the cytostome. Undulating membrane absent	Suborder 2 *Diplozoa* Hartmann and Chagas 1911.

The parasite under consideration obviously belongs to Suborder 2 *Diplozoa*, because its flagella are bilaterally symmetrical and its axostyles are duplicated.

In this suborder we may recognize two families, viz.:—

A. Cytostome double, flagella variable in number	Family 1 *Distomatidæ* Senn 1900
B. Cytostome single or absent, flagella eight in number	Family 2 *Octomitidæ* Minchin 1912.

As the organism described above has no cytostome and eight flagella it belongs to Minchin's family *Octomitidæ*, which possesses, as far as we know, only three genera, which are differentiated as follows:—

A. Anteriorly three pairs and posteriorly one pair of flagella, nucleus single, bilaterally lobed or doubled, sucker absent:—	
1. Parasitic	Genus 1 *Octomitus* Prowazek 1904
2. Free living	Genus 2 *Hexamita* Dujardin 1841
B. Antero-laterally one pair, mesially two pairs and posteriorly one pair of flagella, nucleus usually double, sucker present	Genus 3 *Giardia* Kunstler 1882

With regard to the third genus it is better known under the name *Lamblia* Blanchard 1888, and contains *Giardia intestinalis* (Lambl 1859), better known as *Lamblia intestinalis* (Lambl 1859), which is so commonly present in man, and which we have also repeatedly found in adult and encysted forms in human fæces in the Anglo-Egyptian Sudan.

The parasite which we are at present considering, however, does not belong to the genus *Giardia*, but to Prowazek's *Octomitus*, because it has three pairs of flagella projecting from its anterior extremity and one pair from its posterior end, a single nucleus and no sucker, while it is not free living, but parasitic.

With regard to the species Prowazek created the genus for *O. intestinalis*, which is the broad form found in the rat, and which is possibly the same as Grassi's *O. muris* found in rats and mice. Authorities, however, leave it open as to whether these are the same or different species, and as we have only studied the small form, we are not in a position to make any statement on this point. It may perhaps be as well to note that Alexeieff in 1911 used the name *O. intestinalis* for the form found in the axolotl.

We will therefore recognize *O. intestinalis* Prowazek 1904 as the type species and *O. muris* (Grassi 1879) with *O. dujardini* Dobell 1909 as the remaining species.

The last-named flagellate was observed in Khartoum in 1911 by Stevenson in Bufo regularis. Its synonyms are numerous, but only the best-known need be mentioned, viz., *Hexamita intestinalis* Dujardin 1841.

The species known to us may be differentiated as follows:—

A.	*Nucleus situate close to the anterior end.*	
	1. Nucleus often bilobed ...	*dujardini*
	2. Nucleus double:—	
	a. Measurements.	
	8·12×5·7 microns ...	*intestinalis*
	b. Measurements.	
	4-6×2 microns ...	*Muris*
B.	*Nucleus not situate close to the anterior end.*	
	Nucleus single and rounded	*Human*
	Size 6×3 microns	*Parasite*

Octomitus and Giardia.—We have seriously considered Jollos' suggestion that *Octomitus* might be merely a stage in the life-cycle of a *Giardia*, but plausible as this may appear we have been unable so far to support it, as we have not up to the time of writing observed a single *Giardia* in adult or cystic form in the case mentioned above.

The final solution of this question must await a full knowledge of the life-cycle of a *Giardia*, and therefore at present *Octomitus* remains as a separate genus.

Conclusions.—From the above remarks it will be observed that we believe that the parasite under consideration is not merely new in man, but is also new to science, and therefore we name it *Octomitus hominis* Chalmers and Pekkola 1916, and define it as follows:—

"Flagellate non-amœboid organism measuring about 6×3 microns and possessing six anteriorly directed flagella of variable size and sometimes of considerable length springing from a single or double well-marked blepharoplast situate close to the anterior margin. Nucleus, single, roundish, often homogeneous with well-marked membrane and sometimes with a karyosome, and situate at some distance from the anterior extremity.

"Two axostyles are present arising from the blepharoplast and ending near the posterior margin in two small chromatic particles (axoplasts) from which arise the posterior flagella. Periplast thin without markings, cytostome absent, cytoplasm with vacuoles but not swollen out with gelatinous material and not possessing chromatophores.

"*Known habitat*: Intestine of man in Anglo-Egyptian Sudan."

Perhaps the parasite lies close to the wall of the intestine, and perhaps it lives in the small intestine as it was but seldom recognized in the fæces until the bowels had been well cleared by purgatives, when it appeared it large numbers.

Possibly it was more active than the larger flagellate in producing the attacks of diarrhœa, as previous treatment had been unsuccessful, but after repeated purgation, and after these small parasites had appeared in large numbers in the fæces, salol seemed to produce excellent effect. At all events, the patient has had no recurrence for six months (i.e., up to date of writing this note), while previously an attack of diarrhœa occurred about twice a week for long periods, broken by intervals of only two to three weeks' duration.

Repeated examinations of this patient's fæces since the above treatment have failed to demonstrate the presence of either the Octomitus or the large flagellate. Still, all the remarks with regard to treatment must be received with caution, as they apply only to a single case.

We therefore record as being present in the intestine of man in the Anglo-Egyptian Sudan:—

Giardia intestinalis Lambl 1859.

Octomitus hominis Chalmers and Pekkola 1916, of which the last is the new human intestinal parasite, while, in conclusion, it may be as well to state that *Blastocystis hominis* Brumpt 1912 is very commonly present in human fæces in this country, as is a species of flagellate with which we propose to deal in a future communication.

Khartoum,
April 24, 1916.

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(Arranged in alphabetical order.)

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ILLUSTRATIONS.

FIGS. 1-3.—*Octomitus hominis* from human fæces, collected in a sterile Petri dish and stained by iron hæmatoxylin.
FIG. 1.—× 3,600 diameters. Camera lucida drawing.
FIGS. 2, 3.—× 2,000 diameters. Camera lucida drawings.

FLAGELLATE INFECTION IN CARIES OF THE JAW.

By D. C. MACASKILL, M.D.Edin.
Medical Officer, Kuala Kangsar.

A MALE Tamil, aged 45, was admitted to this hospital on November 24, 1915. He was suffering from swelling and pain of the proximal joints of the limbs, rhinitis, and caries of the right upper jaw, with a very foul-smelling discharge. He had been admitted to hospital with similar symptoms some months previously.

No history of syphilis could be obtained but he was treated with pot. iodid. and mercury by mouth and inunctions of mercury over the painful joints. At the same time the nose was syringed out frequently with Condy's fluid and he also gargled several times in the day with Condy's fluid.

While his general condition and the rhinitis improved the caries of the jaw was resistant, showing no decrease in foul-smelling discharge.

On November 29, on examining the pus for possible presence of pathogenic entamœbæ I found numerous flagellates, pear-shaped, with three flagellæ, at the broader end and an undulating membrane. The flagellates were very active and corresponded in size and appearance to *Trichomonas hominis* Davaine, as described in "The Manual of Tropical Medicine," Castellani-Chalmers, p. 229, 1910 edition.

On November 30, in addition to anti-syphilitic remedies, I began treatment by emetine. Half a grain "tabloid" was given by the mouth three times a day, and on December 2 the patient received ½ gr. by subcutaneous injection.

After one day's emetine treatment no flagellates could be found in the pus and on the continuation of emetine the foul smell disappeared, the pus rapidly became less, and on December 3, when he left the hospital at his own request, the discharge from the gum had ceased.

I think that the caries of the jaw was resistant on account of the presence of the flagellates, and that with their destruction by emetine the condition responded to the action of the anti-syphilitic drugs.

Notices.

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FAILURES IN CLINICAL DIAGNOSIS REVEALED AT *POST-MORTEM* EXAMINATIONS.

THE abstract on p. 148 of this number of the JOURNAL on "Surprises Revealed by the Pathologist" is a most useful contribution to medical literature. We so seldom get opportunities of *post-mortem* examinations in tropical practice that everyone should read the abstract carefully, and it should strengthen the doctor's ardour in asking to be allowed to conduct a *post-mortem* in many more cases than he usually does. The key to the value of Dr. Walter G. Baetz's article consists in the revelation of how easily one infection obscures another. We are so apt to think of only one disease prevailing at a time, and to devote all our attention and treatment to overcoming that ailment that we overlook, or may, even if another is recognized, neglect it, and assign it a secondary potency. "One body, one disease; one disease, one drug" is a state of mind modern scientific medicine is perhaps too prone to encourage amongst us, especially if we have obtained a pure culture of a predominating organism in the blood or tissues. The other organisms present are too often looked upon as of no consequence, regarded as an incubus to diagnosis, and are cast aside as a gardener does weeds.

There is no doctor of any experience who has not met with examples of the nature Dr. Baetz relates. The laity often credulously tell us of "doctors who treated me for kidney when it was liver all the time or for stomach when it was appendicitis from which I suffered"? Luckily for our information, many of the cases recorded by Dr. Baetz are tropical cases, and we each can read them with interest, and, let us hope, with future benefit to our patients.

The first case is particularly interesting from a practical point of view. It is that of a patient who suffered from malaria, and to whom a hypodermic of quinine was administered. *Post mortem*, a gas gangrene lesion was found at the seat of injection, and, rightly or wrongly, the death is attributed to this lesion. Pain after hypodermic injection we

are apt to neglect, and to attribute it to supersensitiveness on the part of the patient. Now and again our attention is bound to be drawn to the spot, for an abscess may develop, and even then we almost invariably consider this a local infection merely. How true the opposite may be is prominently indicated by Dr. Baetz's account of things, and in future, any one of us who has had the good fortune to have read his teaching, will pay more attention to the pain which the patient tells us of. The hypercritical will say, no doubt, that he would like to know about the sterilizing of the instruments and the skin, &c., of the kind of quinine employed, &c.; the quinine, we are told, was the bihydrochloride, and there is no reason to assume that the other steps were not carried out with the usual care. It is only the doctor of limited experience who will deny that, with every possible precaution, local untoward results may not obtain as the result of hypodermic injections of this nature. The writer has in his mind a child who was given a hypodermic of quinine in the Tropics; after coming to England, fever continued, and at the seat of the injection in the hip an abscess formed. This was opened, but a long sinus remained which continued to discharge pus. In course of time the sinus was cut down upon, and at the bottom of one of the diverticuli from the sinus a dry quinine deposit was found. Still an anomaly of symptoms continued to prevail, and a succession of specialists for as many as six different ailments were consulted, ranging from ear and throat specialists to bacteriologists. The child died, and, except for the local trouble in the hip, nothing was found amiss.

The second case referred to in the category of surprises deals with pellagra diagnosed in a negro. Early diagnosis of pellagra in negroes must be vexatious, as a pigmentation of face and hand is the sign that points to the ailment. However, seeing that pellagra is a chronic disease, it is a surprise to find that, *post mortem*, diphtheria proved to be the malady. Special interest attaches to the third death, for it was caused by what must have proved a stumbling-block to many tropical practitioners, namely, typho-malaria. Dr. Baetz records the finding of æstivo-autumnal malaria in the blood during life and obscuring the fact that the cause of illness was due to typhoid—a double infection, long a matter of debate, and diagnosed before the malaria parasite was discovered. Many doctors sniffed at the name typho-malaria and said there was no such thing; that it was either typhoid or malaria, and regarded the diagnosis as but a subterfuge and as a cloak for ignorance. The pronouncement was made shamefacedly to both one's fellow-practitioners and to the patient's friends, for the medical opinion in regard to the matter is well known to be antagonistic.

The possibility of double infection may, however, be admitted, but the friends insist upon a pronouncement one way or the other. Is it typhoid or is it malaria? they ask, and if the answer is typho-malaria, they regard the doctor as one uncertain of his diagnosis and desire another opinion. If the other man called in is an unbeliever in the double infection possibility, his decided opinion of the case being one or other is held to be "business-like" and "downright," let alone the implied superiority of knowledge. At times the malaria diagnosis obtains supremacy, and at times the typhoid. The writer recalls a case of the kind in which he was concerned in the Tropics in which six doctors were consulted—five said malaria, one typhoid; the majority, of course, decided the treatment, and the patient was placed in the draught between an open window and door, as "that was the way they treated malaria in India." *Post mortem*, when typhoid ulcers were found in plenty, the one man who held it was typhoid still found himself in the minority, for the others denied that these were typhoid ulcers; the cause of the death in the certificate was filled in as malaria, an example of persistence of opinion unto death and afterwards.

Dr. Baetz deals severely, yet we think justly, with the diagnosis of malaria hemiplegia and local palsies in malaria-infected persons. The disposition to attribute these to malaria is ever doubtful, and even microscopical specimens of brain sections with malarial-infected blood "blocking" cerebral vessels, it is not conclusive that these do block the vessels and cause paralysis. Examination of the same brain not uncommonly shows other changes in the brain more productive of the hemiplegia, &c., and the blocking of the vessel may be a secondary trouble due to conditions other than the infected corpuscles. Dr. Baetz shows also that leprosy may cause symptoms of dysentery as proved *post mortem;* dysentery, again, may be mistaken for typhoid. Abscess of the liver, the one disease more than any other that shows no single definite symptom—in its earlier stages, at any rate—has been mistaken for many other ailments, and Dr. Baetz mentions carcinoma, a right basal pneumonia, typhoid fever, and diseases of other organs amongst the category of errors in this connection.

The spleen, so constantly in evidence in malarial countries, may be affected by a number of ailments both primary and secondary. The practice of assigning all splenic enlargements to malaria in the Tropics is fraught with danger to the patient and confusion to the doctor.

It is unnecessary to dwell upon the importance of possessing an open mind in regard to possibilities of a double infection, and why not a triple or even quadruple infection? We know that a man suffering from malaria may become infected by one or more parasites; that a person with dysentery, with filaria, with typhoid, with syphilis, with sleeping sickness, &c., may show malaria parasites and other in the blood. And this statement leads one to ask, Are there any diseases in tropical countries in which malaria does not intrude?

It is difficult to cite definite evidence in this direction, and we would ask: Have patients with beriberi been found infected with malaria? Again, sprue patients, in the writer's experience, have never been found with malaria parasites in the blood. This is a line of thought well worth following, and the writer has made the above statements

in expectancy that they may be contradicted, as it is merely a personal experience. In other words, have we any evidence of one infectious disease parasite casting out another; that is, are there any two infections incompatible? This question might lead the therapeutist into fresh fields of investigation, if only of an academic interest.

We are indebted to Dr. Baetz for giving us the lead to publish similar "surprises," for no practitioner lives who cannot supplement the list, and amongst the multitude of possible contributors a wealth of knowledge could be obtained which would make not only interesting, but most valuable reading.

ERRATA.

P. 102, column 1, line 25 from top: *For* "1913" *read* "1915."

P. 103, column 1, line 10 from bottom: *Insert* after "between" "a disease seen in animals and one in man, but also between."

P. 107, column 1, line 22 from top: *For* "Iltihabel Sehaee" *read* "El Iltihab El Sehaee."

P. 110, column 2, table at bottom, Elser and Huntoon column, second item: *For* "0·4" *read* "1·4."

Abstracts.

SURPRISES REVEALED BY THE PATHOLOGIST.[1]

By Walter G. Baetz, M.D.

This collection of more or less exceptional failures in clinical diagnosis, found in hospital autopsies during a period of five years, is arranged in anatomical groups according to the organ or system of organs that was found to be the chief site of the fatal disease. The general infections and intoxications are considered first, followed consecutively by the cerebrospinal, cardio-vascular, pulmonary, gastro-intestinal, hepatic, splenic, pancreatic, and neoplasm groups.

General Infections.

The first case was a young negro adult who was admitted with a serious infection of æstivo-autumnal malaria. He was given bihydrochloride of quinine by hypodermic injections, and died on the sixth day. The diagnosis of æstivo-autumnal malaria received a bad blow when a gas bacillus infection was found at necropsy to be present in the quinine hypodermic site in the left thigh. The clinician had probably paid too little attention to the pain the patient had complained of following the injection of the quinine.

The next case was an adult negro who was sent to hospital with the provisional diagnosis of pellagra. He gave a history of having been ill for a month with dysentery and a sore mouth. The physical examination revealed an exudative stomatitis and pharyngitis. There were no visible ulcerations, but the gums were spongy and bleeding. The patient was very toxic. Peri-anal excoriations were present. The tongue was denuded and fiery red. In view of the history and these findings, the provisional diagnosis of pellagra seemed justifiable, even in the absence of a dermatitis. Before further examination could be made this patient had a convulsion, and died unexpectedly twenty-four hours after admission. The autopsy seemed to corroborate the clinical diagnosis of pellagra until the cultures taken *post mortem* proved the case to be a most unusual diphtheria infection.

The following case shows how easily one infection obscures another. This patient was admitted in a comatose state with a temperature of 104·5° F. A blood film showed the rings of æstivo-autumnal malaria. An hour later the patient died. The autopsy proved the malaria infection, which was chronic, but also showed that the acute illness causing death was typhoid fever and not malaria. This danger of attributing a patient's illness solely to the malarial parasites that may be found in his blood is always present in those parts of the Tropics where practically all natives harbour parasites.

Another acute infection proved to be acute miliary tuberculosis at autopsy. The clinician had only ventured a diagnosis of acute undetermined infection and broncho-pneumonia. The unusual feature of this case consists in the fact that a carefully performed lumbar puncture failed to produce the desired fluid. The reason was very evident when an absolutely dry cord, full of tubercles, was found by the pathologist. Not infrequently we hear the diagnosis of "dry cord" made when the operator fails to obtain fluid. Seldom is his diagnosis sustained at the *post-mortem* examination.

In another case the diagnosis of disseminated tuberculosis was correctly made, but the secondary diagnosis proved to be a very unusual error. On admission the patient was in the last stages of his generalized infection. When the abdomen was palpated, a tender mass the size of one's fist was found in the right lower quadrant, directly over the psoas line. Keeping in mind the infection with which the patient was moribund, it was easily decided that this tumour was a psoas abscess. At necropsy the "psoas abscess" turned out to be a congenital fusion of the right and left kidney.

The following two cases show that the primary disease may be immediately recognized, but the diagnosis of the cause of death becomes a failure because the secondary signs and symptoms are misconstrued.

The first patient came to the hospital suffering with an infection of the right arm; pleurisy and pulmonary infiltration were also noted. The patient died rather suddenly with a profuse pulmonary hæmorrhage. Instead of reasoning that the pleurisy, the pulmonary infiltration, and the pulmonary hæmorrhage were the results of a septic embolus, the clinician dissociated cause and effect by making a diagnosis of cellulitis, plastic pleurisy, and pulmonary tuberculosis with hæmorrhage.

[1] Read at the one hundredth meeting of the Medical Association of the Canal Zone.

The second case of this type was an injury case readmitted to the hospital. The man's previous history was that of a fall between two cars. Contusion of the back was diagnosed at the time. A skiagraph was not made. An extensive callus formation of the spine in the lumbar region threw grave doubts on this diagnosis, though the patient was not incapacitated at any time. Some weeks later he began to complain of pain in the back; he manifested a septic temperature, and pus was found to be present in the urine in great quantities. On examination a palpable tender kidney was found. The spinal exostosis was marked at this time, but was only slightly painful on pressure. The original injury to the spine was consequently disregarded, and a diagnosis of pyonephrosis, arteriosclerosis, and chronic nephritis was made. The autopsy revealed a fracture dislocation of the lumbar spine. This injury site had become infected, presumably after the patient had been discharged, following his original admission for injury. A septicæmia was the cause of death. The palpable and tender kidney which had misled the internist was found to be nothing but a simple ptosis of that organ.

Another case of septicæmia was diagnosed cerebral syphilis and æstivo-autumnal malaria. The clinical diagnosis was undoubtedly correct as far as it went, for the asexual parasites of malaria were found in the blood films of the patient, and his Wassermann test was positive. The presence of facial palsy, Kernig's sign, ankle clonus, paræsthesias, anæsthesias, and coma pointed to central nervous disease. Nevertheless, the pathologist showed that, without doubt, death was due to septicopyæmia. The original focus of the purulent infection, unknown to the clinician, was found to be a chronic solitary ulcer in the cæcum.

Still another case of septicopyæmia was diagnosed clinically as pernicious malarial fever and meningitis. It is highly improbable that any previously untreated patient will die of malarial fever whose blood film, carefully stained and examined, fails to show the parasite. This case was diagnosed pernicious malaria in the face of negative blood findings. Another factor in the failure of diagnosis was the inadequate examination of the fæces. The fatal pyæmia was caused by an extensive ulcerative colitis, acute and chronic. A single microscopic fæces examination was charted as being negative. A white blood count of 7,000 seems to have prejudiced the clinician against a purulent infection hypothesis. The last case of the generalized infections is a pneumococcus meningitis that was diagnosed tertiary syphilis and cerebral softening. A positive Wassermann test proved that the diagnosis of syphilis was undoubtedly correct, but a lumbar puncture would have shown that the cerebrospinal symptoms were due to a pneumococcus infection of the meninges and not to syphilitic endarteritis and softening.

Cerebral.

The first was a solitary abscess of the right occipital lobe in an adult. There was normal temperature, and the white blood count ranged from 8,000 to 14,600. All the classical signs of intracranial pressure were present. A Wassermann test made with the spinal fluid was found to be negative. Then 0·6 grm. salvarsan was given intravenously as a therapeutic test. The immediate improvement was so striking that the diagnosis of cerebral abscess was abandoned for the one of cerebral syphilis. Four days later the patient died in acute delirium, and the autopsy revealed the primarily suspected abscess. The other case of brain abscess was one of multiple foci throughout the right frontal and the left parietal lobes. It occurred in an infant aged thirteen months. The history obtained was one of illness with diarrhœa and vomiting for one month. The white blood count was 10,400. The baby died within three days. Anæmia and diarrhœa were the only tangible clinical findings during that time. The next case is an example of a not infrequent error and one that is difficult to avoid. An adult patient was admitted, suffering with acute maniacal excitement and frequent generalized convulsions. There were high fever and a leucocytosis. Focal cerebral signs were absent. The patient died on the third day, and in the absence of a better diagnosis, "acute undetermined infection" was offered. The pathologist found multiple hæmorrhages, deep and superficial, in the brain. The *post-mortem* Wassermann test was positive. Other internal evidences of syphilitic infection were also noted anatomically.

In the next case the clinical diagnosis really overshot the mark. The *post-mortem* examination presented softening of the brain following embolism from a syphilitic valvulitis. The clinician had mistaken the syphilitic aortitis for the more advanced stage of aneurysm. The cerebral signs of convulsion and hemiplegia were interpreted as cerebral hæmorrhage and softening. The Wassermann test was negative.

Another case which again shows the risk of attributing a serious disease symptom complex entirely to the malarial parasites that happen to be found in the peripheral circulation is the following. A tropical negro boy, aged 7, was admitted in a semi-comatose state. The history given by the mother was that he had been sick for three weeks with palsy of the left arm and leg. Ten hours before seeking hospital treatment the boy had begun to vomit and had lapsed into semi-coma. When roused he spoke disconnectedly and in a decidedly slurring fashion. The white blood count was 13,000. The thermometer registered 100° F. After a tedious search æstivo-autumnal parasites were found in the patient's blood. We read of a good deal of pernicious malaria producing local palsies and hemiplegias, but the pathologist usually finds a better explanation for such definite focal signs. Keeping this bit of experience in mind, we subjected the patient to a spinal puncture in addition to treating him for pernicious malaria. Although the cerebrospinal fluid proved negative both in culture and cytology, the pressure was so decidedly increased that when the patient died on the third day, a diagnosis of simple meningitis was given preference over the malaria diagnosis. The autopsy brought to light a cystic parencephalus involving the pons, crus cerebri, medulla, and cervical portion of the cord.

Internal and external hydrocephalus were marked. A chronic malarial infection with a few parasites in the spleen and the bone-marrow was found, and the possibility of another delusion concerning malarial hemiplegia had been dispelled by the pathologist.

Cardiovascular.

The first three cases are a reminder of how easily septic embolism escapes notice when the ulcerative cardiac focus, if present, gives no physical signs or is overlooked. There is hardly another one single pathological entity that can cause more rapid and diverse signs and symptoms than an embolus. In none of these three cases was there any physical evidence found to cause suspicion to be directed to the endocardium as the origin of the trouble. In all three the diagnosis was based on the effect and not the cause. One was diagnosed cerebral hæmorrhage, another meningitis, and a third "acute undetermined infection."

As to diversity of signs and symptoms, aneurysms are not far behind emboli. The only reason that they are not missed more often, clinically, is that they usually give ample time for examination and observation. As a class by themselves they contribute rather heavily to our gross errors in diagnosis. The Wassermann test has been found positive in 69 per cent. of our cases. A negative test is rather unfortunate in those cases (and they are many) in which *ante-mortem* evidence of syphilis cannot be demonstrated. The first case was that of an aneurysm of the transverse arch, which obstructed the venous channels of the neck. Death came with rupture of the sac into the right pleural cavity. The primary diagnosis was aneurysm with intrathoracic pressure, finally changed to organic heart disease and jugular thrombosis.

Next follows an aneurysm of the abdominal aorta eroding the lumbar portion of the spine, diagnosed as lobar pneumonia. The lobar pneumonia was found to be a terminal massive broncho-pneumonia. This patient had been the rounds of a number of physicians, and the pain he had complained of had been variously diagnosed as lumbago, neuritis, and sprain of the back. An aneurysm of the thoracic aorta eroding the spinal vertebræ and producing transverse compression myelitis was diagnosed as acute transverse myelitis of unknown origin.

Another recent aneurysm patient of unusual interest was admitted to the ward badly cyanosed and breathing like an asthmatic. He gave a history of having suffered with dyspnœa for the past ten days. Physical examination revealed subcutaneous emphysema of the entire body down as far as the hips. The lungs, in addition to the asthmatic breathing under the air-filled subcellular tissues, were so emphysematous that a satisfactory examination was impossible. Infiltration of one apex was suspected. At times the patient seemed to improve, and the absorption of the air in his subcutaneous tissues would progress. Then he would again have severe attacks of dyspnœa which left him exhausted and distended with air. In one of these attacks he died, the twenty-fourth day after admission. The diagnosis was pulmonary rupture, asthma, and emphysema of the lungs and subcutaneous tissues. The solution at autopsy was simple enough. An aneurysm the size of a lime, springing from the aortic arch, had compressed and eroded the trachea. The violent respiratory efforts had produced enough negative pressure in the chest to rupture the right apex at the site of an old tuberculous focus. Subcutaneous emphysema and a slowly forming pneumothorax were the consequences. Syphilitic manifestations in the arterial system were plentiful.

A case somewhat simulating this one was an aneurysm of the innominate compressing the trachea and the right auricle. Chronic emphysema and bronchitis was the diagnosis. When sudden death occurred, "organic disease of the heart" was added. In all these aneurysm cases unmistakable evidence of syphilis was found by the pathologist. These cases teach forcibly that asthma of recent duration should always be looked upon with suspicion, especially when partial relief is obtained with potassium iodide. The last of the cardiovascular cases is an exceedingly rare one. An old negro was admitted to the ward in the very last stage of cardiac hypertrophy and dilatation. Death took place within a few hours. It was thought that the cardiac condition was secondary to the well-marked chronic interstitial nephritis. The rapid termination of the case cut short further investigations. At autopsy the unusually large and dilated heart was explained by the presence of gummata of that organ, involving chiefly the left ventricle.

Pulmonary.

Two cases were selected as being of sufficient interest. One is that of a young negro who slowly failed with all signs and symptoms of bulbar palsy. His Wassermann test was positive, but he showed no signs of syphilis otherwise. About two weeks before death he complained of pain in the right side. At autopsy a degenerative encephalitis of the thalamus and cervical portion of the cord was found, but the immediate cause of death was an abscess in the right pulmonary base. Undoubtedly, the palsy of the accessory muscles of respiration was the reason why a physical examination did not reveal the aspiration abscess; in other words, the very condition that was responsible for the fatal complication also effectually prevented its recognition.

The other pulmonary case was one of gangrene of the lung terminating a chronic interstitial nephritis. In this case the pulmonary complication was missed entirely simply because of negligence on both the physician's and the nurse's part. The odour seems to have been so fœtid that the patient was isolated, but no attempts were made to ascertain the cause of the fœtor, nor even to keep any clinical notes. The presence of septic temperature during the final two weeks alone should have been a danger signal that some complication had set in.

Gastro-intestinal.

The first case was correctly diagnosed as clinical dysentery, a term we have adopted for dysenteries

in which the causative factor cannot be found. The shock of surprise imparted by the pathologist came about by the way of a secondary diagnosis. The patient, a senile negro, presented complete destruction of the nasal bones and adjacent structures. As evidences of an old syphilitic infection were plentiful, no hesitation was felt in making a diagnosis of tertiary syphilis as the secondary cause of death. The pathologist found the necrotic tissues and the right ulnar nerve to be thickly settled with the bacilli of leprosy. The next is a clinical diagnosis of typhoid fever in a patient who died on the fifth day. High temperature, low blood count, a suspicious Widal, and a large soft spleen supported the diagnosis. Against this were the presence of pus and blood in the stools, a negative blood culture, and death approaching with a falling temperature curve. Clinical dysentery was the cause of death given by the pathologist. This case belongs to a class of exceedingly fatal dysenteries in which the undoubtedly present bacillary cause has not been isolated as yet.

The following case of abdominal tuberculosis that had been diagnosed chronic nephritis is an illustration of the great variability in clinical picture of a well-known infection. This patient suffered with an advanced degree of chronic nephritis, as diagnosed, but the pathologist was undoubtedly just when he gave preference to the active abdominal tuberculosis. The reason that not even a suspicion as to the true state of affairs was entertained by the ward physicians lies in the fact that for a period of ten weeks the patient's temperature remained normal or subnormal. Furthermore, he at no time gave any objective or subjective symptoms of abdominal disease. In diagnosing chronic nephritis as the fatal disease, the physicians had once more mistaken the effect for the cause.

Two cases of duodenal ulcer with rupture into the peritoneal cavity represent not only a pathological condition that is a most notorious pitfall for the diagnostician, but also show how the diagnosis can become an impossibility at the present time, under certain conditions. The first was in a negro painter. A diagnosis of lead colic was made. Granting for the sake of argument that plumbism with colic was actually present, as it readily might be, a dual diagnosis seems hopelessly remote when we consider our present practical means of duodenal ulcer diagnosis. The other ulcer was complicated with a tremendous hypertrophy and dilatation of the heart, secondary to interstitial nephritis. To arrive at a diagnosis of duodenal ulcer in such a patient whose liver was tremendously swollen and tender in an abdomen full of fluid would tax the diagnostic acumen of the best.

Hepatic.

Four cases represent a tropical and sub-tropical disease manifestation that is the bane and the fear of the internist. Entamœbic abscess is as elusive as it is destructive of the liver; early diagnosis often means everything to the sufferer. Spontaneous recovery is so rare that a failure to diagnose this affliction is practically always fatal to the patient. These four failures impress the variety of conditions for which hepatic abscess is mistaken. This is not surprising, considering that there is no definite symptom complex of this curse of the Tropics that is not found more often in other causes of hepatic enlargement. Until diagnosis by röntgenology and a serum ferment test become practical possibilities, there will always be patients slowly dying under our very eyes, in whom past history as to dysentery, temperature records, physical examinations, the absolute and the differential blood count, stool examinations, aspiration of the afflicted organ, and even exploratory laparotomy have deceived us. Here is a case of a huge solitary abscess in an old man. A subnormal temperature, extreme emaciation, a large, hard, nodular, insensitive tumour, and abdominal glandular enlargement and induration, a white blood count of 8,000, with a negative dysentery history, made an exploratory laparotomy appear needless cruelty in a case where carcinoma seemed certain. Necropsy was humiliating. Another is mistaken for passive congestion of the liver in a cardiac dilatation case. A third is one in which the high temperature reaction with a low blood count in conjunction with severe toxic stupor was taken for typhoid infection. When the abscess in the hepatic dome caused the lower pulmonary lobe to collapse bronchial breathing was heard. A white blood count that had risen to 20,000 seemed to clinch the secondary diagnosis of complicating pneumonia. A fourth case in which aspiration of the liver was negative gave the same pulmonary signs, and lobar pneumonia seemed probable, the enlarged liver being explained by the usual cloudy swelling of that organ in pneumococcus infections. When the high temperature gradually came to normal and remained there, but the solidified pulmonary base did not become aerated, an unresolved lobe was suspected in a patient seemingly dying from chronic diffuse nephritis. It is in this class of cases that the diagnosis may mean life or death to the patient. The brevity of the notes on clinical progress in some of the records leaves the disquieting impression that at times insufficient attention, bordering on neglect, is accorded these most important cases.

Renal.

A negro, aged 26, walked to hospital, a seemingly robust individual in good health. The history he gave stated that three days previously he began to be annoyed by a painful swelling of one of the submaxillary glands. Before coming to the hospital he also noted a marked swelling of the tongue. Otherwise there were no complaints. Upon inspection the tongue was found to be severely lacerated and swollen. There seemed to be no doubt that the injury was caused by the patient having bitten his tongue. With some urging he admitted that he had had a fit, during which the lingual injury might have occurred, but he stoutly denied ever having had fits before. An hypertrophied left ventricle was the only other finding. Epilepsy was suspected, and as the patient seemed normal in all other respects at the time, he was given pyjamas and the freedom of the ward. Four hours later he suddenly had another convulsion. In spite of mouth-gags

and other improvised instruments, the patient practically bit off the anterior third of his tongue. The convulsion was continuous for about half an hour, at the end of which time he died. "Epilepsy of undetermined origin" was the best diagnosis that the physicians could arrive at with the meagre evidence at hand. Autopsy proved the case to be one of uræmic convulsions caused by a suppression of urine in a chronic diffuse nephritis. Acute degenerative nephritis, superimposed, was also found, and was taken to be the chief factor in producing the unusual rapid termination.

Another case of death from uræmia, but with quite a different etiology, was the following: An American negro, aged 43, came to hospital with a history of pain in the back and vomiting. Syphilis and chronic nephritis were easily demonstrable. The pain in both lumbar regions was settled with the notoriously risky explanation of "neuritis of the lumbar nerves." In about five days it became necessary to check up the original uranalysis because the patient seemed drowsy and took to his bed, but no specimen was forthcoming. Convulsions set in and the anuria persisted for three days, at the end of which time the patient died in coma. The clinical diagnosis of suppression of urine was absolutely correct, but the revelation at autopsy of the causative factor created a mild sensation. A kidney calculus was found obstructing the right ureter near the brim of the pelvis, and another was found occupying the corresponding position on the other side. Cystic degeneration of the kidneys and an extensive acute degenerative nephritis had been the consequence.

The third case is equally rare and interesting. A twelve-year-old negro was sent to the hospital complaining of fever, pain in the side, and vomiting of two days' duration. The boy had several degrees of fever, retraction of the head, enlarged liver and spleen, and a palpable left kidney. He seemed very toxic. The white blood count was 20,000, urine was negative, chemical and microscopical. The next day another specimen was found to be loaded with pus and blood. Incidentally the acute symptoms subsided, and the blood count fell to 15,000. A diagnosis of pyonephrosis of the left kidney was arrived at. Surgical interference was deferred to keep a careful watch on the total urine excretion. Within forty-eight hours complete suppression set in suddenly, and the patient's condition precluded all thoughts of operative measures. A fatal termination came quickly. At autopsy a large pus kidney of the left side was found. The surprise was great when the time came to examine the right kidney. This kidney was found to be congenitally absent.

Spleen.

The spleen, independently, is not often the site of morbid processes. The one case selected was diagnosed pernicious malaria, the patient being admitted in coma with parasites in his blood. Death occurred within eight hours. At autopsy the malarial infection was found to be of secondary importance. A large splenic abscess communicating with the colon was the undoubted cause of death.

Pancreas.

Affections of the pancreas are equally rare and not infrequently missed when they do occur. One case of this description was found. The existing myocarditis and nephritis seemed quite sufficient to explain the patient's moribund state.

Neoplasms.

The failures in the diagnosis come mainly under the heading of sarcomatosis. The reason for the precedence of sarcoma over carcinoma is twofold. The tropical male negro in Panama is not often afflicted with carcinoma. Furthermore, when the latter does occur, it is usually in a situation to give quite definite symptoms, for instance, at the pylorus. Four cases of misinterpreted sarcomatosis will be taken as typical examples. The first occurred in an adult negro suffering with advanced syphilis and entamœbic dysentery. A large sarcomatous nodule was found by the clinician to be protruding from the prostate into the rectum. The rectal mucous membrane over the nodule was ulcerated, and it was from this ulcer that the diagnosis of entamœbic dysentery was made microscopically. Unfortunately for his complete diagnosis, the clinician mistook this ulcerating nodule for a broken-down gumma that had become infected with entamœbæ. Both the entamœbic dysentery and the tertiary syphilis were verified at autopsy, but the actual cause of death was sarcomatosis.

In the second case the dissemination of the neoplasm had caused mainly spinal symptoms. Transverse myelitis due to Pott's disease was wrongly diagnosed. This is not an infrequent mistake, as shown by other records. It is good advice always to examine the prostate for neoplasm in cases with spinal symptoms. This advice can with benefit be extended to all cases of doubtful diagnosis.

The third case was one of sarcomata of the liver. The erroneous diagnosis of syphilitic cirrhosis of that organ was made. This was one of those uncommon cases terminating suddenly with hæmorrhage from the mouth, in which the blood came from the œsophageal veins and not from the lungs or stomach. Gastric hæmorrhage was given in this case as a secondary diagnosis.

The last case of sarcomatosis is an exceedingly rare one. A nine-year-old negro boy was seen suffering with dyspnœa, cyanosis, and dilatation of the veins of the neck. Both liver and spleen were large, hard, and tender. The heart was markedly enlarged, right and left, and very arrhythmic, but murmurs were not heard. A tentative diagnosis of congenital right heart disease was made with secondary hypertrophic cirrhosis of liver and spleen. At autopsy sarcoma dissemination was found, one of the growths almost filling the right auricle and invading the auriculo-ventricular wall of the right side.

The last case of this series is a carcinoma of the œsophagus eroding and compressing the trachea. The patient arrived at the hospital in a desperate condition of suffocation. The rather vague diagnosis of œdema of the larynx was made. The autopsy showed the true state of affairs.

Original Communications.

A NOTE ON THE TRANSMISSION AND EXAMINATION OF PLAGUE SPECIMENS.

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The report of the Manchurian Plague Commission of 1911 contains a paper by Dr. Broquet, recommending the use of his solution—neutral glycerine, 20 c.c.; distilled water, 80 c.c.; calcium carbonate, 2 grm.—as a medium for the preservation of plague material during transmission to the laboratory, by post or otherwise, in order to prevent putrefaction pending bacteriological examination. From the Commission's report it would appear that this solution was extensively used during the Manchurian outbreak, and with satisfactory results.

As in South Africa, specimens sometimes take several days to reach the laboratory and are extremely liable to undergo putrefaction during transit; the solution was welcomed as supplying a much-felt want. It was extensively used in transmitting specimens from Queenstown and neighbouring districts to Cape Town during the earlier part of the recent plague outbreak in the Cape Province. These specimens required three or four days, and sometimes longer, to reach the laboratory. The plan usually followed was to cut cubes of tissue, measuring about 1 in. each way, from the lungs, liver, spleen, &c., and to forward them in wide-mouthed bottles of the solution. The solution effectively prevented putrefaction, but it rendered smears from the specimens much more difficult to fix on the slides.

The best results were obtained by using the central parts of the cubes (least affected by the glycerine) for microscopic and inoculation purposes. It was, however, found that inoculations of such material gave negative results in several cases in which there were strong microscopic, clinical, or epidemiological reasons for suspecting plague, and it was therefore deemed desirable to provide facilities for carrying out bacteriological examinations and inoculation tests at the seat of the epidemic, reserving the Cape Town Laboratory for supplementary or confirmatory investigations.

Subsequent experience fully confirmed the suspicions originally aroused. In one recent case cubes of tissue obtained *post mortem* from a native child, despatched from Queenstown to Cape Town on June 5, 1915, in Broquet's solution, gave negative results after inoculation into two guinea-pigs on June 8, whereas a guinea-pig inoculated with the fresh material at Queenstown on June 5 gave a positive result, dying of typical plague on June 11.

It is clear from Dr. Broquet's original paper that stronger solutions of glycerine have an undoubted effect in devitalizing the plague organism. He states, however, that a solution of 20 to 25 per cent. of glycerine prevents the growth of other germs and preserves the virulence of the plague bacillus for eight or nine days, or, with the addition of calcium carbonate, for thirteen days, but that the virus is attenuated, as shown by the lengthening of the period between inoculation and death of inoculated guinea-pigs. We are unaware whether Dr. Broquet's experiments were carried out at the low temperatures of a Manchurian winter, but in any case they are certainly not borne out by our experience in the warm climate of South Africa, which has been that transmission in the 20 per cent. glycerine solution, even for three or four days, markedly reduces or even entirely destroys the virulence of the plague organism for guinea-pigs, and is thus apt to render the examination of material so transmitted useless or even misleading.

Glycerine is extensively employed in the preparation of calf lymph, use being made of its marked germicidal properties to free the pulp from non-sporulating extraneous organisms. This germicidal action is, however, greatly influenced by temperature. Dr. Blaxall, in his report annexed to that of the Medical Officer of Health to the Local Government Board, 1902-1903, remarks: "Glycerine, in fact, has no germicidal action of itself, but in conjunction with heat it is a powerful germicide, and this action varies directly with the temperature." Glycerinated lymph pulp stored at or below freezing-point shows practically no reduction in its original bacterial contents, but if kept at room or higher temperatures for a few days the reduction is most marked, the lymph frequently becoming sterile in two or three days.

We have found by direct experiment with cultures that the germicidal action of glycerine rapidly affects the virulence of the *Bacillus pestis* when kept in contact with the organism for twelve hours at 37° C., or even at much lower temperatures. Further investigations are being carried out on the point, but it seems highly probable that glycerine solutions of any strength are not suitable fluids in which to forward specimens of plague material for diagnosis by animal inoculation when the outside temperature is above freezing-point.

The method of shaving the abdomen of a guinea-pig and rubbing in the infected material, as advocated by Albrecht and Ghon, has not in our hands given satisfactory results when the virulence of the plague organism has been lowered by putrefaction or by preservation in alkaline glycerine solution. With putrefactive material the most reliable results have been obtained by preparing an emulsion in sterile beef broth or normal saline solution, and inoculating several guinea-pigs subcutaneously with varying quantities of this emulsion. Four animals are generally employed, three being given 5 c.c., 25 c.c., and 2 drops respectively, and the fourth merely a prick with the needle of the inoculating syringe. Animals receiving the larger doses frequently die early from general septicæmia and without showing definite *post-*

mortem or microscopical evidence of plague. Those receiving the smaller amounts often survive for five or six days, sometimes even for seven or eight days, and then die of plague. As a rule, the longer the period between inoculation and death the more characteristic are the naked-eye appearances in the spleen, liver, and suprarenal bodies. Guinea-pigs and other animals used for experimental purposes have a certain "resistance" to plague, and when inoculated with mild strains, or with organisms the virulence of which has been attenuated by unfavourable influences of any kind, do not always develop the disease; hence the importance, when carrying out diagnostic tests, of inoculating several animals and varying the dose. Even when this is done a negative result cannot always be safely regarded as final and conclusive.

SOME OBSERVATIONS ON THE POSSIBLE INTERMEDIARY HOSTS OF SCHISTOSOMA IN NATAL.

By F. G. Cawston, M.B., B.C.Cantab

In various parts of Natal below Pietermaritzburg a number of rivers and freshwater bathing-pools are known to be connected in some way or another with Bilharzia infection. Those which are particularly risky from this point of view are characterized by an excess of vegetation along the banks. Persons who bathe in some of these places experience an itching of the skin following the bathe, a phenomenon which I have experienced myself whilst wading in the water amongst the reeds. This is very marked in some small pools along the course of the little Umhlanga River, close to Durban, where a leading practitioner in the district informed me that three out of five boys had caught the disease as a result of one dip in the river. It was also noticeable in another freshwater pool nearer Durban, which has been almost entirely discarded as a bathing-place because of the prevalence of Bilharziosis amongst the lads who used to bathe there. A similar sensation was notice in one of the monkeys which the Bilharzia Commission to Egypt in 1915 exposed to infection by cercariæ, and it is reasonable to suppose that the itchiness of the skin may be caused by cercariæ that escape from the snails abounding on the rushes at the water's edge.

I have collected specimens of the following freshwater snails among the vegetation along the banks of these bathing-places, viz., *Limnæa natalensis*, *Physopsis africana*, *Planorbis pfeifferi*, *Planorbis leucochcilus*, and *Pyrgophysa forskali*.

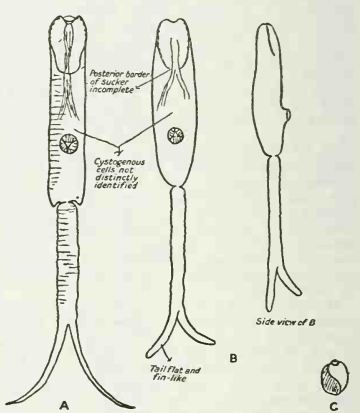
Limnæa natalensis is fairly common. The species has a dextral shell, which is semi-transparent and of a brownish colour. The spiral is somewhat pointed. Experiments to infect this species of snail with miracidia have all failed, nor have any cercariæ with forked tails been seen in them.

Physopsis africana, which is a slightly larger snail, has a sinistral shell, and is darker than the limnæidæ. The end of the shell is markedly blunt. Two different cercariæ with forked tails have been found in some of these snails, after being exposed to possible infection with miracidia obtained from the urine of a Bilharzia patient some weeks previously.

Sporocysts and daughter sporocysts containing cercariæ with undivided tails and in various stages of development are common in some of the following snails: *Planorbis pfeifferi*, *Planorbis leucocheilus*, and *Pyrgophysa forskali*.

The two different cercariæ with forked tails that occur in *Physopsis africana* are sometimes found associated in the same individual snail; more frequently, however, only one kind is present.

"A" (see text figure) is somewhat more common than "B"; it has the appearance of an avian trematode, and may be associated with the Bilharzia affection of the ducks which are frequently seen swimming in these places. "B" is conceivably a *Schistosomum* of man, and is remarkably like the



A and **B**. Cercaria occurring in **C**, *Physopsis africana*. Sometimes both forms occur in the same individual snail.
A is commoner and has the appearance of an avian trematode.
B is conceivably schistosoma.

form which has been demonstrated to give rise to typical Bilharzia infection in the mice, rats, and monkeys which were used in the Wandsworth Expedition to the Far East in 1914, and the Bilharzia Mission to Egypt in 1915. Neither "A" nor "B" appears to have any pharynx or other features characteristic of some other forms of cercariæ which are not related to Bilharzia infection.

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THE JOURNAL OF

Tropical Medicine and Hygiene

JULY 1, 1916.

FOOD AND FAMINE.

THE first impression made by the Tropics is the luxuriance of the vegetation. This is amply confirmed by considering the abundance of natural products available for foodstuffs and other purposes. The second consideration is the lack of health of the residents, their lack of wealth—often amounting to poverty and comparative misery. Scientific observers soon conclude that lack of wealth is largely due to lack of health. The causes are evident; they are the existence of preventable diseases—malaria, ankylostomiasis, plague, cholera, yellow fever, and numerous others, besides tubercle; following in their train are beriberi, pellagra, and many diseases due to defective or deficient diet, all due to deficient hygienic conditions and general amenities of advanced scientific knowledge. For these defects the natives of the Tropics are largely responsible, but they should not be held as the only nations who put a low estimate on the advantages of science; that is seen only too prominently throughout Europe, except, unfortunately, where science is employed for the worst possible purpose. It ill becomes residents in cool climates to reproach Tropic residents with sloth, when they themselves waste so much energy in useless killing, in some cases with cruelty unknown to so-called barbarous races.

To consider first the extreme cases of food and famine; various reasons are given for famines in tropical countries, but the fact is often lost sight of that in the Tropics little expenditure is required for warmth, clothing, fuel, and housing, the main cost of living being food, so that in a time of want it is impossible to save by reducing expenditure. The only possible reduction of expense is in food, the outlay on which has been at a minimum consistent with health, and the only savings are jewels and hoarded coin. Consequently reduction below what is required by health results in lowered vitality and disease. This has been well brought out in the financial causes connected with the increase of pellagra in the southern part of the United States. Following the financial stress, there was the decreased use of a sufficient diet.

Beriberi, another deficiency disease, causes a large mortality in the Tropics, being largely due to faulty diet and to insufficient knowledge of the principles of dietetics. With regard to scurvy, bleeding, and other symptoms of the disease in its virulent form, due to marked deficiency, rare, yet minor forms are present and increase in times of want. From a general survey of food supplies and finance throughout the world, there is little fear of such shortage of food in the Tropics as will lead to an increase of mortality. Indeed, the opposite seems probable, because for a considerable period Europe must draw on the Tropics for food and other necessaries, with consequent increase in prosperity there. With increased knowledge, varied culture of suitable crops, with judicious rotation and use of fodder, there will be an increase in the amount of tropical products and a decrease in the cost, not only in rubber, but more especially in the food supply for exportation, with an increased import of articles of luxury, and increased comfort in living.

With greater wealth in the Tropics there will be more money available for sanitary measures, with corresponding increase in health and reduction in cost of native products.

Annotations.

Septic Wounds affecting English and Indian Troops.—N. W. Mackworth (*Indian Medical Gazette*, May, 1916), from observing wounded soldiers in France and other parts, finds the manifestations of sepsis attending wounds present the same dissimilarity in the East as they do in the West. The great majority of severe infections in sepoys show a more decided tendency towards quiescence and recovery. It is the same with cranial injuries; there is a greater number of recoveries in head injuries amongst Indians, as also with septic bones and joints.

The cause for the greater power of resistance is undecided; but the excessive amount of meat eaten by English troops may have something to do with it.

Blastomycotic Meningitis.—(Goto, *Mitteilungen*, Tokio, xv, No. 1).—The patient, aged 61, had had headache, tinnitus, deafness, persisting "cold in the head," anosmia, and diplopia, with pains in the right leg and reduced sensibility in the right trigeminal region. For seven months there was no fever until toward the last, when symptoms of meningitis became pronounced. From the first were noticed right abducent paralysis and atrophy of the right half of the tongue. The fluid at lumbar puncture the fifth month was under high pressure, and contained blastomycetes and 3 or 5 in 1,000 albumin. No point of entry for the blastomycetes could be discovered, but innumerable blastomycotic nodules were found on the pia, containing blastomycetes and giant celis in profusion.

Gongylonema Human Parasite.—H. B. Ward (*Journal of Parasitology*, March) has recovered from man a *Gongylonema*, probably *G. pulchrum*, a species normally a parasite of the pig. Infection of the human host was brought about probably by the ingestion of larvæ in the infective stage which had developed in some insect. Very likely the croton bug, known by experiment to be able to serve as intermediate host for this species, was the source of the infection, which might readily occur by accident. The presence of the parasite was accompanied by clinical symptoms indicating marked digestive and nervous disturbances, associated with anæmia. These symptoms disappeared with the removal of the worm. The parasite displayed a tendency to wander through the submucosal connective tissue from the lips to the throat.

Silver Nitrate for Vincent's Angina.—F. Ramond (*Progrès Médical*, March 5) finds the lesions of Vincent's angina usually unilateral or much more pronounced on one side. The gland below the jaw is involved constantly and early. The ulceration soon burrows deep, while the exudation covering it grows thinner. The ulceration takes two or three weeks or a month or two to heal, and leaves a deep cavity; sometimes the tonsil is almost totally destroyed. In a third of his cases there were other lesions in the throat of another nature; in one case a syphilitic chancre on the tonsil. In a recent small epidemic of diphtheria there were five cases of associated diphtheric and Vincent's angina. Of all the methods of treatment proposed, methylene blue, iodine, salvarsan, and silver nitrate have given the best results. The part is first wiped dry with cotton, and then a pad of cotton moistened with a 2 per cent. solution of silver nitrate is pressed into the part. The application is repeated twice a day for two days, then once a day till the fifth day. By that time healing is evident.

Recurrence of Gall-stones after Removal of Gall-bladder (Kadian, *Russky Vrach*, xv, No. 7).—Six years after the removal of the gall-bladder the patient returned with new symptoms of cholelithiasis. Operative treatment was applied anew, and at the second operation a new-formed gall-bladder was found, continuous with the common bile-duct. The latter contained about ten cholesterin stones. Twenty-eight cases somewhat similar gathered from the literature are abstracted. A small stone, left in the common bile-duct, kept gradually increasing in size during the six years, because of deposits of bilirubin salts. The origin of the gall-stones is the liver itself. True relapses with new formation of stones are exceedingly rare. To prevent recurrence, the operation must include not only the removal of the gall-bladder and the stones within, but opening up of the common bile-duct and removal of all concretions. The cystic duct must be tied as low as possible to avoid formation of a diverticulum to form a new gall-bladder. No ligatures, sutures, or gauze threads should be left in the duct.

Prophylaxis of Fever in Hospital.—Lemoine and Devin (*Bull. de l'Acad. de Méd.*, April 4), relate that last January a large number of cases of scarlet fever, diphtheria, measles, and mumps were brought to the improvised hospital in their charge, and there was only one large hall where the men could be placed. Low partitions were put up to mark off the sick with the different diseases, but isolation was not possible. The Milne method of prophylaxis was used, veiling head and chest with a gauze curtain which was sprayed with tincture of eucalyptus and an antiseptic three times a day. Every three hours the throat and naso-pharynx were painted with iodized glycerine, and an antiseptic oil was instilled into the nasal passages. These measures were done by the physician himself or by a nurse tending exclusively one group of patients. When the man was allowed to get up he had to stay in part of the room given up to suspects, and three times a day the throat, naso-pharynx, and the nose were disinfected. During the month this treatment was applied to ten men with measles, eighteen with

scarlet fever, sixteen with mumps, and twelve with diphtheria, and no case of contagion and no complications developed. The period of isolation after infectious disease is materially shortened.

Acute Nephritis in Troops on Active Service.—Gaud and Mauriac (*Paris Médical*, April 15) state that of the 2,000 sick and wounded who passed through their hands in the course of three autumn months 6·5 per cent. had acute nephritis, and the proportion has grown larger since. Acute nephritis was a rarity during the early part of the War. After from three to six days of lassitude, headache and pains in the lumbar region, the œdema develops in the course of a few hours, the face generally puffing up first. This nephritis runs its course like an infectious disease, with a rapid and cyclic course. The fever at first, the extensive œdema, high blood-pressure, high albuminuria, and traces of blood in the urine are its main features.

Under the influence of repose and milk diet, recovery was the rule in two weeks on an average; no case lasted longer than four weeks. No complications were noted except in two cases; these men were in coma when brought in and had had several uræmic convulsions, and the urine contained up to 8 grm. of albumin to the litre. Venesection twice repeated brought rapid improvement and recovery in one case, but the other patient succumbed. This has been the only death from nephritis in the Service. No drugs were used except a little theohromin. The hardships of the campaign reduce the resisting power of the kidneys, so that albuminuria is frequent among the apparently well soldiers. When some infection occurs the kidneys bear the brunt of its attack. In five of these nephritis cases bacilli resembling those of typhoid and paratyphoid were isolated from the blood or urine.

Abstracts.

POST-OPERATIVE TREATMENT.[1]

By Harold G. Giddings.

Post-operative treatment really begins with the pre-operative care. This means that in order better to get the desired ultimate results, it is essential that our patients be properly prepared beforehand, both mentally and physically. On general principles it is better, when possible, to give patients a preliminary rest in bed before operating. Besides the confidence which they acquire, the surgeon has an opportunity to study carefully the case, to learn the physical conditions, a knowledge of which may prevent a subsequent calamity, to become acquainted with the peculiarities of the individual, and to determine what anæsthetic is best. The presence in the urine of acetone or diacetic acid forbids any but an emergency operation. Sugar, or granular or fatty casts, or a considerable quantity of albumin, makes us hesitate to operate. The advisability of operation on patients with hæmoglobin under 50 per cent., except for bleeding, is questionable. Constipation should be corrected as far as possible. Besides increasing the possibility of wound infection through escape of intestinal bacteria into the tissues, it adds to the patient's discomfort; also, by decreasing the patient's resistance, it increases the chance of infection from without. Violent purgatives should be avoided. They act as depressants. The rationale of emptying the bowels by a saline cathartic the night before, and by an enema on the morning of operation, is that should a shock enema become necessary during or after operation, the bowel will absorb the enema much more readily. Also, in abdominal operations the intestines are much more easily manipulated. If iodine is to be used as a disinfectant, the surface to which it is to be applied may be scrubbed with soap and water several hours before, but not immediately preceding, operation. This is because the water swells the surface epithelium and prevents the iodine from entering into the skin. Operations should preferably be done in the morning. Thus the patient is saved several hours of dread and worry, and the surgeon is at his best.

Certain post-operative complications may be guarded against by watchful observation on the part of the anæsthetist during the operation. In capital or prolonged procedures, in operations upon weak and debilitated persons, or at times when haste is essential, much valuable information may be had from frequent readings of the blood-pressure. The warning of approaching disaster given by this scientific course enables the surgeon to order proper stimulation to prevent the calamity, and oftentimes from going on with the operation to do something advisable, but not absolutely necessary. It is perfectly possible and practical for the anæsthetist to follow the blood-pressure without in any way interfering with the operator. This is done by the auscultatory method, using a Tycos instrument, the hulh and dial of which may be carried to the head of the operating table merely by lengthening the rubber tubing.

Immediately at the end of the operation, the patient is to be carefully wrapped in blankets and placed in a bed previously warmed with suitable heaters. The temperature of these should not be above 110° F. When the patient is put to bed, these heaters should be placed about him, *always* outside the blanket, never inside, for the danger of burns is ever-present, and cannot he too strongly emphasized. The patient must never be left alone. A reliable nurse or attendant should remain with him to guard against accidents from choking or vomiting, or to prevent any act of violence. A watchful attendant will frequently note the appearance of symptoms premonitory of collapse which demand immediate relief measures. Following operations in or about the month, the tongue must

[1] Abstracted from the *Boston Med. and Surg. Journ.*, June 8.

sometimes be held forward until the patient is fully out of the anæsthetic.

Unless there be special contra-indications, it is best to place the patient on his right side, propped there by pillows at his back. Hewitt advances these reasons for so doing: "In this position stertor at once ceases; the tongue gravitates to the side of the mouth, and a free airway is established; mucus and saliva are not swallowed; coughing is prevented, and should vomiting occur, any vomited matter will readily find an escape from interfering with breathing."

It is the writer's practice, almost without exception, to give hypodermically, as soon as the patient is in bed, or recovering consciousness, a proper dose of morphine. This keeps the patient quiet until the immediate effects of the ether have worn off, and prevents the restlessness so common after anæsthesia. Also, it lessens the pain incidental to the operation.

As an accompaniment to post-anæsthetic nausea and vomiting, it is usual to have a certain amount of pallor and feebleness of pulse. This should occasion no alarm, unless it continues and becomes progressively worse, when measures should be taken to combat it.

As the patient recovers consciousness there arises the question of posture. Probably because it has become a custom, patients are usually kept on the back. There are many definite objections to this position. Women who are kept long in this posture after laparotomy are very liable to develop cystitis, from inability to empty the bladder completely. The position also undoubtedly increases to some extent the nausea and vomiting, as it allows the mucus or saliva to collect in the mouth and fauces. It is also responsible for much of the backache of which patients complain. Very few people, as a matter of fact, sleep wholly on the back, and when forced to do so, are most uncomfortable. The posture straightens the lumbo-sacral curve, putting on a stretch the muscles and ligaments in this region, and thus inducing pain. If, for any particular reason, the patient *must* lie on his back, the lumbar region and knees should be supported by pillows. There is also an increase in the tendency to gaseous distension in the dorsal position.

It is our practice to allow patients to assume, as soon as they wish, whatever position is the most comfortable, nor do we remember any evil results therefrom.

The Fowler, or semi-erect position, is one of our greatest assets in treating cases of appendicular abscess, septic peritonitis, or any condition in which the patient has been exposed to abdominal infection. In this position all the fluids gravitate to the pelvis, the lymphatic supply of which is relatively poor. This means, of course, less absorption. It is in the upper part of the abdomen that the lymphatics are most abundant, hence the desirability of keeping septic material from this area. The fluids gravitating to the pelvis are very readily carried off by proper wound drainage.

Thirst.

One of the most unpleasant after-effects of anæsthesia is the intense thirst; not infrequently it is more distressful to the patient than the pain itself. Following anæsthesia the watery elements of the blood are diminished, and the intensity of the thirst is nearly always increased in proportion to the amount of blood lost during the operation. The thirst following ether is probably greater than after any other anæsthetic. One of the most satisfactory methods of allaying this condition is to give directly after operation, either before the patient leaves the table or as soon as he is put to bed, a high rectal enema of warm salt solution. The average rectum tolerates and retains from 4 to 6 oz., which may be repeated every four hours. This also acts, of course, as a stimulant. The fluid is absorbed from the rectum into the circulation, thereby replacing the lost element. Patients invariably call for cold water, but sips of hot water unquestionably give greater relief. It is our custom to allow the patient a liberal amount of hot water, if he desires it, soon after recovering from ether. This almost invariably washes out the stomach, thus overcoming, to some extent, the nausea and vomiting, and enables the stomach to retain more of the fluid which is subsequently allowed. If the water does not suffice, a little champagne on shaved ice, a little hot black coffee, cold wet cloths kept in the mouth, or frequently bathing the lips and rinsing out the mouth with cold water, usually does.

Nausea and Vomiting.

Post-operative nausea and vomiting are other exceedingly uncomfortable complications, and which may at any time assume serious proportions. The nausea coming after ether is likely to be much more severe than that following gas-oxygen, chloroform, or any of the so-called ether-chloroform-ethyl-chloride mixtures. Indeed, it is advanced as one of the strong points in favour of gas-oxygen anæsthesia that it is free from this unpleasant complication. This has been the writer's experience, too, that while there usually is a certain amount of nausea after this form of anæsthesia, it is likely to be much less than after the other forms. In general, it may be said that the amount of vomiting after anæsthesia is in direct ratio to the length of the anæsthesia and the quantity of the anæsthetic. Bearing this in mind, it should be our endeavour to reduce to a minimum the volume of anæsthetic.

The nature or extent of an operation undoubtedly has its influence upon post-operative vomiting. Operations upon the intestines, female pelvic organs, protracted laparotomies in which the bowels are exposed or freely manipulated, or in which there is much traction on them, are more likely to be followed by post-operative sickness. Vomiting is frequently due to swallowing the mucus and saliva containing some of the anæsthetic in solution. The anæsthetic thus acts as a direct irritant to the stomach, and vomiting is induced by the elimination of the drug through the glands of the gastric mucosa.

Two plans prevent this local effect: first, a local cocainization of the gastric mucosa; second, by protecting it by the use of some substance which will form a coating over it, such as mucilage of acacia or a thick decoction of Iceland moss. To combat these conditions numerous remedies have been used. Hot coffee, champagne, small doses of cerium oxalate, or bismuth subnitrate or calomel in small and frequently repeated doses, and sodium bicarbonate have all been employed with more or less effect. Lavage with sterile water or salt solution gives the most beneficial results.

Gastro-mesenteric Ileus.

Following upon post-operative vomiting we every now and then meet with a case of so-called gastro-mesenteric ileus. In this there is a persistent and seemingly uncontrollable vomiting, at first merely of mucus and bile, and later brownish, foul-smelling material. The patient is usually very much distended, and almost always it is possible to outline the stomach, which is the most distended organ of all. The condition is one not absolutely understood, but is probably due to kinking of the gut at a point near the stomach. Unless recognized and properly treated, it is very likely to end fatally. The only treatment which is of real benefit is frequent and thorough lavage. As the tube enters the stomach there is usually a tremendous rush of gas, followed by quantities of the material described. We recall the case of a young, vigorous man, who had a severe local peritonitis following an acute appendical attack. His vomiting began as soon as he recovered from ether, becoming increasingly more violent, and within a few hours the character of the vomitus became that already referred to. The stomach was tremendously hallooned, making respiration extremely difficult. Lavage with normal salt solution was instituted and repeated many times, at two-hourly intervals. It was several hours before there was noticeable improvement. It was necessary to continue the lavage for nearly three days before the stomach washings were clear. As soon as the conditions improved the patient began to get better, and made an uninterrupted convalescence. In this class of cases there is likely to be marked prostration or even collapse, calling for most vigorous stimulation.

Pseudo-ileus.

Another unpleasant complication now and then encountered is that of intestinal paresis, or pseudo-ileus. This implies a form of intestinal obstruction brought about by a certain degree of muscular paralysis of the intestinal tract. The condition may follow prolonged intestinal exposure, but is most likely to follow minor procedures. No definite pathological condition has, so far as we know, been demonstrated in these cases, but rather they seem to be neurotic in character, and to be due to lack of intestinal nerve force. It is very easily confused with peritonitis. There is marked distension of the bowels, apparent exhaustion of the patient's vital forces, with subnormal or normal temperature, feeble pulse, the symptoms usually coming in from forty-eight to seventy-two hours after the operation. One of the most distressing symptoms is inability to move the bowels. In treating the condition, the aim, of course, is to establish peristalsis as quickly as possible. The stomach should be washed out, and high rectal enemas containing vigorous peristaltic agents should be given. An enema which we have found useful consists of magnesium sulphate, glycerine, salt solution, each 2 oz., powdered aloes, 40 gr. This mixture is very often sufficient, but if it fails, to it may be added 2 dr. of turpentine, often with good results. At the same time should be given active cathartics from above, such as calomel in divided doses, followed either by Rochelle or Epsom salts. Eserine salicylate may be given in $\frac{1}{20}$-gr. doses subcutaneously.

Hiccough.

Hiccough is sometimes persistent and hard to control. It is usually indicative of inflammatory conditions of the abdominal viscera. It is seen with post-operative as well as ante-operative peritonitis. If it be due to gastric irritation, lavage is sometimes promptly curative. Morphia may control where other remedies fail. Sometimes ether sprayed over the epigastrium is sufficient to cause it to disappear.

Post-anæsthetic Complications.

There are certain conditions directly the result of the anæsthetic itself which we meet at times. Such are ether burns of the face, easily prevented by spreading vaseline over all surfaces with which the ether may come in contact, either directly or through the cone; conjunctivitis, which is the result either of the ether vapour or of the ether itself getting in the eye. This is best prevented by a towel over the eyes, but if once acquired, usually yields promptly to frequent washings of the eyes with boracic solution. Ether pneumonia, fortunately, is rare. It is usually of the broncho type, but may develop into the lobar. One of the early tragedies in our experience was a death from ether pneumonia, following so simple an operation as amputation of the thumb. The treatment of this type of pneumonia is very like that of the ordinary pneumonias with which one meets. It is apt to run a short, sharp course. Acute nephritis, with suppression of urine, is rarely met with, but is a condition which must be borne in mind. The treatment of this complication is essentially that of acute suppression under non-surgical conditions, hot packs, diuretics, and purgation.

Post-operative Temperature.

Following any operation it is usual for the patient to have a certain amount of temperature. This differs materially from surgical fever, and bears no relation to infection, when moderate in degree. This type of fever in clean cases seldom lasts more than forty-eight to sixty hours, and rarely exceeds 102° or 103° F. There is usually associated with it an increased pulse-rate. Let alone, the con-

dition usually subsides of itself, hut practically always disappears directly after catharsis has been established.

If for any reason the temperature does not fall, it should lead to a careful investigation of the patient, both local and general, for it must always be borne in mind that there may be occurring some condition due in no wise to the operation. One of the most striking examples that we recall was that of a patient operated upon for gall-stones. She developed typhoid and, on top of this, a pneumonia. Frequently tonsillitis is seen intercurrently during convalescence, also scarlet fever and other diseases directly to blame for the continued temperature, and easily overlooked. Excluding extraneous conditions, however, a continued elevation of temperature after a clean operation usually means wound infection.

Wound Infection.

Wound infection may either remain local or, hy dissemination, hecome general. When it is local the patient usually complains of tightness, soreness, or stinging pain in the wound itself. Investigation may show nothing whatever, especially in the early stages. Soon, however, it will be noticed that there is a little swelling at some point in the wound, with possibly a little redness if the infection be near the surface. Palpation reveals marked tenderness, causing the patient to pull away. Such an infection is of one of two types—phlegmonous, or there may be actual pus formation. In the former type frequently changed poultices of some hot antiseptic, preferably bichloride in a 1 to 2,000 solution, is sufficient to overcome the infection. If this fails it may be necessary lightly to scarify the area. In the very early stages an ice-bag will usually abort the infection. In those instances in which actual pus formation has taken place there is only one thing to be done—that is, to open the wound and drain out the pus. In doing this he sure that the opening is large enough. If the pus has burrowed, the incision should he carried directly over the path of the burrow and virtually to its limit. This free drainage induces healing very much more quickly than wicking the wound underneath the skin.

The other type of post-operative infection is a septicæmia or pyæmia, which, of course, means a general infection. To combat this drastic measures must he taken. In general, the various channels of elimination should be encouraged to do their best. The patient's strength should be kept up hy proper stimulants, and the source of the infection sought out and eradicated.

Post-operative Hæmorrhage.

This may be a matter of gravity or merely one of annoyance. If of the former type, there is sudden collapse, pallor, rising pulse, which becomes constantly more thready, and if the hæmorrhage be occurring in the abdomen, it is usually possible on percussion to obtain shifting dulness in the flanks. Such a condition calls for immediate interference. The patient must be anæsthetized, the abdomen opened, the bleeding point found and secured. Once this is doue stimulants must be administered. In those hæmorrhages referred to as *annoying* it usually means that there is going on a capillary or venous ooze. This type is most likely to be seen after amputations or operations upon pus cavities, bones, ribs, the tongue, or on any vascular areas. It may be due to the slipping of ligatures, or neglect on the part of the operator to ligate the smaller vessels, or failure to stop all oozing at the time of the operation. This form of hæmorrhage becomes manifest in from two to four hours after operation through the dressings and bandages becoming stained or soaked with blood. Dressings should be immediately removed, and the source of hæmorrhage, if possible, ascertained. If the bleeding is from a vein, all constriction above the wound must be removed. If the hæmorrhage is not profuse, new dressings should he firmly applied and held in place by a snugly fitting bandage. Usually this is all that is necessary. If the bleeding point is deeply seated, pressure may be applied in the form of a compress directly over the surface of the wound.

Care of the Wound.

As a general principle, it may he said that the less we interfere with clean wounds the better. It is usually well to examine a wound from forty-eight to seventy-two hours after operation. If infection is going to occur, it usually is manifest by that time, and it is early enough in the majority of cases to cut short the infection. After this first dressing, unless the patieut complains of tenderness, or unless there is a rise in temperature, the wound need not again he looked at for three or four days. If at any time on examining the wound it is found that the stitches are pulling or cutting, or if there is redness about them indicative of slight infection, they should be immediately removed. On general priuciples stitches may be taken out on the seventh or eighth day. Depending upon the length, situatiou, and character of the wound, we may or may not use adhesive strips to hold the edges together following the removal of stitches.

When to remove the wicks is a question of importance. If the wick is put into a clean wound at the time of its closure merely for the purpose of draining off whatever serum or blood may accumulate, as in hernias or in clean dissections upon the neck, the wicks or drains may be safely withdrawn within forty-eight hours. Whether or not the original should be replaced hy another at this time must be decided in each instance. If there be much dead space, and if there has been a considerable amount of fluid drained away, it is advisahle to reinsert a wick for another day or so, but only under these conditions. As to the time when to remove drains from infected wounds there can he no definite rule. Each case must be considered by itself. In abdominal wounds drained for a moderate degree of infection for a local peritonitis it is our custom to start the wicks on the fourth

or fifth day, to withdraw them 2 or 3 in. on each succeeding day, until on the seventh or ninth we completely remove them. If there has been much infection, or if the wound is draining profusely at the time the original wicks are removed, they should be replaced and carried well into the abdominal cavity along the same tract in which they were lying. In these pus cases the wick should be changed daily, after the original has been withdrawn, or at the most, every other day. If the wound is to be irrigated, irrigation should be begun under the tenth day, for before that time the walling-off adhesions have not become sufficiently established safely to warrant irrigation. Various substances may be used for washing out wounds—mild bichloride, a boric solution, or, best, normal salt solution, which tends to encourage healing. In these cases in which there has been comparatively little infection, and from which the abdominal wicks are removed from the fifth to the seventh day, there should be carried down to, but not through, the peritoneum, a small gauze drain. This may be gradually withdrawn during the next three or four days, and left out entirely by the eighth or tenth day, and the edges of the wound strapped together.

Feeding after Operation.

Patients should be given nothing to eat until the nausea and vomiting have entirely disappeared. Following their disappearance they may have, for the first twenty-four hours, liquids without milk. Such a diet includes milk broths, the whites of eggs, grape-juice, orangeade, and lemonade. Ginger ale is sometimes given, but we feel that it is productive of so much gas that it should be interdicted. Usually forty-eight hours after operation we give our patients 2 gr. of calomel in ¼-gr. doses at half-hourly intervals. In an hour after the last dose we follow the calomel by a saline cathartic, either magnesium sulphate or citrate of magnesia. One hour later this is followed by a compound enema, containing glycerine, magnesium sulphate and water, 2 oz. of each. After the patient's bowels have freely moved allow a diet of soft solids. This includes eggs, moistened toast, crackers and milk or broth, jellies, strained soups, bread without crust, custards, soft puddings, and the like. Within another twenty-four hours, if all is going well, increase the diet to include solids, starting, of course, very gradually. By the end of the fifth or sixth day the patient is usually allowed that which is called house diet.

Post-operative Shock.

Immediately after major operations, and in minor ones in which there is evidence of exhaustion, and before the patient is removed from the operating table, a high shock enema should be given at a temperature of 110° F. The ingredients should be black coffee, brandy, salt solution, each 2 oz., and 1 dr. of adrenalin chloride. Some stimulant should also be administered hypodermically. Strychnia is commonly employed, but seemingly better results are obtained from camphor in oil, 3 gr. in about ½ dr. Other measures combative to shock, whether it comes at the end of the operation or later, are the placing of heaters about the patient, bandaging of the lower extremities from toes to thigh, elevating the foot of the bed from 8 in. to 12 in., and in severe cases a pint of normal salt solution containing either 1 dr. of adrenalin, 1 oz. of brandy, or both, should be given under the greater pectoral. The adrenalin should never be given in any greater concentration than this, as it may cause a local necrosis of tissue, just as salvarsan does, which is extremely difficult to heal. By rectum, until there is response to the relief measures, there should be given every four hours, 2 oz. of brandy in 4 oz. of salt solution. Other stimulation may be given as is considered necessary. In cases in which the shock is primarily due to great loss of blood, intravenous infusion of one pint of normal salt solution or a direct blood transfusion will many times bring the patient to a favourable turning point. It is always well, too, in shock cases, to give morphia, as the more quiet the patient is, the better. The drug, too, undoubtedly has an indirect stimulant effect. As the pulse begins to improve the stimulation may be gradually reduced, but it should not be too suddenly withdrawn. It is well to leave the foot of the bed elevated for several hours after the pulse has become fairly good, for a sudden change in the patient's position may cause a recurrence of conditions.

STREPTOTHRIX IN BRONCHO-PNEUMONIA OF RATS SIMILAR TO THAT IN RAT-BITE FEVER.[1]

Sixty white rats showing acute or chronic broncho-pneumonia were examined. A long, fine, straight, or wavy filamentous organism was observed in smear preparations or by dark field illumination in fifty-six. Three lesions in which no organisms were seen were chronic. The organisms are most abundant in acute lesions. It is a Gram-negative organism, and stains fairly distinctly with carbol-gentian-violet and the Giemsa stain. It is distinguished from cilia by its greater length, more pointed ends, and its occasional wavy form. In the dark field I have observed once or twice a slow worm-like motion, and one organism showed a corkscrew motion. They are barely visible in the tissues stained with methylene blue, but are distinct in tissues impregnated with silver nitrate according to Levaditi's method. Here, they appear more wavy and more fragmented than in other preparations. These organisms were not observed in twenty-four normal rats.

A streptothrix resembling these organisms was cultivated from twenty rats, and isolated in pure culture thirteen times. Cultures from thirty-three rats remained sterile. Why successful cultures

[1] Abstracted from *Journ. Amer. Med. Assoc.*, May 20, 1916.

were obtained from some rats and not from others is undetermined. The character of the lesion does not seem to make any difference. Successful cultures were more frequent in the case of sick rats and from lesions in which other bacteria were present. The other organisms isolated from twenty-two rats were *Streptococcus viridans* and *pyogenes*, pneumococcus, staphylococcus, diphtheroid bacilli, anaerobic spirilla, and a profusely growing Gram-negative bacillus, which was probably a contamination. Seven of these were isolated from cultures in which the streptothrix did not grow. Successful cultures were grown on human blood agar or ascites-goat blood agar. The various mediums for growing spirochætes were used, but no spirochætes were cultivated. This streptothrix is a facultative anaerobe, growing best at 37° C. (98·6° F.) Slight growth appears at room temperature after several days' incubation. Growth generally appears in from forty-eight to seventy-two hours as discrete, colourless, or greyish pin-point colonies. At first they appear dull, but later become glistening, and increase slightly in size. The medium is not changed. The growth in the fluid of condensation and in ascites broth is white and flocculent, the medium remaining clear. The growth on Loeffler's blood serum is similar to the growth on blood agar, but does not always occur. There is no growth on plain and dextrose agar, ascites dextrose agar, in plain and dextrose broth, or in milk.

In cultures the organism is slender, branching, straight or wavy, filamentous, varying greatly in length, and showing bacillus and coccus-like forms. True branching is seen in young cultures, but is not especially frequent. They often show spindle or irregular-shaped swellings. Twisted and wavy forms are more frequent on solid mediums than in ascites broth, where they appear generally as long threads or chains of bacilli. They do not show a radial arrangement at the periphery of the colony. They stain with ordinary stains. They are Gram-negative, except the swellings, and are not acid-fast. The organism here is non-motile.

Young healthy rats injected intraperitoneally with cultures show acute lesions in the lungs. The organism has been isolated in pure culture from the heart's blood and lung.

This streptothrix appears to be the same as *Streptothrix muris ratti* isolated in pure culture from the blood of patients with rat-bite fever by Blake,[2] and seen in the blood during the paroxysms by Tileston.[3] Futaki[4] describes a motile spirochæte in the skin and lymph node of two cases of rat-bite fever. Some of the spiral forms in my Levaditi specimens closely resemble the spirochætes shown in their drawing. Rats causing rat-bite fever have not been examined as far as known. Of twenty-eight wild rats one was infected. The lesions in the lung were the same as those observed in the white rats, and showed the same organism. As the trachea of infected rats is full of mucus containing large numbers of the organisms, it is readily seen that a bite from such a rat might be infectious.

[2] Blake, *Journ. Exper. Med.*, 1916, xxiii, p. 39.

[3] Tileston, Wilder, "The Etiology and Treatment of Rat-bite Fever," *Journ. Amer. Med. Assoc.*, April 1, 1916, p. 995.

[4] Futaki, *Journ. Exper. Med*, 1916, xxiii, p. 249.

PELLAGRA IN NASHVILLE.[1]

An increase in the mortality from pellagra since 1911 was the cause of a survey being made of over half of the city, including 65,000 persons, by Jobling and Petersen.[2] Starting out with no preconceived theory as to the etiology of the disease, the commission gathered data, in more than 500 cases of pellagra, as regards the manifestations of the disease itself, its possible relations to sex, age, and race, the season of the year, social and economic conditions, housing, occupation, diet, milk and water supply, parasitic infestation, method of sewage disposal, and previous exposure.

The statistics indicate that women from 20 to 50 years of age are affected from three to four times more frequently than men, though from 50 years on the two sexes seem equally susceptible; that children, particularly during the second decade of life, are less subject to the disease than adults; that negroes are as susceptible as white people, and that among them the mortality is higher; and that the majority of the pellagrins had their attacks during the spring and summer months, the white people more frequently during the spring, the coloured people during the summer. Symptoms referable to the gastro-intestinal tract and nervousness frequently preceded the attacks for weeks or even months.

A study was made of the diet of the pellagrins. Accepting the conclusions of Chittenden[3] and McCay[4] that 40 grm. of protein a day are sufficient to sustain life, the investigators found that 66·8 per cent. of 421 pellagrins were consuming considerably more than this amount daily. From the standpoint of quality also the protein diet seemed to be reasonably varied; moreover, the height and development of patients compared favourably with the height and development of normal persons; and men with the same diet as women, with probably greater protein requirements than women, were yet less susceptible to the disease. Vitamine-containing substances likewise were being obtained in the form of potatoes, milk, butter, fruit, &c. That there was an excess of carbohydrates in the diet of these people was evident, but "it is gradually being supplanted to such a degree in many pellagrous families by wheat flour that it can hardly be considered an etiologic factor."

The significant localization of this disease in certain areas of the city, and the fact that the social and economic conditions in these areas were the

[1] Abstracted from *Journ. Amer. Med. Assoc.*, May 27, 1916.

[2] Jobling, James W., and Petersen, William, "The Epidemiology of Pellagra in Nashville, Tenn," *Journ. Infect. Dis.*, 1916, xviii, 501.

[3] Chittenden, "Physiological Economy in Nutrition," 1904.

[4] "McCay, "Scientific Memoirs," New Series, Medical and Sanitary Department, India, 1908, p. 34.

same as in other areas not subject to pellagra, pointed directly to the one factor of difference—the method of sewage disposal—as having an etiologic relation to the disease. Pellagra was largely confined to the unsewered areas of the city, and of those pellagrins who lived elsewhere, the majority had developed the disease while living in an unsewered neighbourhood or on the edge of an unsewered area, or had been in the habit of visiting friends and relatives in an unsewered area. The sanitary conditions in the unsewered sections of the city were of the worst. In an area of a square mile in which pellagra and typhoid were most prevalent were found 1,500 privies, rarely cleaned, and almost never enclosed so as to prevent the entrance of flies. These privies were located seldom more than 50 ft. and frequently not more than 15 or 20 ft. from the kitchens of the houses. Two per cent. of the kitchens were screened. Another significant fact brought out in the survey was that 78·8 per cent. of the patients had been in intimate contact with other pellagrins before they themselves had developed the disease. Finally, the installation of sewers in certain areas was followed by a decrease in the number of cases of pellagra originating therein, and the isolation of cases in certain institutions in which pellagra had made its appearance seemed to prevent further spread of the disease.

The results here outlined are highly interesting indeed, and will exercise much influence on investigation of the problem of pellagra, because they indicate that factors other than deficiencies in diet are concerned.

A CASE OF *BOTHRIOCEPHALUS LATUS* INFECTION.[1]

By J. J. Singer.

Cases of *Bothriocephalus latus* infection are rare in America, up to 1904 only twenty-two cases having been reported. In all probability native foci may develop in the United States through the agency of the foreign-born element. The probable reason that practically no cases develop is the method of preparing fish for food, the larvæ being destroyed in cooking. The larvæ of the *B. latus* are found in fish caught in the Great Lakes.

The patient, a native of Vilna, Russia, complained of indefinite pains in the abdomen, especially in the left side, lower quadrant. There was no fever or vomiting; she had a sensation of fulness in the stomach, only slightly relieved by active purgation. Her appetite was poor, and she had been sleeping poorly; during the last few months she felt weak and depressed. For the past few years she had noticed sections of tapeworms in her stools. Sixteen years ago she also passed sections of tapeworm, at which time she was given an anthelmintic, and passed a tapeworm 15 ft. long; she did not remember whether or not the head was recovered. She felt quite well for twelve years, when she again passed sections of the worm. At this time she suffered with fainting spells and attacks similar to the present.

She was again given anthelmintics, with no results. From that time to this she has been passing sections at irregular intervals. She never felt perfectly well. A sister and her mother both had this parasite. The patient states that it was the custom in their vicinity of Russia for everyhody to take worm medicine.

Blood smears were negative, hæmoglobin 90, urine negative, stools showed sections of *B. latus* and numerous eggs; temperature 98·4° F., pulse 76, respiration 22.

She was ordered to take castor oil on the night of January 23, and drink considerable water. On the 24th at noon she was given a 10-gr. capsule of male fern every half hour until six were taken; four hours later 2 oz. of castor oil were given.

At midnight of the 24th she was taken with severe cramps, followed hy perspiration and severe diarrhœa. All the fæces were collected. Up till 12 o'clock on the 25th ten stools in all were passed. The stools were examined and 27 ft. of the *B. latus* were recovered, including the head. The specimen was sent to the Washington University Museum.

The following day the patient felt quite well, her appetite was good, and all tenderness had disappeared. No eggs were found in the stools.

[1] Abstracted from *Journ. Amer. Med. Assoc.*, May 20, 1916.

THE CONTROL OF MOSQUITOES.

It has been stated[1] that where whirligig beetles (Dineutes) are present Anopheles larvæ fail to thrive because of the destruction of the larvæ hy the beetles. The whirligigs are the small, dark, oval, flattened heetles which we see floating lightly on the surface of woodland pools and sluggish streams, usually congregated in considerable numbers, either resting quietly or performing graceful complex curves around each other, at times darting around and around, and yet seemingly never colliding. R. C. Derivaux (*Public Health Reports*, May 19, vol. xxxi, No. 20) investigated the habits of these heetles to ascertain their probable influence in the destruction of Anopheles larvæ and the prevention of malaria. He found that when the beetles were placed in receptacles containing clear water in which there were Anopheles larvæ the hungry beetles devoured large numbers of the larvæ, but that when fragments of light *débris* were thrown on the water and allowed to float on the surface the beetles did not devour the larvæ, apparently having difficulty either in locating them or in securing them when located. The inference would be that in clear water without floating *débris* the whirligig heetles would be a factor in destroying mosquito larvæ.

[1] Theobald, "Monograph of the Culicidæ," London, 1901, vol. i, p. 75: "The larvæ of water-beetles of the families *Dytiscidæ, Gyrinidæ, Hydrophilidæ* feed on mosquito larvæ."

THE COST OF WATER PURIFICATION.[1]

The prices of certain chemicals used in water purification have risen greatly. The actual amount of chemicals used in water purification plants is insignificant from the standpoint of total consumption, and at present the difficulty of the situation consists in the fact that the waterworks officials are at the mercy of the prices set by the needs of the manufacturers of explosives and of many industrial processes. The normal price of bleaching powder, for example, on the New York market is about $1.25 to $1.35 per cwt., while the New York wholesale quotations, March 4, 1916, were from $10.50 to $12.50 per cwt. Fortunately, the advance in cost of liquid chlorine has been much less (about double the normal rate), so that chlorine disinfection may still be inexpensively carried out. The present price of aluminium sulphate and copper sulphate are from three- to four-fold the normal. The cost of iron sulphate, on the other hand, has risen but little. The increased cost of aluminium sulphate, which is so commonly used as a coagulant in the mechanical filters, is probably the most serious item of this sort in waterworks expenses. The present chemical situation suggests at most the substitution of liquid chlorine for calcium hypochlorite, and where practicable of lime and iron sulphate for aluminium sulphate.

Review.

SERUMS, VACCINES, AND TOXINS IN TREATMENT AND DIAGNOSIS. By Wm. Cecil Bosanquet and John W. H. Eyre. Third Edition. Pp. 456 + xviii. London: Cassell and Co. Price 9s. net.

This book will greatly assist to simplify a subject which has been obscured by the coining of words and the multiplication of designation. The profusion of names and confusion of ideas have long been the bane of students and stumbling-blocks in practice. The authors have explained most of the specially technical words; copious diagrams and illustrations aid the comprehension of a distinctly obscure subject, though it may be suggested that even some more difficulties must be explained before the use of serums and toxins becomes generally appreciated. The authors show intimate acquaintance with the difficulties of their subject, and explain them where explanations are possible; though in such an involved and controversial subject as chemotherapy some theories are obscure, others incorrect—to what extent time alone will show.

An enumeration of the chapters will indicate the diseases about which useful information is furnished.

Commencing with immunity and resistance to disease, next the preparation and administration of sera are described; the same for bacterial vaccines, also their use in diagnosis. After this, which occupies in importance about one-third of the book, special diseases are dealt with: diphtheria, tetanus, snake-bite, rabies, small-pox, vaccinia, anthrax and glanders, plague, cholera, typhoid and dysentery, tuberculosis and leprosy. Then the authors describe affections due to streptococci and to cocci, catarrhal affections, diseases due to protozoa, and malignant tumours. An Appendix discusses the various conditions treated with sera.

It is a distinct advantage for such a subject to be dealt with mainly from the pathological side. The work should be in the hands of students of bacteriology to aid the understanding of practical work, and also will help all teachers, however experienced, as it is only by considering the standpoint of other authors that they can attain facility in exposition of a subject distinctly difficult to teach, and of great importance in practice, with every prospect of being still more important in the future.

[1] Abstracted from *Journ. Amer. Med. Assoc.*, April 22, 1916.

Notes and News.

KAPOK, termed in Ecuador the "liena de ceiba," a vegetable wool, is the product of the genus *Eriodendron* (allied to the cotton plant). The wool is obtained from the pods, from which, when gathered, the fibre is extracted by hand. Another plant, the flor de sella, or silk flower, is met with in the same area as kapok; it is a smaller plant, but its wool is finer than that yielded by kapok. Both are used in manufacture of mattresses, but the silk flower wool commands the higher price.

Drugs and Appliances.

"TETHELIN," the growth-controlling principle of the anterior lobe of the pituitary body, is the subject of a paper by T. Brailsford Robertson and L. A. Ray, which appeared in the *Journal of Biological Chemistry*, 1916, vol. xxiv, No. 3. The investigations have been carefully conducted upon white mice, and considerable care was exercised in the housing and feeding of the animals experimented upon. The effects of feeding by tethelin (*Journal American Med. Assoc.*, April 1, 1916) differ but slightly from those produced by administering the whole of the anterior lobe of the pituitary body, but the acceleration in the recovery of weight lost during inanition and in the healing of wounds is marked, the drug when administered hypodermically appearing to have a remarkably stimulating action on tissue repair.

MESSRS. BALE, SONS AND DANIELSSON inform us that the new edition of "Animal Parasites of Man" is now ready. We hope to review the same in a future issue.

Original Communication.

PARACHOLERA CAUSED BY *VIBRIO GINDHA* PFEIFFER 1896.

By Albert J. Chalmers, M.D., F.R.C.S., D.P.H.
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AND

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Introductory.—The study of a vibrio associated with a case of paracholera is always interesting because of the difficulty of comparing one vibrio with another, and also because of the practical importance of arriving at a correct diagnosis as to the species in question, and when to this is added the rediscovery of a vibrio found some twenty-five years ago in the water-supply of a place where there had been a small epidemic of a cholera-like disease, we feel that sufficient excuse is given for bringing forward the following remarks.

Clinical History.—The history of the case from which the vibrio we are about to study was obtained is as follows:—

A Sudanese man, who had never left the Sudan, and who was employed as a coal-heaver for steamers calling at Port Sudan, which is situate on the Red Sea and in the Red Sea Province of the Anglo-Egyptian Sudan, was brought to the local hospital early in the morning of December 14, 1915.

He was in a state of collapse and was suffering from intense colic and diarrhœa, which suddenly commenced during the preceding night, and had been associated with slight cramps and vomiting; but, on admission, these last-mentioned symptoms had ceased.

The stools passed in the hospital were greenish-brown in colour, completely fluid, and apparently containing no fæcal matter, but did not contain rice flakes, and therefore were of a severe diarrhœal and not of a cholera type.

A peptone broth culture of the stools was made, and when examined next day was found to contain vibrios resembling the cholera germ.

The patient was given rectal injections of normal saline solution and surrounded by hot-water bottles, while brandy was administered by the mouth.

The collapse rapidly passed away, but diarrhœa continued for some days, and was treated by bismuth and morphia.

In four days the patient became convalescent, but for some time did not appear to be in a normal mental condition, being dull and apathetic.

On December 24 he was given a brisk purge, but as no vibrios were discovered in his motions he was discharged from hospital on December 26, 1915.

It may perhaps be of interest to note that a similar case, which, however, quickly ended fatally, was observed in Port Sudan by one of us five years ago, but at that time no bacteriological examination was made.

The Vibrio.—On examining a peptone culture derived from the fæces it was found to be teeming with actively motile vibrios which, after being plated out on gelatine plates, were obtained in pure culture, and gave the following characters and reactions:—

Morphology.—Peptone cultures showed a pellicle in twenty-four hours, and contained a comma-shaped actively motile organism, measuring on an average 1·8 microns in length by 0·3 micron in breadth. The length and breadth, however, varied, and forms of 2 microns by 0·4 micron were not uncommon. In older cultures S-shaped spirillum-like and coccoid forms could be seen, as well as all the involution varieties usually described for the cholera organism.

Vibrio gindha Pfeiffer 1896. Stained by Stephens' modification of Van Ermengem's silver nitrate method. Note the long comma-shaped form and the short form, each with one polar flagellum. × 3,200 diameters. Photomicrograph.

Division of long forms evidently took place at right angles.

When stained for flagella by Van Ermengem's silver nitrate method, as improved by Stephens (*vide* Besson's "Practical Bacteriology"), one long polar flagellum could be seen. This flagellum was approximately twice the length of the vibrio (*vide* illustration), when the latter is of usual length.

The vibrio coloured well with the ordinary stains which are in common use in the laboratory, but was discoloured by Gram's method.

Biological Characters.—It grows well aerobically at 18° C. and at 37° C., but only slowly at 12° C. and at 40° C., and not at all at 60° C., and but feebly under anaërobic conditions.

Cultural Characters.—In peptone and broth media it rapidly gave rise to a pellicle, and later to a general turbidity, but after subcultivation it formed

both a pellicle and a general turbidity together in twenty-four hours.

On *gelatine plates* at 18° C. it formed no visible growth in twenty-four hours, but in forty-eight hours round white colonies appeared which, when examined by the microscope, were seen to have sharply defined regular margins and to be granular and darker in the centre, with a lighter periphery.

After three days' growth the colonies became yellowish, and occupied a cup-shaped area of liquefaction, but later than this date the liquefaction spread rapidly, and ultimately included the whole plate.

In *gelatine stabs* at 18° C. it forms a little depression on the surface, which leads into the track of the needle which is filled with a whitish growth. In forty-eight hours the growth is more marked, and on the third day a small air-bubble appears just below the surface of the medium, and in this way the typical appearance of a true cholera gelatine stab is obtained.

Later (five to six days) the air-bubble increases in size, while the liquefaction proceeds rapidly, so that it reaches the sides of the tube at about the tenth day. The growth at the bottom of the liquefied gelatine in old cultures is of a yellowish colour, and is collected into masses.

The growths on *agar-agar* plates in twenty-four hours at 37° C. are roundish white colonies measuring about 4 mm. or less in diameter, and with a moist, glistening surface. When slightly magnified the centre is seen to be yellowish, while the periphery is opalescent, and the edge clearly defined and regular, while in forty-eight hours this appearance can be seen with the naked eye. When examined microscopically the colonies were seen to be finely granular. In stabs it forms a yellowish-white glistening surface growth, and the same coloured growth spreads outwards into the medium from the track of the needle, being specially marked in the upper parts of the stabs.

On *inspissated ox-blood serum* at 37° C. it forms a glistening film, which is associated with so rapid a liquefaction of the medium that the whole tube is liquefied in three days.

On *alkaline potato* at 37° C. it grows well, producing a maize-yellow growth corresponding in colour with Plate IV. 19 YO-Y, of Ridgeway's Colour Standards, the medium not being altered in any way.

Biochemical Reactions.—Acidity without gas formation was produced by growth in the following carbohydrate, glucoside, and alcoholic media:—

(*a*) *Qualitative Reactions.*

Monosaccharides.—*Hexoses:* Glucose, fructose, and galactose.

Disaccharides.—Maltose, lactose, and saccharose.

Alcohols.—*Pentahydric:* Adonitol. *Hexahydric:* Dulcitol (very slight), and mannitol.

No fermentation was observed in:—

Monosaccharide.—*Pentose:* Rhamnose (too slight to be seen qualitatively).

Trisaccharide.—Raffinose.

Polysaccharides.—Amylum, dextrin, and inulin.

Glucoside.—Salicin.

Alcohols.—*Trihydric:* Glycerol (not sufficient to show qualitatively); *Tetrahydric:* Erythrol.

Phenol.—Inosite.

(*b*) *Quantitative Determination.*

The quantitative determination of acidity expressed in terms of $\frac{N}{20}$ KOH is as follows:—

Name of reagent	Acidity	Name of reagent	Acidity
Glucose	1·3	Inulin	0·0
Fructose	1·0	Starch	0·0
Galactose	1·1	Salicin	0·0
Rhamnose	0·4	Glycerol	0·3
Maltose	1·5	Erythrol	0·0
Lactose	2·1	Adonitol	0·9
Saccharose	2·3	Dulcitol	0·7
Raffinose	0·0	Mannitol	1·2
Dextrin	0·0	Inosite	0·0

With regard to other biochemical reactions the following were noted:—

Hæmolysis was marked, whether tested by the plate or by North's method.

Nitrates were reduced to nitrites readily.

Indol was produced, and, as a result of this and the foregoing, the cholera red reaction was faintly obtained in five hours' growth in peptone or broth, but in sixteen hours it was well marked, though often in twenty-four hours it was faint or absent, and in later cultures was often absent, especially in peptone media, but in broth was present after four days.

Sulphuretted hydrogen, as demonstrated by cultivation in lead acetate broth, was produced.

Neutral red was completely reduced aërobically and to a less extent in anaërobic cultures, in which the reductiou was most marked superficially.

In litmus milk there was often no change, but acid and clot were obtainable at times.

The Voges-Proskauer reaction is negative.

Serological Reactions.—There is no agglutination in dilutions of 1 in 100, 1 in 1,000, or 1 in 10,000 with cholera immune serum obtained from the Swiss Institute or from Messrs. Burroughs Wellcome and Co., as tested microscopically and macroscopically, the former being repeated several times. Grown by Bandi's method it gave rise to general turbidity, and did not form flocculi.

Pfeiffer's reaction performed with guinea-pigs was negative.

The Bordet-Gengou reaction (complement fixation) with cholera immune serum was negative, *i.e.*, there was no complement fixation.

The patient's serum did not agglutinate a cholera vibrio, neither did it agglutinate his own vibrio in dilutions of 1 in 50, 1 in 100, and 1 in 1,000 with serum taken one month after the illness.

Pathogenicity.—It was non-pathogenic to guinea-pigs when injected subcutaneously and intraperitoneally, and the same for rabbits, in which animals' intravenous injections were also negative. It produced no illness in pigeons when injected into the pectoral muscle. These injections were repeated several times.

Laparotomies were performed upon two monkeys *Lasiopyga callitrichus* (I. Geoffrey, 1851), and one

was inoculated into the small bowel high up, while the other was inoculated into the colon low down. The result was negative.

It may be noted that Wherry failed to infect *Macacus cynomolgos* with strains of *V. choleræ*, and that we did not administer purgative salts to our monkeys before injection, as was done by Pottevin and Violle. In man, however, it was present in, and presumably caused, an attack of paracholera.

Classification.—As the organism which we are considering is a comma-shaped, actively motile germ possessing one polar flagellum, and capable of forming short chains of similar forms while it multiplies by division at right angles to its long axis, it belongs to the Schizomycete family *Spirillaceæ* Migula 1900.

The family contains three genera, which are distinguished as follows:—

Spirillaceæ:—Non-motile, comma-shaped or spirally curved filaments, rigid, without flagella	Genus 1 *Spirosoma* Migula 1900
Spirillaceæ:—Motile, short, slightly curved, rigid, comma-like, sometimes in chains, with one rarely more flagella at one, rarely at both ends.	Genus 2 *Vibrio* O. F. Müller 1773 emendavit Löffler
Spirillaceæ:—Motile, long, spirally curved, usually with a bunch of polar flagella composed of long and short forms	Genus 3 *Spirillum* Ehrenberg 1838 emendavit Löffler

It is difficult to say what the type species of genus *Vibrio* Müller 1773 emendavit Löffler should be, because, if *V. rugula* Müller 1773 really has a bunch of flagella at one end and not a single flagellum as Koch, according to Macé, found, then it is a spirillum and not a vibrio, and hence probably *Vibrio choleræ* Koch 1884 is the type species. As the Port Sudan organism agrees with *V. choleræ* in many points, it must belong to the genus *Vibrio* O. F. Müller 1773 emendavit Löffler.

As originally constituted, Müller's genus contained a number of forms of anguillula as well as of bacteria and vibrios which were separated off into new genera by various authors, *e.g.*, Ehrenberg's *Anguillula*, the same author's *Spirillum*, and Migula's *Spirosoma*; but much confusion existed as to what a vibrio might be, with the result that a number of synonyms appeared because Müller's definition covered too many organisms, and therefore Migula proposed to drop the term vibrio and use *Microspira* instead, and though this was supported by Chester it never came into general use, and, indeed, many authors still keep *Spirosoma* under the genus *Vibrio* as improved by Löffler.

The various groups at present included in O. F. Müller's genus *Vibrio* in its modern form can be divided into two, viz.:—

(*a*) Those which grow anaërobically.

(*b*) Those which only grow anaërobically.

At present we are only concerned with those which grow aërobically, including therein facultative anaërobes.

There is no hesitation as to the first distinguishing character of this group, which is the presence or absence of phosphorescence giving rise to the phosphorescent *Albensis Group*, nor is there any doubt as to the importance of the liquefaction or non-liquefaction of gelatine as a distinguishing feature of the non-liquefying *Terrigenus Group*.

The next point is the formation or non-formation of pigment. This is to meet the requirements of such vibrios as have been described by Drennan in 1914, and also in the same year by Jonesco-Mihaesti and Ciuca, and in the preceding year by Craster.

Drennan's organism was a large, monoflagellate, motile vibrio which slowly liquefied gelatine, while Jonesco-Mihaesti and Ciuca's was a motile, monoflagellate vibrio, measuring 10 to 12 microns, which liquefied gelatine. They both formed white colonies on agar; in the former the colony became dark-brown, while in the latter the medium turned brown. They are both aërobes and facultative anaërobes. They both show a growth on alkaline peptone water. Drennan's did not form indol and was Gram-negative, and slowly hæmolytic, and produced a geranium-like odour on alkaline blood agar, while the *résumé* of Jonesco-Mihaesti and Ciuca's paper before us does not mention these points.

It will be observed that there is a close similarity between these two organisms, which may be one and the same species and make it worthy of a name, and therefore we give it the appellation *Vibrio drennani* Chalmers and Waterfield 1916. If a difference is subsequently found between the two organisms, the name would be retained for Drennan's vibrio.

It also appears to us that *V. drennani* should be the type of a group, and in this view we are supported by Craster's observations in 1913 upon three out of 100 non-cholera strains, which more or less resembled the cholera vibrio morphologically, were all motile and monoflagellate, while they apparently grew aërobically, and were not said to be phosphorescent, while they liquefied gelatine at various rates and produced pigment, though Craster does not say on what medium, nor does he mention the colour of the pigment. They were distinctly hæmolytic, while the indol reaction was absent or slight, the odour not being constantly fæcal in type, while they fermented glucose, maltose, and saccharose; but lactose was variable, though we are not told specifically about this sugar.

With regard to the pigment-forming organisms, they were not agglutinated by cholera immune serum, and were non-pathogenic for animals, and with their own immune sera showed peculiar agglutinative reactions, suggesting to the author a relationship between the various members of the 100 strains.

This pigment-producing group of vibrios we propose to call the *Drennani Group*.

Its characters are:—

Vibrios.—Motile, aërobic, non-phosphorescent, liquefying gelatine, and producing pigment in peptone water cultures, and not being agglutinated with specific cholera serum in dilutions of 1 in 200 or more.

The next point to discuss is the possibility of the

presence of a group of motile, aërobic, non-phosphorescent, and gelatine liquefying and non-pigment-forming vibrios which can give rise to gas in certain media. Craster mentions one, but does not say in what medium it gave rise to the gas, nor does he give its specific characters, and therefore we leave the consideration of this type of vibrio to future writers.

Now comes the differentiation of the Cholera Group of vibrios from the cholera-like organisms by means of the agglutination or non-agglutination of *cholera immune serum* in dilutions of not less than 1 in 200.

With regard to this test we are met with difficulties. Thus Zlatogoroff, Wankel, and others believe that a typical cholera vibrio can change into one which either agglutinates with difficulty or fails to agglutinate at all, while the first-named observer states that out of eighteen vibrios which did not agglutinate ten could be made to acquire agglutination in a dilution of 1 in 5,000 by passage through many guinea-pigs associated with transplantation on good media.

These observations have not been confirmed by McLaughlin and Whitmore, whose results were as follows:—

> "Our vibrios isolated from the human intestine, from water or other sources which are negative to agglutination tests with cholera serum and classified by us as non-cholera do not develop agglutinability to cholera serum when treated as described by Zlatogoroff."

Similarly, Wankel's results clash with those of Horowitz, who affirms the specificity of the organism.

Flu thinks that inagglutinability arises in the human being on the strength of his own and Crendriopoulo's observations that agglutinable vibrios in the fæces may be followed in a few weeks by inagglutinable vibrios in the gall-bladder. Merelli kept a number of cholera strains alive, and found them to remain unchanged except with regard to the loss of virulence, which was easily restored by injection into guinea-pigs except one strain, which after three years cultivation became inagglutinable, and did not give Pfeiffer's test nor the Bordet-Gengou reaction when treated with cholera immune serum, and produced a serum which did not agglutinate nor give complement fixation with the cholera vibrio, though this serum agglutinated the vibrio in question. Some peculiar variation features could be induced in this vibrio in its early stages of culture life. With regard to this point, among the many papers published upon the subject, three appear to us to be deserving of particular attention.

In 1903 there appeared a most important publication by Kolle and Gotschlich, with the collaboration of Hetsch, Lentz, and Otto, dealing with the vibrios found in the cholera epidemic in Egypt during 1902, which established the high practical value of the agglutination test, and of Pfeiffer's reaction as regards the diagnosis of cholera.

They classified the vibrios which resembled the *V. choleræ*, but which did not agglutinate with the specific immune serum, as follows:—

A. Polytricha.

Long thin rods with 2–8 flagella:—
- I. With cholera red reaction, virulence strong.
- II. Without cholera red reaction, virulence weak.

B. Monotricha.

With only one polar flagellum—
- I. Pathogenic for pigeons (Metschnikoff type).
- II. Without pigeon pathogenicity.
  - (*a*) Without movement.
  - (*b*) With movement:—
    1. Long thin vibrios with cholera red reaction.
    2. Short plump vibrios without cholera red reaction.
    3. Forms intermediate between one and two.

It is obvious that the Polytricha belong to the genus *Spirillum* and the Monotricha without movement to the genus *Spirosoma*, while those pathogenic for pigeons belong to a Metschnikovi group, leaving those which are without pigeon pathogenicity, and yet resemble the cholera vibrio in growth on gelatine, and especially gelatine stabs, to form another group distinct from the quickly liquefying Finkler-Prior type, and to this group we propose to give the name of the *Gindha Group* for reasons which will presently be stated, and which would include strains XII, XXXI, XXXIV, XXXV, LII, LVI, and LXXVII of their investigations.

When we turn to Ruffer's researches, published in 1907, upon the "Bacteriological Diagnosis of Cholera," we find that he divides his "comma-shaped, monociliated, motile, non-phosphorescent vibrios," which were extremely virulent with one exception for guinea-pigs, non-virulent for pigeons, liquefied 10 per cent. gelatine, did not coagulate milk, and gave a marked indol reaction into:—

Group I.	A.	Cholera Immune Serum:—
		1. Agglutination positive.
		2. Saturation positive.
		3. Pfeiffer's reaction positive.
		4. Complement fixation positive.
	B.	*Hæmolysis negative.*
Group II.	A.	Cholera Immune Serum:—
El Tor Vibrios.		1. Agglutination positive.
		2. Saturation positive.
		3. Pfeiffer's reaction positive.
		4. *Complement fixation negative.*
	B.	Hæmolysis strongly marked.
Group III.	A.	Cholera Immune Serum:—
		1. Agglutination positive.
		2. *Saturation negative.*
		3. *Pfeiffer's reaction negative.*
		4. Complement fixation positive.
	B.	Hæmolysis feeble and late.
Group IV.	A.	Cholera Immune Serum Reactions. *All negative.*
	B.	Hæmolysis strongly marked.

In 1911 there appeared a most valuable report on the "Bacteriological Diagnosis of Cholera" by a committee composed of Ruffer, Calmette, Gaffky, Geddings, Murillo, Praum, and Pottevin, in which the whole ground of the diagnosis of this type of vibrio was discussed.

They agree with Kolle and Gotschlich that

cholera immune serum allows vibrios to be classified into two entirely distinct groups.

Group A. Vibrios which are only agglutinated by strengths of immune serum which it is necessary to employ when one works with normal serum (1 in 20, 1 in 50). Pfeiffer's reaction is negative. Some members of this group resemble Koch's Vibrio, while others are clearly distinct, and many are polyflagellate.

Group B. Vibrios which are agglutinated by much diluted immune serum (1 in 1,000; 1 in 20,000). The members resemble Koch's Vibrio, and have one flagellum.

In accordance with these results, we believe that the agglutination with cholera immune serum is a suitable test for dividing off a series of organisms which may be gathered into a Cholera Group by agglutinations in dilutions from 1 to 200 upwards from those which do not so agglutinate. The other reactions mentioned above are useful for differentiating the various sub-groups of the Cholera Group, but this does not concern us at present.

We now come to the difficult task of dividing up the vibrios which do not agglutinate with cholera immune serum, do not produce pigment in alkaline peptone water, do not produce gas, liquefy gelatine, are not phosphorescent and grow aërobically.

Gelatine plates do not offer any good distinguishing feature; but gelatine stabs, with the true cholera vibrio, produce a striking picture with the little air-bubble and the relatively slow liquefaction, as against the type of liquefaction produced by an organism of the Finkler-Prior type.

Unfortunately, our knowledge as to the factors at work during the liquefaction of gelatine by a given organism is almost *nil;* but Wherry has not merely gathered together the knowledge available when he wrote, but has tested several important points himself.

With regard to the cholera vibrios he has shown that acidity, whether acquired by the fermentation of a carbohydrate existing in the medium or present before inoculation, has a marked effect in retarding the liquefaction.

He also quotes Schroeder as demonstrating that the longer a gelatine solution is kept at 100° C. the more the viscosity diminishes, until a constant is reached, the explanation of this phenomenon being hydrolysis.

He also showed that an organism situate at the surface of a medium may, on account of its greater supply of oxygen, be expected to produce a more rapidly spreading area of liquefaction than one more deeply situate. This, however, more especially applies to gelatine plates.

Notwithstanding all these objections, we believe that the stab cultures give an easy, though perhaps not very trustworthy, method of differentiation between large groups of vibrios, and that in spite of the fact that in the Tropics 30 per cent. gelatine may have to be used instead of the 10 per cent. commonly employed in temperate climates, if only the other details as to the preparation of standard culture media are observed.

It is most difficult to diagnose vibrios described long ago unless media on which the older workers grew their organisms are used for differentiation purposes, and therefore the *gelatine stab* is introduced into our Diagnostic Table I, in order to separate the cholera-like forms from other gelatine liquefying vibrios until some better method is adopted.

There is more or less a consensus of opinion as to the value of *small injections into the pectoral muscle of a pigeon* as indicating a Metschnikoff type of vibrio if it causes septicæmia and death in twenty-four hours.

When these various reactions considered above are tabulated they form a differential table for the various groups of aërobic vibrios, and as such are set forth in Diagnostic Table I given below.

When the Port Sudan vibrio is compared with the reactions set forth in this table, it will be observed that it is excluded from *I. The Albensis Group* because it is not phosphorescent, and from *VII. The Terrigenus Group* because it liquefies gelatine.

As its growths in alkaline peptone water do not form pigment it may be excluded from *VI. The Drennani Group,* and as it does not agglutinate with cholera immune serum in dilution of 1 in 200 or more, it does not belong to *II. The Cholera Group.*

As its stab cultures in gelatine closely resemble those of the true cholera organism, and as it does not cause septicæmia and death in twenty-four hours when injected into the pectoral muscles of pigeons, it does not belong to *III. The Metschnikovi Group,* and therefore comes under *IV. The Gindha Group.*

This group may be defined as follows:—

"*Vibrios.*—Motile, aërobic, non-phosphorescent, growing in and liquefying gelatine, not producing pigment in peptone water, not agglutinated by true cholera immune serum in 1 in 200 or greater dilutions, with growths in gelatine stabs resembling those of *V. choleræ,* and not causing death in twenty-four hours in pigeons when injected into the pectoral muscles in small quantities."

In this group are temporarily included forms described many years ago, and in which the cholera immune serum agglutination and the pigeon pathogenicity are unknown.

It is now necessary to investigate this group in detail.

Gindha Group.—It is a most difficult and thankless task to attempt to classify organisms described long ago, as many reactions concerning which we desire information are missing; nevertheless, we have attempted the hopeless task. The first recorded organism which we have found in the literature available in the Sudan which is classifiable under the Gindha Group as defined above is that found by Pasquale in 1891 at Gindha, in Erythrea, and named *Vibrio gindha* by Pfeiffer in 1896 in the second edition of "Flügge's "Mikro-organismen."

The next is the germ found in water by Bonhoff in 1893, and named by Migula *Microspira liquefaciens* in 1900.

Then come *Microspira wieseckensis* and *M. striata,* both found in water by Kutscher in 1894, and both named by Migula in 1900.

In 1893 Wolf found a vibrio in the discharge from

the cervix uteri in a case of endometritis, and this Migula called *M. wolfii* in 1900. By its description we judge that it comes into the Gindha Group.

In 1894 Brix described a vibrio in sputum, which Migula named *Microspira sputigena* in 1900, and which he distinguishes from the organism found by Miller in carious teeth, and by Lewis in the mouth, and which is often called *Spirillum sputigenum*, *Spirillum milleri*, or *Vibrio milleri*, which he maintains is extremely like Finkler-Prior's vibrio. Brix's vibrio, as described by Migula, appears to us to belong to the Gindha Group.

The strains described by Kolle and Gotschlich and their collaborators as forming the Group IV mentioned above also belong to the Gindha Group, but cannot be further classified as species were not defined, and the same remarks hold good with regard to Ruffer's Group IV and to some of the forms of the Committee's Group A.

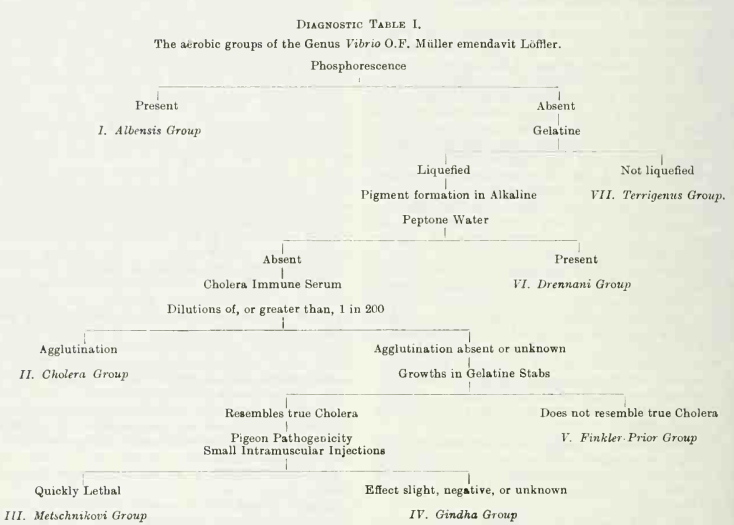
In 1911 Orticoni, while examining 1,500 specimens of fæces during the epidemic of cholera in Marseilles, met with three vibrios from cases of paracholera which, though resembling the *Vibrio choleræ*, did not agglutinate with the specific immune serum, did not give Pfeiffer's reaction, and would therefore come into either the Metschnikovi or the Gindha Group, but the *résumé* before us does not show that pigeon pathogenicity was tested. In the same year Kandiba met with several vibrios from cases of paracholera which, though morphologically and culturally resembling *V. choleræ*, did not agglutinate with the specific serum; but these we cannot classify further.

In 1912 Gloster met with some vibrios in which no pellicle formed on the surface of peptone water, and which did not agglutinate with cholera immune serum and were hæmolytic for human blood, while complement fixation was negative. These vibrios would come into either the Metschnikovi or the Gindha Group, but into which it is not possible to say.

Some of the strains of non-cholera vibrios described by Craster in 1913, which did not form either pigment or gas, seem to belong to this group, as they were aërobic and non-phosphorescent, while they all liquefied gelatine, and were not agglutinated by cholera immune serum, as well as being non-pathogenic to guinea-pigs. In gelatine stabs some gave rise to bubble formation and others to a stocking-like liquefaction, *i.e.*, were cholera-like or Finkler-Prior-like. As already stated, gelatine as a medium for differentiating strains will probably break down, but at present it is the only available test for the older forms, and we are compelled to differentiate the two types, though Craster thinks that the peculiar agglutinative reactions with their

DIAGNOSTIC TABLE I.

The aërobic groups of the Genus *Vibrio* O.F. Müller emendavit Löffler.



various antisera suggest a relationship between his various strains.

In 1914 Drennan described a non-cholera vibrio (Case 7050) which apparently was not phosphorescent, liquefied gelatine, did not agglutinate with cholera serum, did not form pigment in peptone water, morphologically resembled the cholera vibrio, and was not like the Finkler-Prior, though its liquefaction of gelatine was more rapid than the cholera vibrio.

It was distinguished from *V. metschnikovi* by this vibrio's pathogenicity for fowls and guinea-pigs. We take it that she means that her vibrio was non-pathogenic for fowls, though we cannot find it anywhere definitely stated that the experiment was performed.

As it was non-pathogenic when twice inoculated intraperitoneally into guinea-pigs, we note a very considerable resemblance between her organism and ours.

Drennan's 7,050 came from an Italian and ours came from Port Sudan, and both resemble *V. gindha*, which came from Erythrea. We suspect vibrios from patients came from Vendrell and Gerona in Spain, and agreed with each other in complement fixation and agglutination, and differed from *V. choleræ* and the river vibrio, which in its turn disagreed from *V. choleræ*. The morphology and all biological characters are stated in the *résumé* to be described in detail by Lamas, and therefore it should be quite easy to classify these organisms if the *Boletin Instituto Nacional de Higiene de Alfonso XIII* for 1913 was easy to obtain in Khartoum, which it is not at the present time.

Klimenko in 1914, while examining the fæces of a young female scarlet fever patient, found a large number of vibrios which agreed with *V. choleræ* morphologically and culturally, but did not agglutinate with cholera immune serum, and were not virulent to pigeons and guinea-pigs, and therefore came under the Gindha Group. The patient's serum failed to agglutinate these vibrios.

In this same ward several of the patients developed slight diarrhœa at that time, and non-cholera vibrios were grown from three cases, while many others showed them in fæcal smears.

Diagnostic Table II.

Name	Source	Morphology	Gram	Motility	Agar colony compared with cholera	Gelatine liquefaction	Cholera red	Flagellum	Pathogenicity to guinea pigs	Agglutination cholera immune serum	Hæmolysis	Glucose	Saccharose	Lactose
Drennan's 7,050	Human fæces	Like cholera vibrio	Negative	Very rapid	Larger, moister and slimier	More rapid than cholera	A faint red	One	Nil	Nil	Marked	Acid	Acid	Nil
Port Sudan	Human fæces	Like cholera vibrio	Negative	Very rapid	Larger, moister and slimier	Slightly more rapid than cholera	Often good, sometimes faint red	One	Nil	Nil	Marked	Acid	Acid	Sometimes acid, sometimes nil

that all three are slight variations of one and the same organism, viz., *V. gindha* Pfeiffer 1896.

Also in 1914 Defressine and Cazeneau found vibrios in mussels and other shell fish, which agreed with the *V. choleræ* in morphology, type of movement, non-Gram staining, in colony characters (and hence cannot have shown pigment), and in liquefying gelatine. They did not agglutinate with the specific serum nor give Pfeiffer's reaction. All these characters taken together place these vibrios near or in the Gindha Group.

They did not reduce nitrates to nitrites; they were markedly hæmolytic, coagulated milk, and subsequently dissolved the clot, and fermented sugars, of which a list is not given in the *résumé* before us. They killed guinea-pigs and entered the bile in these animals. They were very toxic to rabbits.

There can be no doubt that this vibrio could be placed in a diagnostic table if we had the full paper before us, but we are not able to do so with only a *résumé*.

The same remarks apply to *V. fresceris* Lamas 1911 and *V. vendrellensis* Lamas 1911, the former of which was obtained from cases of paracholera, while the latter was derived from river water. The

The four strains thus obtained produced specific sera which did not agglutinate the other vibrios, while complement fixation showed that the patients' sera did not contain specific antibodies to these strains.

He believes that enormous numbers of vibrios may be present in a sample of fæces, and yet these may be in no way related to the cholera-like infection of the case.

The last important paper which we have read is that written by Castellani in 1915, in which he describes two new vibrios, *V. kegallensis* and *V. insolitus*, discovered and named by himself in 1913. The former was obtained from cases of paracholera in Kegalle, in Ceylon, and from the water of a well in Matale, Ceylon. This well was situate near a locality in which a small epidemic of paracholera had occurred.

The latter was found in the water of a canal in Colombo, also in Ceylon.

The growths are not said to be phosphorescent, while they liquefy gelatine, and evidently are not pigment formers, while they are not agglutinated with cholera immune serum.

As the growth on gelatine is described as having

"a certain resemblance to true cholera," the two vibrios obviously belong to either the Metschnikovi or the Gindha Group, and as they do not give the indol reaction and do not reduce nitrates, we insert them provisionally into the Gindha Group.

We have gathered together now eight species which apparently belong to the Gindha Group, and have shown that probably a number of others do so as well.

The eight species are:—

(1) *V. gindha* (Pfeiffer 1896),
(2) *V. liquefaciens* (Migula 1900),
(3) *V. wieseckensis* (Migula 1900),
(4) *V. striatus* (Migula 1900),
(5) *V. wolfii* (Migula 1900),
(6) *V. sputigenus* (Migula 1900),

only the cholera red reaction was tested, and, in the case of a negative result, it is not known which of the tests or whether both are absent.

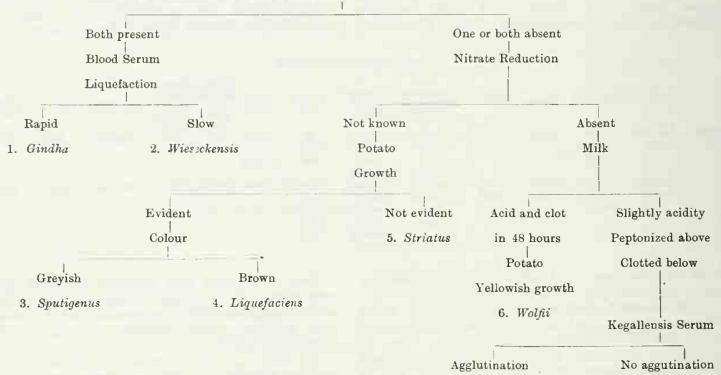
Criticism of these tests will be found in the Report of the Committee mentioned above, especially with regard to nitrate reduction, while the whole subject of indol formation was studied by Telle and Huber in 1911, and to their paper the reader is referred for further information.

The Gindha Group may therefore be divided into those forms which give both reactions, and therefore produce a cholera red, weak or strong, and into those which fail in one or both reactions, and therefore do not give a cholera red.

The rapidity of the liquefaction of blood serum serves to separate *V. gindha* from *V. wieseckensis*.

DIAGNOSTIC TABLE III.

Gindha Group.



(7) *V. kegallensis* (Castellani 1913),
(8) *V. insolitus* (Castellani 1913),

but agglutination reactions have not been performed with 2, 3, 4, and 5, and pigeon pathogenicity has not been recorded with reference to 2, 3, 5, 6, and 7, so that their position in the group is provisional, though their general characters point to a close relationship to *V. gindha*, and hence they are included.

It appears to us that the first test to be applied to the Gindha Group of organisms should be the power to reduce nitrates to nitrites and to produce indol. The combination of the two reactions would, of course, give the cholera red, but it is much better to consider the two tests separately.

Unfortunately, with regard to the older organisms

The organisms which do not give the cholera red may be further divided into those which are known not to reduce nitrates to nitrites, and those in which this knowledge is lacking.

Milk, alkaline, potato, and serological tests help to complete the differentiation of the species.

The list constructed from these tests is given as Diagnostic Table III, and though obviously imperfect, is the best method of differentiation we have been able to make, because the older organisms have naturally not been studied by modern methods.

The table sufficiently indicates the way in which *V. gindha* can be differentiated, and it now behoves us to study this organism in greater detail.

Vibrio gindha.—In 1891 Pasquale, while investigating an outbreak of cholera which was occurring

in Massawa (Italian Massua) in Erythrea, isolated, from the dejecta of one of the patients, the *V. massuah* Pfeiffer 1896, which differs from the true cholera vibrio which it closely resembles, in possessing four long, thin, curved flagella, and in having round, sharply defined yellowish colonies on gelatine plates, and by its animal pathogenicity being greater in that it kills not merely guinea-pigs, but pigeons also, by subcutaneous and intramuscular injections. It may be mentioned that it gives a good nitroso-indol reaction in twenty-four hours' culture in a peptone medium.

We have been unable to refer to Pasquale's original paper, but he appears to have proceeded in the same year to a town called Gindha, situate inland from Massawa, and to have investigated the well water there, because there had been a choleric epidemic in that place some months previously, although no cases were in existence at the time of his visit. From this well he obtained a vibrio which he not merely described, but gave to Pfeiffer, who called it *Vibrio gindha* in 1896 in the second edition of Flügge's "Die Mikro-organismen," p. 590.

Pfeiffer's description is as follows:—

"Es sind ziemlich lange, deutlich gekrümmte Stähchen, im ganzen entschieden schmäler erscheinend als die Cholerabacillen. Sie besitzen nur eine endständige Geissel. Ihre kulturellen Eigenschaften, besonders auch die Form der Kolonien auf Gelatinplatten zeigen, eine sehr ausgesprochene Aehnlichkeit mit denen der echten Cholera, doch fehlt in Peptonlösungen nach 24 stündigem Aufenthalt im Brutschrank die Nitroso-Indolreaktion entweder ganz oder ist nur schwach angedeutet.

"Die Tierpathogenität des Vibrio Gindha ist gering, einfache Impfungen haften weder bei Tauben noch bei Meerschweinchen; dagegen ist diece Vibrionenart sehr giftig und relativ kleine Mengen lebender oder abgetöteter Agarkulturen töten durch Intoxikation Meerschweinchen bei intraperitonealer Einspritzung.

"Von den echten Choleravibrionen sind sie durch den negativen Ausfall der spezifischen Immunitätsreaktion leicht zu trennen."

A comparison between Pfeiffer's description and the vibrio from Port Sudan is as follows:—

No.	Character of reaction.	*Vibrio gindha* Pfeiffer, 1896	Vibrio from Port Sudan.
1.	Habitat ...	Water	Human intestine
2.	Length	Slightly shorter than the Cholera vibrio	Slightly shorter than the Cholera vibrio
3.	Polar flagellum	Single	Single
4.	Nitroso-Indol reaction	Present at times	Present at times
5.	Pathogenicity Guinea-pigs subcutaneous injections ...	Nil	Nil
6.	Intraperitoneal injections into guinea-pigs ...	Toxic	Not toxic
7.	Intramuscular injections into pigeons ...	Nil	Nil
8.	Cholera specific immunity reaction	Negative... ...	Negative

The Port Sudan vibrio, therefore, only differs from the Gindha vibrio in the toxicity to guinea-pigs when inoculated intraperitoneally, and it appears to us that this may possibly be due to the fact that the former is a less pathogenic form of the latter, and in this we are supported by the fact that the Port Sudan case was relatively mild and quickly recovered; while, according to Macé, a severe attack of cholera in man resulted from a human experiment with the vibrio from Gindha. Moreover, according to the same authority, Metschnikoff produced typical intestinal cholera in animals with the Gindha vibrio, while we have failed to do so in two monkeys.

We therefore consider that there is no essential difference between the Port Sudan and the Gindha vibrios, and therefore consider the Port Sudan germ to be:—

Vibrio gindha Pfeiffer 1896.

Comparisons.—It is, however, useful to indicate more fully the differentiation of *V. gindha* from other members of the Gindha Group by means of tables, and as by far the most thoroughly investigated are *V. kegallensis* and *V. insolitus*, as described by Castellani, who also investigated a number of strains of true cholera from Saigon and from Ceylon, we therefore give Diagnostic Table IV, which institutes a comparison between the Port Sudan strain and these four organisms, but for purposes of simplicity we have dealt with Castellani's three strains of *V. kegallensis* in one line, and his six Ceylon strains of true cholera also in one line.

We have been unable to keep the laboratory in stock with "arabinose," and therefore could not test *V. gindha* from Port Sudan with this sugar, and have therefore omitted it from the table.

DIAGNOSTIC TABLE IV.

Classification	Reaction	Port Sudan	*Vibrio kegallensis*	*Vibrio insolitus*	*Vibrio cholerae* (Saigon)	*Vibrio cholerae* (Ceylon)
Monosaccharides	Glucose	A	A	A	A	A
	Fructose	A	A	A	A	A
	Galactose	A	A	A	A	A
	Rhamnose	O	O	O	O	O
Disaccharides	Maltose	A	A	A	A	A
	Lactose	A	A	As	As	A
	Saccharose	A	A	A	A	A
Trisaccharide	Raffinose	O	O	O	O	O
Polysaccharides	Dextrin	O	A	A	A	A
	Inulin	O	O	O	O	O
Glucoside	Salicin	O	O	O	O	O
Alcohols	Glycerol	O	O	As	O	O
	Erythrol	O	O	O	O	O
	Adonitol	As	O	O	O	O
	Dulcitol	As	O	O	O	O
	Mannitol	A	A	A	A	A
Phenol	Inosite	O	O	O	O	O
Other Reactions	Indol	+	O	O	+	+
	Nitrates	+	O	O	+	+
	Voges-Proskauer	O	O	O	O	O
	Neutral Red	+	O	O	O	O
	Milk	Ac	As Pc	As Pc	As	O A or Ac
	Gelatine	+	+	+	+	+
	Serum	+	+	+	+	+
	Gram	O	O	O	O	O

In these reactions the Port Sudan organism differs from the other vibrios in its action upon adonitol and dulcitol, but it only produces slight acid, and also in its power to reduce neutral red.

It disagrees with *V. kegallensis* and *V. insolitus* in that it, like the cholera vibrio, reduces nitrates and produces indol, and therefore gives the cholera red reaction.

While on this part of the subject, it may be as well to indicate that *V. gindha* from Port Sudan differs from true cholera in giving:—

(1) Negative agglutination tests with cholera immune serum.
(2) Negative Pfeiffer's reaction.
(3) Negative complement fixation.
(4) Negative animal pathogenicity.
(5) Reduction of neutral red.
(6) Non-fermentation in dextrin.
(7) Slight fermentation in adonitol and dulcitol.

With regard to starch, it may be noted that Gordon found that the strain of cholera with which he was working fermented starch which the Port Sudan strain certainly does not.

Adverting to the less important organisms of the Gindha Group, there is first of all *V. wieseckensis*, which was one of several water vibrios found by Kutscher in 1895, and which is said to be morphologically and culturally very like *V. choleræ*. The differences between the two organisms are as follows:—

Reaction	Port Sudan	Wieseckensis
Blood serum liquefaction	Quick	Slow
Potato...	Maize yellow growth	Hardly visible growth
Cholera red	Generally but not always present in young and old cultures	Present
Pathogenicity to guinea-pigs ...	Negative	Like cholera

There may be many more differences, but the description of Wieseckensis available to us only deals with gelatine, blood serum, potato, broth, peptone, cholera red, and pathogenicity to pigeons and guinea-pigs.

The differences between the Port Sudan organism and *V. sputigenus* may be tabulated as follows:—

Reaction	Port Sudan	*V. sputigenus*
Growth along agar stab...	White	Brown
Potato growth ...	Maize yellow ...	Grey
Cholera red	Present	Absent
Smell	Offensive	Aromatic

The variations from *V. wolfii* are:—

Reaction	Port Sudan	*V. wolfii*
Reduction of nitrates	Present	Absent
Potato growth ...	Maize yellow ...	Yellow white
Smell	Offensive	Not offensive

The distinguishing characters from *V. liquefaciens* are:—

Reaction	Port Sudan	*V. liquefaciens*
Milk	Fermented	No change
Potato growth ...	Maize yellow ...	Brown
Cholera red	Present	Absent
Guinea-pig pathogenicity	Nil	Like cholera

The differential diagnosis from *V. striatus* can be made as follows:—

Reaction.	Port Sudan.	*V. striatus*
Width	About the same as cholera	Twice as thick as cholera
Indol	Present	Absent
Potato growth ...	Easily seen ...	Difficult to see
Guinea-pig patbogenicity	Nil	Marked

Conclusions.—We believe that the case of paracholera occurring in Port Sudan last December was associated with the presence of a but slightly pathogenic strain of *Vibrio gindha* Pfeiffer 1896, and that this was the causal agent because:—

(1) It was present in the fæces in enormous numbers when the man was ill.

(2) It was absent from the fæces, tested culturally, when the man was convalescent.

V. gindha was originally found in Erythrea, and we now report it from the closely situate Red Sea Province of the Anglo-Egyptian Sudan, and we believe that Drennan found it, or a very closely allied organism, in an Italian immigrant in New York.

It may therefore be more widely distributed and more common than is at present realized.

We have been much impressed with the extreme confusion existing with regard to the paracholera vibrios, and we are of the opinion that the recognition of these vibrios would be rendered much easier if some systematic method of working, such as the following, was adopted:—

A. *General Diagnostic Characters.*

1. Does the vibrio grow aërobically, or is it an obligatory anaërobe?
2. Is it phosphorescent?
3. Does it liquefy gelatine?
4. Does it produce pigment or gas?
5. Does it agglutinate with specific cbolera serum?
6. How does it grow in gelatine stabs?
7. What is the pigeon pathogenicity?

B. *Special Diagnostic Characters.*

1. Morphology.
2. Biological characters.
3. Cultural characters on ordinary and special media, but especially including alkaline potato and inspissated blood serum.

4. *Biochemical and Chemical Reactions.*

1. Sugars.
2. Glucosides.
3. Polysaccharides.
4. Alcobols.
5. Phenols.
6. Milk.
7. Voges-Proskauer.
8. Nitrate reduction.
9. Indol formation.
10. Cholera red.
11. Sulphuretted hydrogen formation.
12. Hæmolysis.
13. Neutral Red.

5. *Serological Reactions.*

1. Agglutination.
   (*a*) Specific cholera serum.
   (*b*) As many paracbolera sera as possible.
   (*c*) Its own specific serum.
2. Absorption test.

5. *Serological Reactions (continued).*
   3. Pfeiffer's reaction.
   4. Complement fixation.
   5. Action of normal human blood serum or normal rabbit blood serum.
6. *Pathogenicity.*
   1. Pigeons.
   2. Guinea-pigs.
   3. Rabbits.
   4. Attempts to infect animals by the alimentary canal in some way.

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ILLUSTRATION.

Text figure.

Vibrio gindha Pfeiffer 1896. Stained by Stephens's modification of Van Ermengem's silver nitrate method. Note the long comma-shaped form and the short form, each with one polar flagellum. × 3,200 diameters. Photomicrograph.

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THE MOBILIZATION OF THE MEDICAL PROFESSION.

FOR the first time in history the members of the medical profession are being practically mobilized, and all men possessing qualifications of all ages are requested to send in returns setting forth their status and their work in a schedule which has been circulated. It is no doubt a step in the right direction,

aud if wisely utilized will be of great service for the present urgent need and serviceable for future organization.

There has been much discontent in many quarters over the manner and methods adopted to secure a sufficiency of medical men in order to cope with the national wants. All medical men are willing to help, and most have offered their services since the outbreak of War in 1914, and ofttimes free of all idea of being paid for their work. Consultants retired from hospital work have given in their names as willing to take over hospital duties of the younger men on the staff, so that they may he set free to work at the Front or elsewhere; but up to date these offers have not been entertained by the military authorities. The usual answer has been "Whole time or nothing," a form of wastage of the resources of the profession which is unfortunate and resented by the men who have come forward and offered their services.

Amongst the general practitioners many cases of services offered being refused are on record. Many doctors practising in the neighbourhood of a camp or of a military hospital have offered their services free of charge to the authorities, hut the reply of "Whole time or nothing," has stultified the intended help.

Many men have also retired from active service abroad because they saw their time was being wasted, as week after week and month after month they were doing practically nothing. They had given up practices many of them, and had been tied up for twelve months and more as surgeons to a unit in Yorkshire, in the Midlands, or in Scotland, doing perhaps half an hour's work a day; work which they say would have been gladly done by the local practitioners free of charge if so required. So many instances of the kind abroad and at home occurred that the civil medical profession were either vituperous in their remarks upon the situation or well-nigh broken-hearted or actually financially ruined through what they regard as official nonsense.

Yet we must look at the side of the authorities. Their primary object was an adequate supply of medical men against the day of the big advance. In war the great objective is to clear the front of wounded; a few days of intense stress is laid upon the medical officers, and afterwards, when the battle is over, a period—it may be days, weeks or months —of practically nothing to do. This is an inevitable consequence which it is well-nigh impossible to avoid; and the Army medical authorities are placed in a difficult position to placate men whose work in civil practice is that of many daily visits and day and night calls. The men on the regular staff of the Army do not feel this in the same way; their life is to be spent in the Army, their promotion comes in due course whatever they are doing, and their time is not wasted, for they are living towards their pension. With civil practitioners it is different; Army rank is of no future benefit to them, military distinction does not help them towards earning their daily bread, and but for the fact that they are performing their duty to their country—a great reward, no doubt—these are of no material benefit.

Were the profession mobilized and called up when necessary all would be well. The trenches and battle-fronts in France are hut twelve hours from our shores, and one or two days' warning is all that is required to bring them to the place where they are wanted. It may be said that it is impossible to get men to do the work required of them at a moment's notice; they must know Army methods, military discipline, &c., before they are efficient helpers. This is only in part true; they are called to an organization already in heing, and they become but a unit in the machine in which they are to play a part, and it heing medical and surgical work which is their daily duty they can render the help that is needed efficiently.

That the work at the Front is being done efficiently is without doubt. We are receiving men at our railway stations in London in twelve hours after they have been wounded at the Front; the medical machine at the Front and along the lines of communication is perfect; and the Special Order of the Commander-in-Chief conveying to the directors of the medical services, and through them to all medical units, with instructions that it shall he read on parade, is evidence of the fact:—

"The Commander-in-Chief directs me to convey to you, and through you to the directors and all concerned under them, his high appreciation of their hard work and the efficiency of arrangements for dealing with the medical aspect of the present situation."

The criticism, owing to what cause it may be, that, when one divisional command happened to be in action and an overwhelming strain was thrown on the medical department of that division, help from a neighbouring division or hrigade was refused, is no longer true; for it is now published that such help has been afforded, and the cause of humanity freed of a slur which has heen more than once stated with hitter comments. The Directors of the Medical Department and of the Medical Services in France have earned an undying reputation of which it is impossible to speak too highly, and the whole medical service has attained a state of efficiency which has never been surpassed hy that of any country, and it is perhaps correct to say has never been equalled.

Typhoid Orchitis (Ohner and Voisin, *Progrès Médical*, April 5).—The orchitis and epididymitis developed during convalescence from typhoid and left limited induration. The course was about six days. Others have reported three cases in the recent epidemic of typhoid. The affection was unilateral in all; hut the cord was involved in three of the cases and the tunica vaginalis in two. There was suppuration in two cases and a relapse in another case. None of the patients had gonorrhœa. Typhoid hacilli were cultivated from the process in two cases; the colon bacillus in one, and the paratyphoid B in one. This typhoid complication resembles the orchitis of mumps by its rapid course, and the orchitis of gonorrhœa by the involvement of the cord and epididymis, while the tendency to suppuration is peculiar to it.

Original Communication.

THE BERIBERI PUZZLE: A SUGGESTED SOLUTION.

By W. M. McDonald, M.R.C.S., L.R.C.P.

Medical Superintendent, Hospital, Antigua, B.W.I.

Of recent years it has been generally considered that what I have termed "The Beriberi Puzzle" has been effectually solved by the fact that Fraser and Stanton and some others have produced beriberi experimentally in man by special diet consisting largely of a special kind of rice.

Students of the disease appear to have so welcomed this discovery as bringing order out of the previous chaos of existing theories that they have been glad to accept it without undue questioning. As an observer, not of the disease itself but of the circumstances of its occurrence in different parts of the world, this discovery of Fraser and Stanton's appears to me to render the problem more complicated than ever.

As a general principle, it may be stated that no theory of the etiology of any disease should be accepted unless it is applicable to all cases and outbreaks of the disease in all parts of the world.

How, then, are we to reconcile the rice theory with the following facts?—

(1) There was no beriberi in Singapore Prison for twelve years from 1885 to 1897. An outbreak began in 1899, which in six years accounted for 1,319 cases. There was no change in diet during that time.

(2) 81st Pioneers left Secunderabad August, 1908, leaving behind them one of their men suffering from beriberi. In October 580 men encamped at Dthala, the remainder of the regiment being camped along the line of communications to Aden. Thirty-two cases occurred among the men in camp, and no cases occurred among the men along the line of communications, although the rations supplied to both were the same. The same amount and kind of rice to all.

(3) In 1906 an outbreak of beriberi occurred among the men of the second battalion King's Own Scottish Borderers at Aden. These men had the usual Army rations. They brought with them several men suffering from beriberi.

(4) Ninety-one cases of beriberi occurred among Boer prisoners in St. Helena. No rice in diet. No cases among the troops guarding them.

(5) Two hundred cases of beriberi occurred among Kaffirs in camp at North End, Port Elizabeth. No cases in Indian or European camps near by. Indians ate rice. Kaffirs ate none. It is hard to see how even the most biased can reconcile these facts to the rice theory, or even to the deficiency theory. Further, the universally acknowledged broad facts of sex incidence, age incidence, and the epidemic occurrence of the disease do not fit in with the dietetic theory.

Beriberi is recognized as being much more common among men than women. The ratio of incidence, based on the admissions to Tung Wali Hospital for a period of ten years, is given at fourteen males to one female.

In regard to this it is reasonable to assume that females of all races, classes, and places partake of the same diet as males of the same race, class, or place.

The age incidence of the disease is generally conceded to conform to the wage-earning years 18 to 40, and it is acknowledged to be extremely rare in the extremities of life. My own conclusion, based on study of the circumstances under which this disease occur, is that beriberi is a specific infectious disease, that its transmission is dependent in some way on overcrowded sleeping accommodation, and that the disease, which has been experimentally produced in men and animals by subjecting them to special diet, is not the specific entity which is true beriberi, but is a multiple peripheral neuritis due to some deficiency in diet and simulating beriberi.

If this conclusion is correct, I should expect to find that the principal points of difference between the two diseases would be:—

(1) That the experimentally produced disease is rarely or never fatal, can be cured entirely by change of diet alone, and produces only superficial heart symptoms, and cannot be transmitted.

(2) That true beriberi is often fatal, cannot be cured by change of diet (though it may be accentuated by unsuitable diet), and is characterized by gradually increasing heart weakness, which may be precipitated by any sudden exertion, and which is due to some toxin which specially affects the heart in somewhat the same manner as in diphtheria. This disease can be transmitted in some way by crowded sleeping accommodation.

In support of my theory that the transmission of beriberi is entirely dependent on overcrowded and unhygienic sleeping accommodation, I beg to submit the following facts:—

(1) That crowded sleeping accommodation is the only factor which is common to all recorded outbreaks of beriberi.

(2) In the Malay States, Hamilton Wright has told us that there is not a tin mine in the length and breadth of the Colony that has not at some time been scourged by beriberi, and at the same time we are told that the disease is extremely rare among agricultural labourers. The miners, it is stated, sleep huddled together in long low kongis.

(3) In the annual report of Pekan Hospital, Pahany, 1905, it is stated 401 cases of beriberi were admitted. Most of the cases came from the mining kongis in and round Blat.

(4) In the outbreak in the Kaffir Camp, Port Elizabeth, mentioned above, it is stated that the Kaffirs associated in their work during the day with the Indians from the camp near by, but they slept in separate tents.

(5) In an outbreak reported among imported Japanese labourers in Fiji in 1894, where 219 out of 250 contracted beriberi, it is stated that the

Japanese associated in the fields during the day with Indians, but that no Indians contracted the disease. The Japanese are described as being accustomed to sleep huddled together under one mosquito screen, and as wearing the same garments night and day.

(6) Although beriberi is, generally speaking, so much less common among women, epidemics have been recorded among institutions for women; for example, in the Po-Seund Institution for the reception of Chinese women and girls suspected of having been kidnapped, eighteen cases occurred in seventy-two days. It is reasonable to suppose that in an institution of this kind several women or girls slept together in a limited accommodation.

(7) Beriberi is very common among sailors, who sleep crowded together in cramped quarters.

(8) Beriberi is very common among coolies and workers inhabiting common lodging-houses.

(9) The decrease in beriberi in the Japanese Army and Navy, which has been attributed to alteration in diet, coincides with improvements which have been made in hygiene, and particularly in sleeping accommodation.

(10) The relatively small incidence of beriberi among women is best explained by the fact that women's work does not require them to live crowded together as workmen do.

(11) The age incidence of beriberi is best explainable by the fact that children and old people do not work under crowded conditions as do miners, coolies, labourers, sailors, and other workmen. In this connection the outbreak recorded by Ingram among the 81st Pioneers in Dthala is of particular interest.

Outbreak of Beriberi among 580 men of the 81st Pioneers encamped at Dthala.

	Sleeping accommodation	Rice in diet	Cases of beriberi
1905			
August	Left Secunderabad, leaving behind one of their men suffering from beriberi.		
October	580 camped at Dthala, remainder of men being camped along line of communications to Aden. Rations identical.		
,,	Tents. 118 men to 686 cubic feet	1½ lb.	—
November	,,	,,	1, November 17.
December	,,	,,	None.
1906			
January	,,	,,	1, January 25.
February	,,	,,	1, February 10.
March	,,	,,	None.
April	,,	1¾ lb.	7, April 10 to April 20.
,, 26	Isolation camp for beriberi cases	,,	—
May	,,	,,	None.
June	,,	,,	21, June 10 to July 17.
July	New camp tents spread out over large area	1¾ lb.	—
,, 17	,,	⅞ ,,	—
August	Nine new English pattern tents, capacity 2,773 cubic feet, issued to men to prevent overcrowding	,,	None.
September	,,	1¾ lb.	None.
October	,,	,,	1, October 5.
	No further cases reported.		

As has already been mentioned, the 580 men in camp were supplied with exactly the same food as the rest of the regiment, which was encamped along the line of communication from Dthala to Aden.

Their diet was composed of the usual Army rations, and could not therefore be regarded as deficient.

The peculiar facts of the outbreak may be seen in the above table.

The interesting points in this report are:—

(1) The increase in number of cases at intervals of about two months, pointing to an infectious disease with an incubation period of about two months.

(2) The spread of the disease under conditions of greatly overcrowded sleeping accommodation.

(3) The cessation of the outbreak after the institution of an isolation camp, and the provision of larger tents on a larger area so as to prevent overcrowding.

(4) The fact that though the rice ration was reduced by one half for a period of two months—July 17 to September 17—yet on return to what might be considered an excessive rice ration of 1¾ lb. no further cases of beriberi occurred.

This outbreak has been particularly fully recorded by Dr. Ingram. If equally careful and full reports could be obtained of all outbreaks of beriberi, much valuable data might be obtained.

The evidence of all outbreaks appears to point to the probability of beriberi being of protozoal origin, and to the bed-bug or body louse as being the agent of transmission. An explanation of the fact that hitherto attempts which have been made to transmit the disease by these insects have failed may be found in the possibility that it is necessary for the parasite to undergo a developmental phase of unknown duration in the body of the insect host analogous to that which takes place in the mosquito in the transmission of malaria.

It is well to consider also in this connection the facts of the mode of transmission of yellow fever. Though no specific organism has been found in the blood of yellow fever patients, yet it has been proved that the blood of such patients contains an infective organism, and further, that this organism is only present in the blood during the first three days of the illness. In like measure we may assume the possibility of the blood of beriberi patients containing an infective organism which is present in the blood only during a certain stage of the disease.

Extensive and repeated experiments on these lines are indicated either to prove or to refute conclusively this theory.

While no proof is available as to the correctness of these surmises, yet I am of opinion that the volume of evidence is sufficient to warrant the assumption that improvement in housing and sleeping accommodation where large numbers of men live together, as in barracks, prisons, common lodging-houses, mining kongis, ships, &c., should be considered as a particularly important prophylactic measure in countries where beriberi is endemic or epidemic.

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THE JOURNAL OF

Tropical Medicine and Hygiene

AUGUST 1, 1916.

THE PRODUCTION OF DRUGS WITHIN THE BRITISH EMPIRE.

IN common with many other commodities the production of drugs has been allowed to pass into other hands and other lands than our own. This is to be explained in several ways no doubt, but when it comes to the bed-rock of things it can be traced to want of protection from competitors, who, endowed by their Government, have combined to deprive the British producers of their pre-eminence. We have seen so many branches of industry brought to ruin by German organization systematically set on foot to do so, that we cannot be astonished at the drug industry being one of the first to fall. To capitalists this may seem a small industry and it is difficult to induce men concerned with gigantic enterprises to condescend to so small an affair; but we might look, and to our thinking we have a right to look, to our pharmacists and chemists to combine and to check the tendency to the extinction of the production of material which is to them of primary importance. The great pharmaceutical community most assuredly have the ability and the capital to see to this, and they will have the support and sympathy of all their professional brethren and of the medical profession. Support and sympathy are not definite terms in commercial circles however, and unless put in an active and substantial form are not likely to bear fruit. That both can be obtained we have not the slightest doubt and it only wants competent men to take up the matter seriously. There are no drugs used in medicine which cannot be produced within this Empire and many of them can be successfully and profitably raised in the British isles themselves.

The Imperial Institute has done a great deal of good work lately in the investigation of medicinal plants and their qualities, and it only wants capitalists to take the matter up to see that Britain obtains the foremost position in production and becomes the drug centre of the world.

To mention but a few items in the multitude of drugs affected by the circumstance of the War and other causes: *Opium* has been subjected to close analysis during recent years; Indian opium has been analytically compared with Turkey and Persian opium. With these great competitors some varieties of Indian opium have been shown to be in no wise inferior. Samples from India are found to be rich, and some even richer in morphia than any from rival countries, whilst several of the Indian samples contain more of the valuable alkaloid codeine than is usually contained in other opiums. The effects have been carefully tested in St. Thomas's Hospital, London, and the results have proved wholly satisfactory. These facts, although they were made known to the Government of India, were not acted upon owing, it is said, to "considerable difficulties in the way of permitting an export trade." No doubt this attitude is due to the hue and cry raised about the export of opium to China and the evils of opium smoking in that country. This question was outwardly one raised by missionary societies, and with them the matter was genuinely and whole-heartedly dealt with for the benefit of the Chinese; but we now know that they were only made the mouthpiece of Germany and of Chinese financiers who had axes to grind, the former for political purposes mainly, the latter for financial reasons. The attempt succeeded, and to such an extent that the Government of India are now so timid over the matter that they dread exporting opium to this or any country even for purely medicinal purposes. This "gift of God to man" is being denied us by politicians it would

seem, who, for purposes of so-called political necessity, think it better to withhold it.

Since the war, however, Turkey opium has become scarce and there is an increased demand for the drug; under these circumstances the export of a certain amount of provision and excise opium has been allowed to be sent to this country. But provision and excise opium are comparatively of poor quality and we may expect an inferior form of drug in the market. One is glad to know that better conditions are imminent, and that reason is likely to gain sway over the extremists in regard to the supply of opium from India. Experiments are afoot in India, on a scientific basis, and there can be no doubt that India is able to supply all the opium required for medicinal purposes, not only for the British Empire but for the whole world.

Podophyllum. — This widely used purgative is obtained from the root of the American plant *Podophyllum peltatum*, the American May apple. Now it is found that the Indian variety *P. emodi* also yields a satisfactory product and is included in the British Pharmacopœia.

Aconite.—The properties of the Indian variety have been recently carefully investigated at the Imperial Institute, and besides aconitina other useful alkaloids have been obtained.

Hyoscyamus. — The present high prices of the alkaloids atropine, hyoscyamine and hyoscine are largely due to the fact that their manufacture has been carried on in Germany. It is now discovered that an Egyptian solanaceous plant (*Hyoscyamus muticus*) is a valuable source of alkaloids.

Before the war, Germany took almost the whole of the Egyptian product, now the plant is being brought to Britain, where the alkaloids are being prepared for our market. In Northern India there exists a variety similar to the wild plant found in Egypt, and therefore a further source of supply is available.

Datura metal and *Datura stramonium* are also examples of plants native to India which are serviceable as sources of supply of this solanaceous alkaloid.

As it is unwise to depend upon the wild variety of any plant for the supply of drugs, it is essential that cultivation be undertaken.

Several of the plants named grow in Britain and there are a plethora of places in the Empire where every plant from which a drug can be extracted or prepared are available; it only wants the master mind to see that this is done, and there are plenty of shrewd men within the Empire to see that this is accomplished and the whole matter set on foot on a scientific basis with sufficient financial ability to ensure success.

LONDON SCHOOL OF TROPICAL MEDICINE.

EXAMINATION RESULTS. FIFTY-FIRST SESSION.
MAY—JULY, 1916.

H. L. CUMMING (Distinction),[1] K. T. Jungalwalls (Distinction), J. B. Flamer-Caldera, S. C. Biswas, J. T. Watt, G. T. Makhijani, Miss I. N. Clough.

[1] Dr. Cumming gains both the "Duncan" and "Lalcaca" Medals. The former is awarded to the student who obtains the highest aggregate of marks for the session: the latter being awarded to the student who gains the highest marks for the academic year.

Annotations.

New Differential Medium for Cholera Vibrio (Teague and Travis, *Journal of Infectious Diseases*, June).—On sugar-free nutrient agar to which is added 1 per cent. saccharose, 0·25 per cent. nutrose and 0·0625 per cent. bluish eosin, the cholera colonies have red centres, while the colonies of *B. coli* are uniformly pink.

Method of Preserving Typhoid Stools for Delayed Examination (Teague and Clurman, *Journal of Infectious Diseases*, June).—The fæces are added to 30 per cent. glycerine, not more than 1 part of fæces to 2 parts of glycerine, in a bottle with a screw top such as is used for sputum. The bottle should be shaken well to distribute the stool material throughout the glycerine. The 30 per cent. glycerine is prepared by adding glycerine to sterile 0·6 per cent. sodium chloride solution.

Medium for Isolation of Typhoid Bacilli from Stools (Holt-Harris and Teague, *Journal of Infectious Diseases*, June).—The medium consists of a combination of methylene blue and eosin in nutrient agar containing lactose and saccharose. On plates of this after eighteen hours' incubation the colonies of typhoid are colourless and transparent, while those of *B. coli* are a deep black and do not transmit light. The medium immediately around the colonies of *B. coli* remains practically unchanged. Hence the plate is workable even when the colonies are close together. More of the fæces, therefore, can be safely inoculated on this than on the Endo plate, and it is to that extent more delicate and to be preferred.

Decoud's Operation for Treatment of Varicocele (E. Del Valle, *Surgery, Gynæcology and Obstetrics Journal*).—The external abdominal ring and the spermatic cord are exposed, then the veins, from the external abdominal ring to the testicle, separated from the rest of the cord. The veins are separated into two groups, an anterior and a posterior. A catgut ligature is passed and tied around the posterior group, one finger's breadth above the upper limit of the testicle. Another ligature (silk) is similarly applied to the anterior group but two fingers' breadth above the level of the catgut suture and left long. The anterior group of veins is passed through an opening in the fascia of the internal or external pillar so as to raise the testicle. The operation is finished by suturing the edges of the incision in the fascia together behind the loop of the veins, thus leaving each end of the incision open for the veins to pass through.

Improved Brilliant Green Medium for Isolation of Typhoid Bacilli from Stools (Teague and Clurman, *Journal of Infectious Diseases*, June).—Eosin brilliant green agar containing lactose and saccharose,

after eighteen hours' incubation, shows the typhoid colonies by reflected light grayish in colour, while the colonies of *B. coli* have red centres. By transmitted light the typhoid colonies are transparent and colourless, while colonies of *B. coli* show dark centres. On further incubation the typhoid colony becomes pink, and the whole colony of *B. coli* becomes dark or red purple in colour; the typhoid colony remains translucent, while the colony of *B. coli* becomes more and more opaque. The typhoid colony may show the centre somewhat darker than the periphery, but the whole colony is much paler than that of *B. coli*, and is readily distinguished from it. If the colonies are packed closely together on the plate this differentiation is obscured, the typhoid colonies assuming a darker colour and those of *B. coli* failing to develop centres properly; however, on account of the inhibition which the medium exerts on the growth of most strains of *B. coli*, this is not likely to occur.

Summary of the Results of "The Rapid Production of Antidysenteric and Antimeningococcic Sera" (Professor Simon Flexner, M.D.): (1) Potent antimeningococcic serum can be safely produced in the horse by the method of three successive intravenous inoculations of living meningococci and parameningococci repeated at stated intervals.

(2) Sudden and alarming symptoms and sudden death are avoided by employing first a desensitizing injection, and then by adjusting the doses according to the febrile reaction and by making the highly diluted injections slowly.

(3) Horses undergoing this process of immunization remain in good condition, and may even gain in weight.

(4) Specific immune bodies appear in the serum early and rise rapidly.

(5) By inoculating alternately several strains of living meningococci and parameningococci, and the autolyzed products of each, a polyvalent serum of high titre can be produced in ten weeks instead of in the ten months required by the subcutaneous method.

(6) The serum produced by this rapid method has been employed therapeutically in America, England, France, and some other countries.

(7) It is highly desirable to isolate meningococci from many sources and test the strains against the polyvalent serum. Strains which are not agglutinated in high dilution in such a serum should be included subsequently in the iot of strains used for immunization.

Sight-testing in the British Army.—Commenting upon the visual standards used in the medical examination of recruits in the British Army and continental armies in the *Lancet* of May 16, 1916, J. V. Paterson, F.R.C.S.Edin., and H. M. Traquair, F.R.C.S.Edin., state that up to the commencement of the present War the British Army was organized largely with a view to its use in foreign countries at a great distance from its base. Under these circumstances the difficulties attendant on the provision of spectacles and their use by men on active service were overcome by the simple method of prohibiting glasses altogether, while by adopting a sight test conducted without glasses recruits with other than low errors of refraction were largely excluded. A recruit who failed to pass the test without glasses was finally rejected, no matter how good his corrected vision might be. At that time, and in the earlier stages of the present War, the standard was $\frac{6}{24}$ with each eye, or $\frac{6}{6}$ with one eye, and $\frac{6}{36}$ with the other. With the increasing need for men, however, a modification was introduced, and in September of last year the standard was altered to $\frac{6}{24}$ in each eye, or $\frac{6}{24}$ in the right eye with $\frac{6}{60}$ in the left for general service, while $\frac{6}{60}$ in the right with $\frac{6}{24}$ in the left was accepted for the auxiliary services, the test being still conducted without glasses.

In France, Germany, Austria, and Italy it is the vision with glasses or corrected vision which determines the acceptance or rejection of a recruit. Men with myopia as high as six or seven, or even eight diopters, are accepted for combatant service provided that the vision with glasses reaches the required standard.

The main defects of the British system in the order of their importance are the following: (1) The prohibition of the use of glasses during the test, thus making the uncorrected vision the standard of visual efficiency. (2) The insistence on an arbitrary and unnecessary standard of vision in the worse eye when the sight in the better eye is good. (3) The failure to ascertain by the test whether any visual defect present is caused merely by a refractive error corrigible by glasses or by organic disease of the eye.

It was stated in the House of Commons on March 16, 1916, that the present British visual standard was fixed by a mixed committee of military officers and ophthalmic experts. We are confident that British ophthalmic surgeons will be found practically unanimous in condemning the present system, and we are informed by the Ophthalmological Society of the United Kingdom that they have not been consulted since 1906.

In collecting information as to the sight tests in other countries, we were strongly impressed by the fact that for scientific studies of the vision required for shooting and for general military service it is necessary to go to foreign literature, as nothing of this kind appears to have been undertaken in Great Britain. We have been unable to find any reference to the subject in English medical literature, whereas it is fully discussed in continental journals by numerous writers, amongst whom Scherer, Steiger, Coullaud and Ginestous, Lagrange and Cuny may be mentioned. In some of their papers extensive bibliographics are given without mention of a single English work. This absence of military ophthalmology in Great Britain is as regrettable as it is important, and may undoubtedly be attributed in great measure to the operation of a sight test for recruits conducted without glasses, and which

excludes without question cases of bad sight in one eye only.

As far as shooting is concerned, it is generally agreed that vision of $\frac{6}{12}$ at least is necessary, and on the continent it is believed that a soldier with $\frac{6}{12}$ vision wearing glasses is more efficient as a combatant than another with $\frac{6}{24}$ vision without glasses. Continental authorities have found that on the average soldiers who see best shoot best, and that those who wear correcting spectacles shoot better than those who do not.

In summarizing their observations the authors set forth their views as follows:—

(1) The present sight test for general service for recruits for the British is by far the highest in Europe, and excludes from the fighting line large numbers of men who are freely used as combatants in the armies of the chief continental powers.

(2) This is due to the fact that in the British sight test the vision without glasses (uncorrected vision) is what counts, whereas in the chief continental armies it is the vision with glasses (corrected vision) which counts.

(3) In view of the present want of men there is urgent need for the immediate adoption of a remodelled sight test based on corrected vision, on the lines of the military visual standards in use on the continent of Europe.

Amyotrophic Lateral Sclerosis (John H. W. Rhein, American Neurological Association, May 8).—The patient was aged 56. The symptoms were atrophy of both arm muscles, including the small muscles of the hand, the flexors and the extensors of the forearm, the biceps, triceps, shoulder girdle, pectoralis, and serratus magnus. There were fibrillary tremors of both arms. Both sides of the tongue were atrophied; the knee and arm jerks were exaggerated, but there was no Babinski sign or spasticity. The Wassermann reaction was positive. Death occurred about a year after the onset.

A classical case of Friedreich's ataxia is reported in a girl of 12 or 15 years of age. At a later period the mother of this girl, who was then about 42 years of age, developed amyotrophic lateral sclerosis. In a second case the patient died within two years. Some round cell infiltration was found. In about one-third of these cases syphilis plays a very important *rôle*.

Diffuse Endothelioma of Spinal Cord (P. Bassoe and C. L. Shields, American Neurological Association, May 8).—The patient, a girl aged 16, was taken with headache, vomiting, and dizziness eight months before death. Later there were failing vision, two weeks of strabismus, and finally complete blindness. Hearing also was lost. The optic discs showed secondary atrophy, and the tendon reflexes were lost. The spinal fluid showed lymphocytosis and increased albumin. There were convulsive seizures during the last two weeks before death. The necropsy revealed the unusual condition of a diffuse greyish-white thickening of the pia along the entire cord, most marked posteriorly. Histologically, the tumour was an endothelioma.

Visual Disturbance from Denatured Alcohol (Eleonskaia, *Russky Vrach*, No. 11, 1916).—Poisoning from denatured alcohol was extremely frequent in the Petrograd hospitals soon after the sale of liquors was forbidden. From 123 to 332 persons per month were treated in one hospital, while in another during the six months 1,292 cases were admitted. As denatured alcohol contains about 1 per cent. of wood alcohol which affects the vision, causing amblyopia, the latter was a very common occurrence in cases of denatured alcohol poisoning. Of 1,432 men treated during 1915 for poisoning from denatured alcohol, 6 per cent. suffered from amblyopia. Half of this number drank denatured alcohol only, while others used in addition Cologne water and furniture polish. It required three or four months for the onset of visual disorders, and this occurred usually only after large quantities of alcohol had been imbibed. The main symptoms were decline in visual acuity, especially of central vision, and disturbances in colour sense, especially for red and green. Occasionally central scotoma for all colours was observed, including white. Narrowing of the field of vision was observed in fifteen out of forty cases examined, and the fundus was found changed in sixty-one out of ninety-six cases (hyperæmia of the papilla, blurred outline, pallor of the temporal half of disc, &c.). The pupils were usually normal. Abstinence from further use of denatured alcohol brought in many cases improvement of vision, but very slowly and imperfectly. In general, the visual disorders caused by the use of denatured alcohol are milder than those brought on by pure wood alcohol, but they are more severe than those from plain alcohol.

Benign Miliary Tuberculosis (Muralt, *Correspondenz-Blatt für Schweizer Aerzte*, April 15).—The case described shows the possibility of miliary tuberculosis developing in a mild chronic form with ultimate recovery. The patient was a physician of 35 with an inherited neuropathic and tuberculous taint, but healthy, except for "children's diseases" and pleurisy at 22, until the age of 31, when, after several months of overwork as physician at a tuberculosis dispensary, with inadequate food, pleurisy with effusion developed insidiously, and kept up for fifteen months without impairing the general health particularly. Then miliary tuberculosis developed with an acute onset, but soon subsided to such a mild course that the contrast between the Röntgen findings and the good general health was striking. The Röntgen picture was highly characteristic within three weeks of the first miliary onset. After two years of this two tuberculous tumours in the scrotum required excision in turn, and later tumours of the same kind developed in the spinal cord and medulla, one finally proving fatal after two had been removed. There were no night sweats at any time, and after

the initial phenomena the disease subsided into an entirely latent course, and death occurred eight months later, from the tumours, with no further signs from the miliary disease.

Miliary tuberculosis seems to be accompanied by tumours in the central nervous system comparatively often. The ease is quoted of a young woman with acute miliary tuberculosis, and night sweats presented symptoms of a tumour in the brain. On account of the septic condition no attempt at operation was ventured, and death followed in less than a year from the first symptoms of the miliary tuberculosis.

Atrophic Rhinitis (*Ozæna*) *and Tuberculosis* (D. McKenzie, *Journal of Laryngology, Rhinology and Otology*, May).—*Post-mortem* evidence of the frequent association of tuberculosis and atrophic rhinitis (ozæna) has been found, as well as clinical evidence of the same (*a*) in the personal history and status of the ozænatous patient; (*b*) in the family history. Tuberculin tests showed active tuberculosis in the majority of cases of ozæna. This was supported by the phenomena and results of the tuberculin treatment. There is some evidence tending to show that ozæna is commoner in patients with phthisis pulmonalis than in the general community. There is also evidence tending to show that the acid-fast bacillus of the ozænatous crusts is an attenuated variety of the tubercle bacillus. Ozæna resembles in many of its details other "paratuberculous" diseases. The final conclusion is that ozæna, as seen in England, is a manifestation of tuberculosis.

Serum and Combined Treatment of Tetanus (Etienne, *Paris Médical*, April 9).—Five patients out of six recovered under systematic administration of antitetanus serum. The men all had fever except one, and this was the one fulminating fatal case. This patient proved to be a carrier of tetanus germs as he had no symptoms until, under a course of quinine, the fulminating tetanus developed. Similar cases have been observed before, and has been produced in animals, quinine injections arousing latent tetanus to a rapidly fatal course. In the five other cases, all with favourable outcome, the incubation period had been three, six, seven, ten or eleven days. Tetanus is primarily an infectious disease, then an intoxication, and finally a nervous affection. The first calls for treatment of the focus, the second for antitoxin treatment, and the third for chloral and morphine. With serotherapy it does no good to shoot at a lion. Adequate dosage is the main point.

Agglutination Reaction with Serum derived from Human Cases of Leprosy and from Experimental Animal on various Members of the Acid-fast Group (W. H. Harris and J. A. Lanford, *Journal of Medical Research*, May).—The agglutinin present in the serum of the human subject affected with leprosy is usually low in titer and inconstant in its action. The employment of this procedure, therefore, has proved of no avail in serving to authenticate any of the various cultures isolated from the leprous lesion of the human as the Hansen bacillus. The serums derived from rabbits inoculated with various bacillary antigens yield agglutinins likewise inconstant in amount and erratic in their action. Serums derived from these inoculated animals do not serve to differentiate the various species employed in these experiments, but suggest a group relationship. Until some further refinement in these procedures is devised, but little reliability can be placed on this type of test as a means of identification of any culture isolated from the lesion of leprosy as the bacillus of Hansen.

Action of certain Volatile Oils on Isolated Intestinal Segments (A. L. Muirhead and H. F. Gerald, *Journal of Pharmacology*, May).—The following oils were studied: Pennyroyal, tansy, wormwood, turpentine, rue, anise, savin and thymol. A number of these oils produce marked stimulation of isolated intestinal segments when applied in dilutions of 1 to 50,000 to 1 to 25,000. This is especially true of oil of anise, oil of turpentine, and oil of wormwood. All of the oils produced relaxation of intestinal segments when applied in dilutions of 1 to 5,000 to 1 to 10,000.

Subacute Anterior Poliomyelitis (A. W. Harrington and J. H. Teacher, *Glasgow Medical Journal*, May).—The patient whose case is cited was an elderly woman who presented a flaccid paralysis beginning in the peroneal group, extending rapidly to the upper extremities, and finally involving the muscles of respiration. The paralysis appeared first, and later atrophy of the affected muscles became marked. No fibrillary tremors were observed. Repeated and thorough examinations showed that there were no disturbances of sensation beyond occasional shooting pains. The sphincters were not affected. The reflexes were early abolished. An examination of the electrical reactions on admission showed reaction of degeneration fully developed in the affected muscles of the left leg and incomplete in the right leg. The Wassermann reaction was not ascertained, but there was no history or suggestion of syphilis. The patient died from involvement of the diaphragm and intercostal muscles, the duration of the illness being probably less than a year. Clinically, the diagnosis lay between peripheral neuritis and anterior poliomyelitis. The pathologic report was wholly in support of the latter diagnosis. The principal features were the advanced degenerative changes in the ganglion cells of the grey matter of the spinal cord, and to a less degree in the medulla and pons, and the absence of tract degenerations and peripheral neuritis. A second patient, a woman aged 48, exhibited a flaccid paralysis beginning in the peroneal group of muscles, rapidly extending to the upper extremities, and finally involving the muscles of respiration. The paralysis preceded the atrophy. Reaction of degeneration was present,

hut there were no fibrillary tremors. There was no disturbance of sensation beyond occasional shooting pains in the right leg. The duration of the illness was less than one year. The diagnosis was indicated by the somewhat selective nature of the palsy, by the distinct atrophy which followed, and by the complete absence of sensory disturbance. Clinically, the case could be definitely distinguished from progressive muscular atrophy and peripheral neuritis. Pathologically there was degeneration of the lower motor neurones. The case probably should be regarded as a subacute poliomyelitis.

Perforating Ulcer of Foot and Varicose Ulcers of Leg and their Treatment by Nerve Operations.—Smits (*Annals of Surgery*, May) from experience in Sumatra finds the only modern surgical method of treatment is local treatment of the sore combined with stretching or laceration of the nerve, in the region in which this sore is situated. In the twenty-five cases of perforating ulcer of the foot cited, the mere local surgical treatment was shown to be useless in all these cases, even when combined with an absolute rest cure. The same surgical treatment combined with a nerve operation, whether executed once or repeatedly, always led to cure. Eighteen cases of varicose ulcer similarly treated are cited. Locally he applied a liquefied medicated gelatine made as follows: Dissolve in a water bath 20 parts of gelatine in 40 parts of water. To this add 10 parts of glycerine; mix with 15 parts zinc oxide previously ground up with 15 parts glycerine, and add water enough to make 100 parts. Smits spreads a thick layer of this liquefied medicated gelatine over the leg, and covers this while still wet with a thin layer of cellulose wadding, which immediately sticks and forms an immovable dressing. Over the layer of cellulose wadding a bandage of well starched gauze is placed. The patient remains in bed until the dressing is thoroughly dry.

Pathologic Changes in the Sympathetic System in Goitre.—L. B. Wilson (Association of American Physicians, May) made a study of cervical and other sympathetic ganglia removed at operation and necropsy from patients with goitre, the results being controlled by a study of ganglia from non-goitrous patients. Sections of the ganglia, stained by various methods, show extensive histologic changes, consisting of various stages of cell degeneration, namely: (*a*) hyperchromatization, (*b*) hyperpigmentation, (*c*) chromatolysis, and (*d*) atrophy, or (*e*) granular degeneration. So far as may be determined from the small number of specimens examined (twenty-five cases), the pathologic changes in the ganglia are parallel to the stage and intensity of the symptoms of hyperthyroidism and to the hyperplastic and regressive change in the thyroid.

Rapid Healing of Acute and Chronic Abscesses in the Neck without Scars (H. Chaput, *Paris Médical*, April 22).—A small superficial abscess is pierced with a needle, carrying two strands of silkworm gut which are knotted to form a loop, repeating the process perpendicular to the first, and thus providing crucial drainage. A deep abscess is lanced at the top, and through this minute incision with a needle introduced through the incision the skin is pierced from within, at the poles of the abscess and the diverticula. The ends of silkworm gut are tied at the central incision. This provides radiating drainage. A single drain may suffice if at the absolutely lowest point. A fine rubber bougie or spiral wire may answer likewise for the filiform drainage. With active suppuration, induration is liable to follow evacuation of the abscess if the patient is up and about. Hence it is better to leave the drains in place until all induration has subsided, keeping the patient in bed or at least confined to the room. Filiform drainage is nothing new, but it has never been applied generally, and its advantages have not been appreciated.

End-results of Treatment of Sterility (J. O. Polak, American Gynæcological Society, May).—One hundred and thirty-two uterine and three ectopics are the sum total of pregnancies occurring in 358 women in whom conception was a probability, or 37 per cent. In a large number of sterility cases, the women applying for relief have no chance whatever of becoming pregnant, as the pathologic condition is such as to make conception impossible. The male is largely responsible for the poor results in treatment. There is a definite chemico-physiologic factor in conception, at present unexplainable, which is a cause of preventing conception. Operative procedures on the uterus, except amputation of the hypertrophied portion, have but a slight influence on the end-results in the treatment of sterility. Each case must be individualized, and both contracting parties carefully studied before any treatment is inaugurated.

Thyroid Autograft (Kummer, *Revue Méd. de la Suisse Romande*, April).—A woman, aged 36, had bilateral goitre compressing the trachea and extending outward beyond the ears. Both lobes were removed nearly completely, but the structure of the thyroid seemed normal at certain points, and some segments of this were implanted under the skin over the right acromion. The portion of the thyroid left undisturbed gradually enlarged, as also the grafts in the acromion region. A scrap of the graft was excised three years later, and the microscope confirmed that it had not only taken root but had proliferated. The result was a kind of small neothyroid gland which had apparently shared in the total functioning of the thyroid gland. Nine years later—that is, twelve years after the operation—another scrap was excised, and the findings confirmed that the graft had continued its functioning. No sign of inflammation had been observed at any time.

Abstracts.

ANTITYPHOID VACCINATIONS, FREQUENCY OF PARATYPHOID, AND MULTIPLICITY OF PARATYPHOID SPECIES OF BACILLI IN THE ITALIAN ARMY.

By G. Galeotti.

In the autumn of last year, by appointment of the Italian military authorities, I gathered some notes, and carried out bacteriological researches on the efficacy of antityphoid vaccinations and on the cases of typhoid infections which occurred amongst our mobilized troops.

Regarding the results of antityphoid vaccinations, I did not have sufficient data to establish reliable statisties which could serve to illustrate the real efficacy of the vaccinations executed from March to November, 1915, with a simple antityphoid vaccine.

In studying the cases of typhoid developed amongst the soldiers, I observed those who had undergone inoculation and those who had not been inoculated. In 1,844 cases clinically diagnosed as typhoid, 608 had been inoculated three times, 192 once or twice, and 1,044 had never been inoculated.

The verification of a considerable number of typhoid cases amongst those who had undergone three immunizing injections created a certain mistrust in the efficacy of vaccinations, but a more accurate examination of the state of things showed that such mistrust was unjustified or at least exaggerated.

In fact, in the regions of the Carnia, where the morbidity for typhoid amongst the vaccinated and the non-vaccinated was especially studied, the following results were obtained:—

	Per thousand
Morbidity amongst non-vaccinated	4·11
,, ,, vaccinated	1·45

The principal reason why the vaccinations carried out in the spring and summer of 1915 did not have all the efficacy which could have been expected was that, as I will now explain, a great number of infections, characterized as typhoid, were produced by paratyphoid germs. It is therefore comprehensible that the vaccine used, which contained only typhoid bacilli, could not prevent also paratyphoid infections.

Regarding the extension of paratyphoid amongst our fighting troops my researches counted 459 cases, which were studied by means of agglutination, blood culture, and isolations from the stools. The germs obtained were then identified with the usual specific media of cultures (Agar-Drigalski-Conradi, gelatine, milk, neutral red agar, Barsiekow mediums containing different carbohydrates), and by means of agglutination with high power serums.

The results of these researches were the following: Of 459 cases clinically diagnosed as typhoid, 77 (from which no cultures were obtained) proved negative (16·8 per cent.) at the agglutination test, and in 19 the diagnosis remained undetermined on account of group agglutination. Of the remaining 362 cases:—

184 were typhoid, viz.	50·8 per cent.
128 were paratyphoid B, viz. ...	35·4 ,,
29 were paratyphoid A, viz. ...	8 ,,
21 were anomalous paratyphoid, viz.	5·8 ,,

Furthermore, I gathered the data of other observers who also practised serological and bacteriological researches on our sick soldiers with typhoid infections. These notes concern 1,041 cases, of which 136 (13·1 per cent.) proved negative, 504 were typhoid, 337 paratyphoid B, 30 paratyphoid A, and 34 paratyphoid non-determined.

Adding my results to these, statisties of 1,506 cases is obtained, of which

54·3 per cent.	were	typhoid	
36·7	,,	,,	paratyphoid B.
4·6	,,	,,	paratyphoid A.
4·3	,,	,,	anomalous paratyphoid

On the whole it can be concluded that out of 100 cases clinically diagnosed as typhoid infections, 54·3 per cent. were actually typhoid and 45·7 per cent. paratyphoid.

The proportion of paratyphoid cases amongst the abdominal infections of our soldiers is therefore remarkable. The frequency of paratyphoid B is much greater, but it should be noted that the greater part of the above-stated observers did not submit the paratyphoid bacilli A to agglutination.

Both in the bacteriological researches carried out by me, as in those of others, either by means of blood culture or isolations from the stools, strains of paratyphoid were obtained, which, although resembling paratyphoid A and B for their morphological and cultural characteristics, differed from same on account of their biological behaviour on carbohydrates and their properties of agglutination. I have designed these strains as anomalous paratyphoid. It is likely that to these anomalous paratyphoid bacilli are due the numerous cases in which the sero-diagnostic test proved negative, and which in my researches were 16·8 per cent., and in those of others 13·1 per cent.

It is known for some time that the germ species of the group coli-paratyphoid present a great number of varieties, of which the most important differential characteristics consist in the properties of fermenting various sugars (with production of acids and carbon dioxide) and immunizing reactions. But little we know whether these characteristics represent fixed properties such as to allow a well-defined situation to be given to this bacteria in the classification of the above-mentioned large group, or whether they are changeable properties according to the conditions of life to which a strain is accustomed or is becoming accustomed to.

But if, with regard to the biology and classification of these species of bacteria, the above properties are of little importance, they cease to be so when one considers the immunizing properties of the various types in relation to the pathology of the intestinal infections and their epidemiology.

Hence the study of anomalous paratyphoid bacilli is worthy of some interest, and therefore the isolated strains have been diligently studied. In this way there have been discovered eighteen types of paratyphoid bacilli different from species A and

B, and differing also amongst themselves for their capacity of fermenting various sugars, for their indole reaction and for their properties of agglutination. Generally the serum prepared with a strain agglutinates its own strain only and no other. Also other researches, still in course and which regard the bactericidal properties of these serums, indicate that there exists a distinct immunizing independence amongst the various strains. The greater part of these species are pathogenic to guinea-pigs.

The verification of the plurality of the types of bacilli capable of producing typhoid infections is most important for the knowledge of the pathogenic intestinal bacteria.

And here must be brought to evidence the fact that the conditions of a war camp must necessarily cause variety in the bacterial flora of the digestive canal of the soldiers, and this either because of the continual and immediate contact between men coming from different parts who can be carriers of most varied germs, or on account of the fatiguing life they lead, the want of cleanliness, the facility of contamination to food and water, and the prevailing meat nutrition of often unfresh and badly cooked meat. And it seems that just amongst the fighting troops the best opportunity lies for isolating these anomalous paratyphoid bacilli.

If, lastly, when one considers that the above germs generally produce illnesses which clinically differ very little from abdominal typhus whilst their immunizing reactions are different, so that the immunity obtained for one type does not apply to another even very near type, we can explain some obscure facts belonging to the epidemology of typhoid. For instance, the not uncommon repetition in the same individual, even at a small interval, of illnesses of the type of typhoid in spite of the natural immunity acquired by man after the illness, because the two diseases produced one after the other can have been caused by varieties of paratyphoid bacilli having different properties of immunity; hence also the lack of positive serum reactions in using the usual diagnostics of typhoid and paratyphoid A and B, and lastly, also the partial unsuccess of vaccinations and not only with simple antityphoid vaccine (as I said above), but also sometimes with vaccines containing the two paratyphoid bacilli A and B.

Conclusions.

(1) If the antityphoid vaccinations carried out in the spring to autumn of last year did not have entire effect, this must be principally attributed to the fact of having used a simple antityphoid vaccine, whilst half of the infections, on the typhoid type, turned out later to have been produced by paratyphoid bacilli.

(2) It was consequently found advisable to use in future a mixed vaccine typhoid-paratyphoid which was adopted by the military sanitary authorities.

(3) From the serological and bacteriological study of 1,500 cases of typhoid infections, 45·7 per cent. resulted that were due to paratyphoid bacilli.

(4) In many cases germs were isolated which, for their biological characteristics and for their immunizing reactions, represent varieties distinct from types A and B. Of these germs eighteen different types were studied.

(5) The conditions of war-life modify considerably the intestinal bacteriological flora of the soldiers, and therefore so many anomalous paratyphoid bacilli were brought to evidence.

(6) The existence of numerous paratyphoid bacilli, different for their immunizing properties, throws light on some important facts in the pathology and epidemiology of typhoid infections, such as reinfections, the apparent lack of immunity in certain cases, the not infrequent negative results of sero-diagnosis.

(7) The question remains still open whether the constitution of mixed vaccines should be altered in order to render them capable of preventing every kind of typhoid and paratyphoid infections.

THE TREATMENT OF HEPATIC FAILURE IN YELLOW FEVER, MALARIA, AND OTHER CONDITIONS: A SUGGESTION.[1]

By Andrew Balfour, C.M.G., M.D.Edin.

Symptoms similar to those present in delayed chloroform poisoning may occur in tropical diseases where the liver, so to speak, is thrown out of action, where it fails to perform its functions, and where, as a result, the patient is in imminent peril of his life. Sufficient stress has not been laid on this hepatic failure, at least so far as remedial measures are concerned; as in yellow fever and in cases of so-called "infectious jaundice." Studying sections of the liver from cases of yellow fever, toxic jaundice, blackwater fever, and malaria associated with icterus, one notes the marked destruction of liver cells which occurs in those diseases. In a case of malarial infection, although quinine eventually cleared the blood from a heavy infection of *P. falciparum*, death occurred after a peculiar set of cerebral symptoms, due to hepatic failure.

The symptoms associated with the destruction of liver cells are chiefly of cerebral origin, pointing to a poisoning of the higher nerve centres. The patient begins to grow restless, watchful, excited, anxious, and light-headed. He complains of severe headache and, it may be, of photophobia. He wanders in his mind and suffers from an incoherency of ideas and from hallucinations. His muscles twitch and tremble and delirium ensues. It may be of a low, muttering type, or may become active, the patient trying to get out of bed, but it is not usually very violent, for there is great weakness. Convulsions may set in, and if cardiac or respiratory failure does not occur coma ends the scene. In addition, we find that if jaundice is already present it deepens, while hiccough, clammy sweats, and anuria are not infrequent.

These symptoms are common to delayed chloroform poisoning, yellow fever, severe cases of

[1] Abstracted from the *Lancet*, May 20, 1916.

epidemic jaundice, the so-called Mediterranean yellow fever, Weil's disease, whatever that may be, and blackwater fever, certain forms of fatal malaria, acute yellow atrophy, phosphorus poisoning, &c.

These symptoms have been vaguely attributed to the action of the toxins of the virus causing the disease, and little or no attempt has been made to treat the serious liver condition which is present. To dilute the toxins in the blood and to stimulate the action of the kidneys by an alkaline treatment has the further benefit of counteracting the blood acidosis which is present in these cases, and which may be recognized by the occurrence of acetonuria. Cases of blackwater fever have quite recently been treated with success by means of intravenous injections of calcium chloride, and either potassium or sodium bicarbonate. This combats the diminished blood alkalinity, for the urine in blackwater cases contains acetone. The acidosis, of which it is the expression, is due to the fatty acids being poured into the blood owing to the disordered hepatic condition, and the above line of treatment is undoubtedly based on sound principles. We may go further and endeavour to prevent, or at least cut short, the rapid destruction of liver cells which plays so important a part in bringing about a fatal issue in such diseases as yellow fever and bilious remittent fever.

In such diseases the antitoxic functions which the liver cells discharge into the portal blood are first of all depressed, and then suppressed by the poisons generated by the disease viruses. Strain is thrown on the liver cell. It endeavours to maintain its energy by taking up carbohydrate material. If sufficient cannot be obtained from sugar it turns to fat, and when this also fails to yield the supply, to tissue proteins. There is thus increased fat metabolism with acidosis and acetonuria, and the liver cell, coming under the influence of its own ferments, undergoes autolysis, and thus presents the characteristic appearances seen *post mortem*. Ammonia, as a rule, keeps the ferments in check, and the practice, common alike before operations and in the early stages of febrile diseases, of purging the patient with calomel and of withholding food, prevents the formation of ammonia, and thus the hepatic ferments have full play. As already stated, the liver cells being thus thrown out of action fail to deal with the poisonous portal blood. The latter passes unchanged into the general circulation, and the characteristic cerebral symptoms result.

The precise manner in which the disease toxins act on the liver cells has not been ascertained. It may, as has been suggested, be a neutralizing action upon anti-ferments which, quite apart from any question of ammonia, normally preserve the hepatic cells from self-digestion. The one important practical conclusion is, the necessity in cases of delayed chloroform poisoning and toxæmic jaundice of keeping up the supply both of sugar and of protein food, the latter in peptonized form. The former is ensured by the administration of glucose. It can be given by the mouth or as rectal enemata, solutions of 5 or 10 per cent. being used. If pure glucose cannot be obtained, preserved (candied) fruits may be given, or, indeed, sugar in any form. The necessity for protein is met by administering enemata of peptonized beef-tea, eggs, or other protein material.

ANTITETANIC SEROTHERAPY AND ANAPHYLAXIS.

At the Réunion médico-chirurgicale de la Ve armée, Dr. Genouville described five cases in which he employed, with anti-anaphylactic precautions, the injection of anti-tetanic serum in cases of wounded men who had already received an injection of this serum for previous wounds. First the injection of 1 c.c. was given very slowly in a vein of the elbow, and a few minutes later an injection of 10 c.c. hypodermically. The only phenomena noted were a slight serous eruption in one; a transient fever in another; a third person, a few minutes after an intravenous injection, developed a cough and slight faintness which lasted a quarter of an hour. This man had received a wound of the thigh from a fragment of shell two days before. He had breathed tear-producing gases, and showed signs of bronchitis. The subcutaneous injection was postponed until the next day, and produced no inconvenience. It is fair to ask oneself, in this case, whether the inhalation of the gases had not some causal relation with the phenomena observed. At any rate, these new observations show that, if appropriate anti-anaphylactic precautions are taken, one can without danger practise anti-tetanic injections on every wounded soldier, even if he has received an injection of the same serum several months before.

There was no theoretical reason why the irritation of the respiratory apparatus by asphyxiating gases should be regarded as a contra-indication to anti-tetanic serotherapy. The irritation, even generalized, of the broncho-alveolar structures does not seem to produce a condition of anaphylaxis in the same way that infectious diseases do when there is pulmonary localization, such as tuberculosis and asthma. There is, however, some fear that a second injection of serum in those who are suffering from "gassing" may provoke serious symptoms owing to the congestion of the pulmonary system, as a result of asphyxiation. In this case one is justified in guarding against anaphylaxis by using a preliminary small injection. On the other hand, the mildness of the immense majority of anaphylactic incidents which occur after the second hypodermic injection of serum seems to justify, in the present circumstances and in ordinary cases, the omission of this precaution. This, however, is not true for reinjections given intravenously or intraspinally. The severity of the anaphylactic symptoms in these conditions calls for the greatest prudence.—*Journ. Amer. Med. Assoc.*, June 17.

Notes and News.

THE SUITABILITY OF THE WHITE MAN FOR THE TROPICS.

At a meeting of the British Science Guild, Mr. Andrew Fisher, High Commissioner for Australia, delivered a remarkable address in which he described the operations of the Institute of Tropical Medicine in Queensland, part of whose investigations related to the effect of climatic conditions. As far as their statistics guided them, he said, it would appear that Europeans had a better chance of life in the tropical portions of Australia than in the temperate zone of that continent. It was remarkable, as the latest figures showed, that Queensland, largely a tropical State, had at once the highest birth-rate and the lowest infantile death-rate in Australia. This was a matter of world-wide importance. It was an interesting human experiment, confined not merely to a selected locality, but applied to a country three times as large as the United Kingdom. It was also of vital interest to Australia, for it was hoped that it would decide the question of climatic influence on the white man in the Tropics, the maintenance of whom was a principle to which Australia has pinned her faith as a nation.

The "Sanitas" Company, Limited, inform us that they have recently introduced three new preparations, "Sanitas Anti-Vermin Paste," which is reputed to be a simple, safe and preventive remedy for body vermin, and therefore eminently useful to our soldiers at the front, "Kaytor," an application for use in cases of nasal catarrh and hay fever; and "Potex," a scientific potato remedy, which has been proved to afford great relief in cases of rheumatism, lumbago and allied painful affections.

Surgical Notes.

Treatment of Septic Wounds.

The question of the treatment of septic wounds depends on the carrying out of the principles of antisepsis and osmosis. Syringe out the wounds with pure rectified spirit, and paint surface of wound and neighbouring skin with 20 per cent. ichthyol in glycerine (or equal parts of these) twice daily, and cover by gauze absorbent wool and a bandage.—Major C. W. Duggan, R.A.M.C., *Brit. Med. Journ.*, July 15, 1916.

An Extension Splint in Fractured Humerus.

As a means of procuring extension in cases of fractures of the shaft of the humerus, Captain D. Hingston, Canadian A.M.C., uses an extension made of the aluminium splinting supplied in the field fracture box bent into an oblong frame which reaches from above the shoulder, down the sides of the arm, to beyond the elbow. The frame nowhere touches the fractured limb, but is from 1 in. to 3 in. away from it. Plaster is now fixed to the lower part of the inside of the fractured arm, carried below the frame, and up to the outer side of the arm. A well-fitting axillary pad, consisting of cotton-wool wrapped round an elastic piece of tube, is tied to the frame above in such a manner that it acts like a perineal band in cases of fractured femur, and thus procures extension. The forearm is then supported in a small arm sling.—*Brit. Med. Journ.*, July 15, 1916.

Treatment of "Shell Shock."

E. T. C. Milligan, Captain R.A.M.C., suggests that many cases of shell shock, such as loss of speech, hearing, memory, or of function in limbs should be treated as are many cases of hysteria by suggestion under chloroform. Whilst the patient is being slowly anæsthetized, the anæsthetist, by speaking to the patient of, say, his home life, his wife, mother, or child, may "cure" a case of loss of memory or of mutism or of deafness.—*Brit. Med. Journ.*, July 15, 1916.

Danger of sterilization of skin by iodine in abdominal operations is dealt with by A. Ernest Maylard, B.S., M.B., Surgeon to Victoria Hospital, Glasgow. He holds that as iodine is well known to cause tendency to adhesions when allowed to touch the peritoneum, many of the distressing after-effects of operations from adhesions would be avoided by withholding the application of iodine before the operation, as some of the iodine may be carried during the incisions and subsequent manipulations to within the peritoneal cavity.—*Brit. Med. Journ.*, July 15, 1916.

Personal Notes.

From March 21 to July 6, 1916.

Arrivals reported in London.—Lieutenant-Colonel E. C. Hare, I.M.S.; Major A. W. Overbeck-Wright, I.M.S.; Major T. S. Hovis, I.M.S.; Captain R. B. Lloyd, I.M.S.; Major H. B. Drake, I.M.S.; Major N. E. H. Scott, I.M.S.; Lieutenant-Colonel N. Rainier, I.M.S.; Captain A. Robertson, I.S.M.D.; Major R. M. Carter, I.M.S.; Lieutenant-Colonel J. Entrican, I.M.S.; Major G. A. Jolly, I.M.S.; Lieutenant-Colonel T. W. Irvine, I.M.S.; Major T. H. Delany, I.M.S.

Extensions of Leave.—Major E. A. St. Romaine, I.S.M.D., to July 12, 1916; Major G. King, I.M.S., to July 5, 1916.

Permitted to Return.—Major F. W. Cragg, I.M.S.; Captain D. M. C. Church, I.M.S.

List of Indian Civil Officers on Leave (including Military Officers under Civil Rules).

Showing the Name, Province, and Department, and the Period for, and Date from, which the Leave was granted.

Clark, Lieutenant-Colonel W. R., I.M.S., Punjab, 9 m., March 18, 1915.

Morgan, Major E. J., I.M.S., U.P., 24 m., October 1, 1913.

Nutt, Major H. R., I.M.S., Und. Prov., 19 m., March 31, 1914.

Robertson, Major J. C., C.I.E., I.M.S., India Sany. Commn., 8 m., April 14, 1915.

Hare, Lieutenant-Colonel E. C., I.M.S., Bihar and Orissa Sany. Commn., 18 m., February 3, 1916.

List of Indian Military Officers on Leave.

Showing the Name, Regiment or Department, and the Period for which the Leave was granted.

Drake, Major H. B., I.M.S.

King, Major G., I.M.S., to July 5, 1916.

Lloyd, Captain R. B., I.M.S.

Novis, Major T. S., I.M.S.

St. Romaine, Major E. A., I.S.M.D., to July 12, 1916.

King, Lieutenant-Colonel A. F. W., I.M.S., to July 28, 1916.

Original Communications.

A NOTE OF A CASE OF CATALEPTIC TRANCE.

By J. A. Haran, M.D.
Nairobi.

The patient's friends who brought him to the dispensary stated that, on the previous evening, when he was attending an ngoma, he suddenly fell down and lapsed into unconsciousness. There was no history of convulsions prior or subsequent to his fall. He was subsequently carried to his quarters and kept there overnight, during which time he was not observed either to micturate or defæcate.

On examination the patient—a Somali in the early twenties—was found to have a normal pulse. His respirations were quiet, his temperature in the axilla 98·2° F. Patellar reflexes were present. On opening the eyelids the pupils were noticed to be dilated and to react sluggishly to light; the eyeballs themselves were observed to be moving together in various directions. The heart-sounds were normal. No enlargement of either liver or spleen was detected.

On passing a catheter 9½ oz. of urine were drawn off of acid reaction, sp. gr. 1025, and showing no albumin.

Cutaneous sensibility, as tested with a needle, was absent, except about the eyelids and the immediately subjacent cheeks. Deeper stimulation caused local muscular contraction, more especially of the deltoids and outer thigh muscles. On putting the arms into any position they so remained, whether elevated, depressed, flexed, or extended. The fingers, however, when opened, closed again. The mouth was opened, though with difficulty, and remained so, the tongue lying motionless. The head, when rotated to either side, or when elevated or depressed, remained in the position placed. The lower limbs retained any position in which they were placed, but when either was raised from the ground, it slowly descended until the foot touched the ground again.

When placed sitting on a bench the patient retained that attitude, and when put in an upright position he continued standing, with a slight tendency to swaying backwards and forwards. In the upright position, when the trunk was bent to one side, the upper limbs elevated above the head, and the feet separated sufficiently to maintain the centre of gravity, the posture was adhered to.

After the above observations of the patient's condition had been made, stimulative treatment, including artificial respiration, was applied. In a few minutes, on his eyelids being opened, they remained so, and soon he rotated his eyes from side to side and upwards and downwards, as if confused by his surroundings. Progress towards recovery, momentarily retarded by the patient's being placed in a sitting position, gradually followed, and, as soon as he felt that he was able to return to his home, he was permitted to leave in the care of his friends.

MEASUREMENTS OF DUTTON AND TODD'S GAMBIA STRAIN OF *TRYPANOSOMA GAMBIENSE* DUTTON 1902.

By Albert J. Chalmers, M.D., F.R.C.S., D.P.H.,
Director, Wellcome Tropical Research Laboratories,
Member, Sleeping Sickness Commission, Anglo-Egyptian Sudan,
and
Captain W. R. O'Farrell, R.A.M.C.,
Protozoologist, Wellcome Tropical Research Laboratories, Khartoum.

Contents.—*Introductory—Dutton and Todd's Gambia Strain — Comparisons — Conclusions — Acknowledgment—References—Illustrations.*

Introductory.—This is the second of a series of short notes published in this Journal with reference to the trypanosomes studied in the Khartoum laboratories.

In the first note we described the type of trypanosome which we obtained from cases of sleeping sickness occurring in the Lado Enclave of the Anglo-Egyptian Sudan, and came to the conclusion that it was the same organism as that found in cases of sleeping sickness occurring in Uganda and the Congo, but we were unwilling to consider it to be the same species as that described by Dutton in 1902 because, in our opinion, there was not sufficient information available as to the specific characters of that strain.

Dutton and Todd's Gambia Strain.—By the kindness of Professor Todd, of Montreal University, Canada, we have been permitted to examine the original slides made by Dutton from the first case of Human Trypanosomiasis discovered by him on the Gambia. Unfortunately, the number of trypanosomes present on the slides was much too small for the purpose of measuring 1,000 non-dividing individuals, and therefore we merely show in the illustrations attached to this note a photomicrograph of one of the long forms of the original strain of *T. gambiense* Dutton 1902.

Professor Todd with great generosity not merely supplied us with slides from the first case, but also with a number of slides labelled Exp. LXIX, which are described in the Trypanosomiasis Section of the Report of the Expedition to Senegambia, published by Dutton and himself in 1903.

On turning to the table in this report, entitled "*Human Trypanosome; First Passage Inoculation in Rats*," we find Exp. LXIX described as follows:—

Animal.—Tame black rat.

Inoculation.—

Date.—January 19.

Source.—Mr. Q.

Mode of Inoculation.—Intraperitoneally with 0·5 c.c. of blood, showing seven parasites to preparation.

Date of Appearance in Peripheral Blood.—February 8.

Result.—Died.

Date of Death.—February 28.

Duration.—Forty days.

The source being Mr. Q. it was necessary to

possess details about this case, and these we found set forth on pp. 13-16 of the report in question. Mr. Q. was the second European case to be observed by Dutton and Todd, the first case being Mr. K., *i.e.*, the original case discovered by Dutton. These slides, dated February, contained a large number of trypanosomes, and appeared to us to be the nearest approach which we were ever likely to make nowadays to the original strain described by Dutton, and therefore we have measured 1,000 non-dividing individuals found therein with the results set forth in Tables I, II, and III and Chart 1, which sufficiently explain themselves, and all that is necessary is to say that we divided the 1,000 individuals into sets of 20 as met with while making the necessary drawings.

TABLE I.—DISTRIBUTION IN RESPECT TO LENGTH OF 1,000 NON-DIVIDING INDIVIDUALS OF DUTTON AND TODD'S GAMBIA STRAIN OF *Trypanosoma gambiense* DUTTON 1902, AS SEEN IN THE ORIGINAL BLOOD FILMS FROM A SINGLE BLACK RAT.

NUMBER OF SETS		IN MICRONS																						AVERAGE	
		15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	of each 20	of each 100
First set	1	—	—	—	—	—	1	2	—	4	1	—	2	2	2	2	2	2	—	—	—	—	—	26·2	
	2	—	—	—	—	—	2	3	1	1	4	3	—	2	—	3	1	—	—	—	—	—	—	24·7	
	3	—	—	1	1	—	2	2	1	2	3	2	2	2	1	1	—	—	—	—	—	—	—	23·8	24·8
	4	—	—	—	—	1	—	1	2	1	4	4	1	2	2	2	—	—	—	—	—	—	—	25·1	
	5	—	—	—	1	3	2	—	3	—	1	1	3	—	1	4	1	—	—	—	—	—	—	24·3	
Second set	1	—	—	—	1	—	2	2	2	3	2	2	—	1	1	2	1	1	—	—	—	—	—	24·5	
	2	—	—	—	—	—	1	—	1	3	1	1	3	3	5	—	1	1	—	—	—	—	—	26·2	
	3	—	—	—	—	1	—	1	2	2	3	1	2	—	2	4	2	—	—	—	—	—	—	25·5	25·2
	4	—	—	—	—	1	4	—	1	—	1	2	4	3	—	—	3	—	1	—	—	—	—	25·2	
	5	—	—	—	—	—	—	3	4	2	3	2	1	1	1	2	1	—	—	—	—	—	—	24·4	
Third set	1	—	—	—	—	—	3	2	2	—	2	2	3	2	2	1	—	1	—	—	—	—	—	24·8	
	2	—	—	—	—	—	2	4	5	2	1	—	1	1	1	1	2	—	—	—	—	—	—	23·9	
	3	—	—	—	—	—	4	—	2	3	3	1	2	—	1	2	2	—	—	—	—	—	—	24·7	24·4
	4	—	—	—	1	1	—	1	1	5	2	1	2	2	2	1	1	—	—	—	—	—	—	24·7	
	5	2	—	—	—	—	2	2	—	2	1	5	—	1	3	1	1	—	—	—	—	—	—	24·1	
Fourth set	1	1	—	—	—	—	—	1	1	3	1	—	2	3	1	2	—	2	—	—	—	1	—	26·8	
	2	—	—	—	—	—	—	—	1	—	1	1	4	2	3	2	3	1	—	1	1	—	—	28·1	
	3	—	—	—	—	—	2	2	4	1	1	—	1	2	4	2	—	1	—	—	—	—	—	26·2	27·4
	4	—	—	—	—	—	1	1	3	1	—	3	—	—	2	5	2	1	1	—	—	—	—	27·6	
	5	—	—	—	—	—	—	—	3	1	1	2	1	3	1	2	2	2	1	1	—	—	—	28·3	
Fifth set	1	—	—	—	—	—	—	1	—	4	1	—	3	4	1	2	1	—	2	1	—	—	—	28·0	
	2	—	—	—	—	—	—	—	2	—	2	2	2	2	1	2	2	5	—	1	1	—	—	29·2	
	3	—	—	—	—	—	1	—	2	—	3	1	6	1	1	2	—	2	1	—	—	—	—	27·4	27·7
	4	—	—	—	—	—	—	—	3	3	3	—	2	4	2	—	—	2	1	—	—	—	—	27·2	
	5	—	—	—	1	—	—	3	—	1	1	3	5	2	2	—	—	1	1	—	—	—	—	26·6	
Sixth set	1	—	—	—	—	—	—	—	—	3	1	4	2	1	2	1	1	3	—	1	1	—	—	27·6	
	2	—	—	—	—	—	1	5	3	2	1	1	1	1	1	2	1	1	1	—	—	—	—	25·6	
	3	—	—	—	—	—	2	1	—	2	2	1	—	1	2	3	6	—	—	—	—	—	—	27·6	27·3
	4	—	—	—	—	—	—	2	—	—	1	2	2	1	1	4	5	—	1	—	1	—	—	28·8	
	5	—	—	—	—	—	1	1	2	3	1	1	1	5	—	2	2	—	1	—	—	—	—	26·9	
Seventh set	1	—	1	—	—	1	1	—	1	—	—	—	4	2	1	1	1	2	4	—	1	—	—	28·5	
	2	—	—	—	—	—	—	—	—	2	1	4	3	1	2	2	2	1	1	—	1	—	—	27·5	
	3	—	—	—	—	—	—	—	2	2	2	5	—	3	1	3	1	1	—	—	—	—	—	26·3	26·9
	4	—	—	1	—	—	—	—	—	1	3	5	3	3	1	1	1	—	—	—	1	—	—	26·1	
	5	—	—	—	—	—	1	—	1	—	1	4	4	4	1	3	—	1	—	1	—	—	—	26·1	
Eighth set	1	—	—	—	—	1	—	—	—	3	1	5	3	2	1	2	2	—	—	—	—	—	—	25·9	
	2	—	—	—	—	—	2	2	4	2	4	1	1	1	1	1	1	—	—	—	—	—	—	25·1	
	3	—	—	—	—	—	1	1	7	—	3	4	1	1	—	1	—	1	—	—	—	—	—	25·2	25·9
	4	—	—	—	—	—	1	1	1	2	4	2	2	—	—	2	1	2	1	—	—	1	—	27·4	
	5	—	—	—	—	—	—	1	2	4	3	3	3	1	—	2	—	1	—	—	—	—	—	26·1	
Ninth set	1	—	—	—	—	1	1	1	2	—	3	2	1	5	1	—	1	2	—	—	—	—	—	26·6	
	2	—	—	—	—	—	—	—	1	3	5	2	2	2	—	1	1	1	1	1	—	—	—	26·3	
	3	—	—	—	—	—	—	—	3	6	3	1	1	—	2	1	—	—	1	1	—	—	—	26·1	26·2
	4	—	—	—	—	—	—	1	3	4	—	1	1	1	2	1	2	2	1	—	—	—	—	26·8	
	5	—	—	—	—	—	—	3	2	2	3	—	3	3	—	2	1	1	—	—	—	—	—	25·4	
Tenth set	1	—	—	—	—	—	—	—	2	7	2	2	2	2	1	—	1	—	1	—	—	—	—	25·1	
	2	—	—	—	—	—	—	5	—	4	3	3	—	1	2	1	1	—	—	—	—	—	—	24·5	
	3	—	—	—	—	1	—	1	—	3	3	4	1	1	1	1	2	1	1	—	—	—	—	26·0	25·2
	4	—	—	—	—	—	—	—	4	3	3	1	3	2	2	2	—	—	—	—	—	—	—	25·2	
	5	—	—	—	—	—	4	—	2	2	2	2	3	1	—	1	1	1	—	—	1	—	—	25·0	
Total ...		3	—	2	5	10	31	49	68	113	101	105	91	88	81	72	71	43	33	20	9	4	1	1305·2	261·0
Percentage		0·3	—	0·2	0·5	1·0	3·1	4·9	6·8	11·3	10·1	10·5	9·1	8·8	8·1	7·2	7·1	4·3	3·3	2·0	0·9	0·4	0·1	26·1	26·1

TABLE II.—SUMMARY OF MEASUREMENTS (IN MICRONS) OF LENGTHS OF 1,000 NON-DIVIDING INDIVIDUALS OF DUTTON AND TODD'S GAMBIA STRAIN OF *T. gambiense* DUTTON 1902.

Sets		Maximum	Minimum	Averages of each 100	Averages of each 20	Range of averages of each 20
First set ...	1 ...	31·5 ...	20·5	24·8	26·2	2·4
	2 ...	30·5 ...	20·5		24·7	
	3 ...	29·0 ...	17·5		23·8	
	4 ...	29·0 ...	19·5		25·1	
	5 ...	30·0 ...	18·0		24·3	
Second set	6 ...	31·5 ...	18·5	25·1	24·5	1·8
	7 ...	31·0 ...	20·5		26·2	
	8 ...	30·5 ...	19·0		25·5	
	9 ...	32·0 ...	19·0		25·2	
	10 ...	30·5 ...	21·0		24·4	
Third set ...	11 ...	32·0 ...	20·0	24·6	24·8	0·9
	12 ...	30·5 ...	20·0		23·9	
	13 ...	30·5 ...	20·0		24·7	
	14 ...	30·0 ...	18·5		24·7	
	15 ...	30·5 ...	15·0		24·1	
Fourth set	16 ...	35·5 ...	15·0	26·3	26·8	2·1
	17 ...	34·0 ...	22·5		28·1	
	18 ...	32·5 ...	21·0		26·2	
	19 ...	33·0 ...	21·0		27·6	
	20 ...	34·0 ...	23·0		28·3	
Fifth set ...	21 ...	34·0 ...	22·5	27·7	28·0	2·6
	22 ...	35·0 ...	24·0		29·2	
	23 ...	33·0 ...	21·5		27·4	
	24 ...	33·0 ...	23·0		27·2	
	25 ...	33·0 ...	19·5		26·6	
Sixth set ...	26 ...	34·0 ...	23·0	27·3	27·6	3·2
	27 ...	31·0 ...	21·0		25·6	
	28 ...	31·5 ...	21·5		27·6	
	29 ...	35·0 ...	22·5		28·8	
	30 ...	33·5 ...	21·5		26·9	
Seventh set	31 ...	30·5 ...	17·5	26·9	28·5	2·4
	32 ...	34·0 ...	23·0		27·5	
	33 ...	31·5 ...	22·5		26·3	
	34 ...	34·5 ...	18·5		26·1	
	35 ...	33·0 ...	21·0		26·1	
Eighth set	36 ...	30·5 ...	19·5	25·9	25·9	2·3
	37 ...	31·0 ...	21·5		25·1	
	38 ...	32·0 ...	21·0		25·2	
	39 ...	36·5 ...	21·5		27·4	
	40 ...	32·0 ...	22·5		26·1	
Ninth set...	41 ...	32·5 ...	20·0	27·0	26·6	1·4
	42 ...	33·0 ...	22·5		26·3	
	43 ...	34·0 ...	22·0		26·1	
	44 ...	33·0 ...	21·5		26·8	
	45 ...	31·0 ...	21·0		25·4	
Tenth set...	46 ...	32·0 ...	22·0	24·2	25·1	1·5
	47 ...	30·5 ...	21·0		24·5	
	48 ...	32·5 ...	19·5		26·0	
	49 ...	29·5 ...	22·0		25·2	
	50 ...	34·5 ...	20·0		25·0	

With regard to these measurements we find that the minimum length is 15·0 microns, the maximum length 36·5 microns, while the breadth varies from 1·5 to 3·0 microns. The average length of 1,000 non-dividing forms is 26·1 microns.

The general appearance of the trypanosome found in these slides may be judged by the photomicrographs which accompany this paper.

Figures 2-4 illustrate Bruce's *Long Type*, and possess well-marked free flagella.

Figures 5 and 6 show the *Intermediate Type* with either a short, stumpy, or no flagellum. Figure 7 illustrates the *Short Type*, and happens to possess a minute free flagellum, though other short forms, not so suitable for photography, show no flagella.

The trophonucleus will be observed to be situate about the middle of the body, and in no case have we seen it in a posterior position. The kinetonucleus is well marked, being situate at a slight distance from the posterior end, and just in front of it, in some individuals, lies a vacuole.

Comparisons.—We are now in a position to compare the above measurements with those given by:—

(1) Dutton for the original strain.
(2) Bruce for the Uganda strain.
(3) Stephens and Fantham for the Congo strain.
(4) Ourselves for the Lado strain.

Name of strain	Origin	Maximum length	Minimum length	Average length	Curves of length
Mr. Q.	Rat	36	15	26·1	Chart 1
Original from Mr. K.	Human	25	18	22	—
Uganda	Human and several animals	33	13	22·1	Chart 2
Congo	Rat	36	16	24·8	Chart 3
Lado	Monkey	36	18	25·0	Chart 4

There is a remarkable similarity between Mr. Q.'s, the Congo, and the Lado strains, and there is a general likeness between these and the Uganda strain, except that it is about 3 microns less in length, a difference for which we offered an explanation in our previous note and need not repeat here.

With regard to the original strain the measurements are, of course, based on only a few and not on 1,000 non-dividing individuals, as the trypanosomes are but few and far between in human blood.

After comparing the measurements of Mr. Q.'s strain with those from Uganda, the Congo, and the Lado (Yei), we are of the opinion that no essential difference can be discovered morphologically

TABLE III.—ONE THOUSAND INDIVIDUALS OF DUTTON AND TODD'S GAMBIA STRAIN OF *Trypanosoma gambiense* DUTTON 1902 ARRANGED IN BRUCE'S THREE GROUPS.

Bruce's Groups	1	2	3	4	5	6	7	8	9	10	Totals	Percentage
Stumpy: 13-21 microns ...	23	16	24	6	4	2	5	5	6	11	102	10·2
Intermediate: 22-24 microns	27	31	31	22	25	19	19	31	35	40	280	28·0
Long: 25 microns and upwards	50	53	45	72	71	79	76	64	59	49	618	61·8
Totals	100	100	100	100	100	100	100	100	100	100	1,000	100·0

between these four strains, and therefore conclude that they are one and the same species of trypanosome, viz., *Trypanosoma gambiense* Dutton 1902.

In 1915 Da Costa, Sant' Anna, Dos Santos, and Alvares stated that they had met with a form of *T. gambiense* in the island of Principe *which*

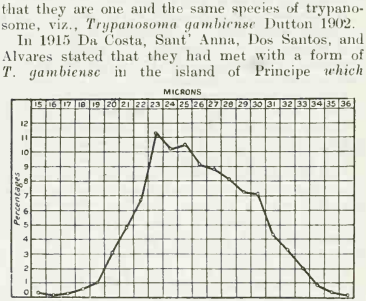

CHART 1.

Dutton and Todd's Gambia strain of *T. gambiense*. Graphical representation made by ourselves of 1,000 non-dividing trypanosomes from one rat inoculated from Mr. Q.

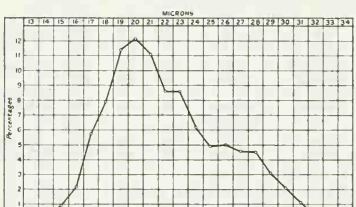

CHART 2.

Sir David Bruce's Uganda strain of *T. gambiense*. Graphical representation of 1,000 non-dividing trypanosomes in man and various animals.

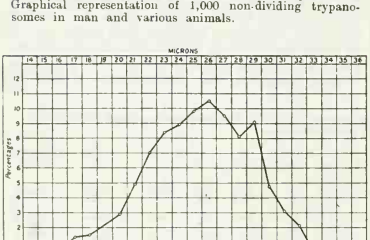

CHART 3.

Stephens and Fantham's Congo strain of *T. gambiense*. Graphical representation of 1,000 non-dividing trypanosomes in one rat.

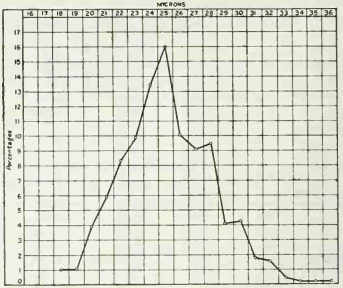

CHART 4.

Our own Lado (Yei) strain of *T. gambiense*. Graphical representation of 1,000 non-dividing trypanosomes in one monkey.

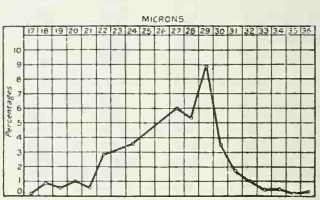

CHART 5.

Da Costa, Sant' Anna, Dos Santos and Alvares' Principe elongated strain of *T. gambiense*. Graphical representation of 500 trypanosomes in the rat.

removed itself sensibly from the classic form. They did not characterize this parasite as a distinct species because of the variability of *T. gambiense*, but regarded it as a local elongated variety possessing marked dimorphism, and gave it the name of *T. gambiense* var. *longum*.

It possessed forms of unusual length, with long, free flagella, and also short, thick forms either without free flagella, or with only rudiments thereof.

The long forms measured between 25 and 39 microns in length, while they were about 1·5 microns in breadth.

The short forms measured from 16-22 microns in length, and generally 2 microns; very rarely more than 2·5 microns in breadth.

The trophonucleus in the long forms was placed approximately at the junction of the posterior third with the anterior two-thirds of the long axis, while in the short forms it was situate approximately halfway along that axis, but forms with a posterior nucleus were not observed.

If these descriptions are compared with our remarks concerning Dutton and Todd's Gambia

strain from Mr. Q. they will be observed to be very similar, especially as the dimorphism of the Principe strain is also a marked feature of the Q strain.

We notice that Da Costa and his collaborators only compared their measurements with those given by Sir David Bruce for the Uganda strain, which are shorter than those given by Stephens and Fantham for their Congo strain, and by ourselves for the Lado (Yei) strain, while they are also shorter than those just given before for Dutton and Todd's Q strain.

It appears to us to be necessary to compare the Principe strain with the Q, the Congo, and the Lado strains, and this can be done by examining the following table :—

Name of strain	Origin	Maximum length	Minimum length	Average length	Curves of length
Principe	500 in rats and 500 in guinea-pigs	39	16	28·5	Chart 5
Q.	1,000 in a rat	36	15	26·1	Chart 1
Congo	1,000 in a rat	36	16	24·8	Chart 3
Lado	1,000 in a monkey	36	18	25·0	Chart 4

The maximum length of the Principe strain is 3 microns longer than Mr. Q.'s strain, the Congo strain, and the Lado strain, while Sir David Bruce's Uganda strain is 3 microns shorter than these strains.

There is, however, one important point to be noted, which is that great care was taken to measure only *non-dividing* forms in figures given for Mr. Q.'s, the Congo, the Lado, and the Uganda strains, while Da Costa and his collaborators state :—

" Making use of the parasites of the rat and of the guinea-pig as the type, let us point out in the first place the absence of protoplasmic granulations in these lengthened forms and the *great frequency of figures of division*."

Further, we have not observed that they anywhere state that they only measured non-dividing forms, and if by any chance trypanosomes with a partially divided kinetonucleus were measured, then greater lengths would be found than those included in Mr. Q.'s and the Lado representations, though we could easily have exceeded our maximum if we had measured these forms.

Still we are of the opinion that we ought to assume that Da Costa and his collaborators only measured non-dividing forms and to attempt an explanation on this assumption.

We note that in Mr. Q.'s strain and in the Principe strain a well-marked vacuole lay just anterior to the kinetonucleus, and we also note that in neither were posteriorly placed trophonuclei found.

To make comparison easier we reproduce the following table from our previous paper, with the addition of Mr. Q.'s strain and the Principe strain, as observed in guinea-pigs and rats :—

Name of strain	Short, stumpy, 18-21 microns	Intermediate 22-24 microns	Long and slender 25 microns and upwards
Principe	6·5	11·0	82·5
Mr. Q.	10·2	28·0	61·8
Lado	11·8	31·4	56·8
Congo	18·2	27·0	54·8
Uganda	51·2	23·1	25·7

When the two extremes, viz., the Principe and the Uganda strains alone are compared, as was done by Da Costa and his collaborators, a considerable difference is noted, but the other strains form a series connecting the two extremes.

If a table is constructed to illustrate the same points with regard to the Principe strain in a monkey, and if this is compared with the Lado strain as seen in a monkey, the following is the result :—

Name of strain	Short, stumpy, 18-21 microns	Intermediate, 22-24 microns	Long and slender, 25 microns and upwards
Principe	30·6	17·8	51·6
Lado	11·8	31·4	56·8

Here we see that the position is actually reversed, and that the Lado strain contains slightly more long forms and far less short forms than the Principe strain, and thus annuls any length difference which may have been apparent in the forms observed in the guinea-pigs and rats, and, moreover, makes it possible that the apparent difference is open to the same explanation as that which we gave in our previous paper with regard to the shortness of Sir David Bruce's Uganda strain.

When the above figures and the graphical representations set forth in the charts are examined, it will be observed that they indicate that the number of intermediate forms is less in the Principe than in the Q, Lado, and Congo strains.

It will also be noticed that the same difference exists, though to a less extent, between Sir David Bruce's Uganda strain and the Q, Lado, and Congo strains, and is probably unimportant from a specific point of view, depending possibly upon some unknown factor in the life-cycle of the trypanosome in the mammal.

Da Costa and his collaborators draw attention to the fall in length in animals other than rats and guinea-pigs, and state that in the dog, cat, monkey, and civet cat, the forms having dimensions over 30 microns diminish in frequency and those over 35 microns become rare.

Finally, we invite attention to the great length of the trypanosome depicted in fig. 1 which represents an individual found in the slides labelled as coming from Dutton's first case of Human Trypanosomiasis, *i.e.*, from the late Mr. Kelly.

After considering all these points we have arrived at the decision that there is no essential difference between *T. gambiense* Dutton 1902 and *T. gambiense* var. *longum* Da Costa, Sant' Anna, Dos Santos, and Alvares.

Conclusions.— In the conclusions which we drew at the end of our previous paper we wrote as follows :—

" There being no data, that we know of, to

compare these strains with *T. gambiense* Dutton 1902 we are of the opinion that, at all events provisionally, it would be safer to keep the name *Trypanosoma castellanii* Kruse 1903 for these strains until more light is thrown upon the complicated problem of: What is *Trypanosoma gambiense* Dutton 1902?"

We now consider that the measurements given above afford sufficient evidence to conclude that the causal agent of sleeping sickness in Uganda, the Congo, the Lado of the Anglo-Egyptian Sudan, Principe, and the Gambia belong to one and the same species, viz., *T. gambiense* Dutton 1902.

Acknowledgments.—It is not possible to conclude this paper without again expressing our thanks to Professor Todd for his great kindness and generosity in lending these valuable slides to us.

Khartoum,
March 2, 1916.

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ILLUSTRATIONS.

A. Photomicrographs.

Fig. 1.—Long form of *T. gambiense* from the original Gambia case, Mr. K., discovered by Dutton. × 1,200 diameters.

Figs. 2-4.—Long forms of *T. gambiense* from a rat inoculated from the second Gambia case, Mr. Q., found by Dutton and Todd. × 1,200 diameters.

Figs. 5-6.—Intermediate forms of *T. gambiense* from the same rat as figs. 2-4. × 1,200 diameters.

Fig. 7.—Short form of *T. gambiense* from the same rat as figs. 2-6. × 1,200 diameters.

B. Charts.

Chart 1.—Dutton and Todd's Gambia strain of *T. gambiense*; made by ourselves.

Chart 2.—Uganda strain of *T. gambiense*; made by Sir David Bruce.

Chart 3.—Congo strain of *T. gambiense*; made by Stephens and Fantham.

Chart 4.—Lado (Yei) strain of *T. gambiense*; made by ourselves.

Chart 5.—Principe elongated strain of *T. gambiense*; made by Da Costa, Sant' Anna, Dos Santos and Alvares.

DEATH.

G. Beatty, M.B., C.M.Edin., Medical Officer, Nigeria.

We congratulate Professor Fleming Mant Sandwith, M.D., F.R.C.P., at present on the Consultant Military Medical Staff in Egypt, upon his being decorated C.B.

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SLEEP.

Much is being written in several quarters just now upon sleep and its disorders. It has formed a theme of philosophers, doctors, scientists of many pretensions, and of daily conversations from time immemorial until the present day. Physiologists have experimented in the matter of sleep, and given us dissertations of more or less value on the subject; but it must be confessed we are but little advanced

THE ORIGINAL GAMBIA STRAINS OF TRYPANOSOMA GAMBIENSE DUTTON 1902.

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4

LONG FORMS.

FIG. 5.

FIG. 6.

INTERMEDIATE FORMS.

FIG. 7.
SHORT FORM.

To illustrate paper, "Measurements of Dutton and Todd's Gambia Strain of *Trypanosoma gambiense* Dutton 1902," by ALBERT J. CHALMERS, M.D., F.R.C.S., D.P.H., and Capt. W. R. O'FARRELL, R.A.M.C.

in our knowledge, and it would seem as though everyone is a rule unto him or her self. Light sleepers and heavy sleepers are with us; advocates of short time and of long time spent in sleep have each their supporters, and the arguments are interminable. To reduce the subject to some kind of formula is a matter of difficulty and perhaps one impossible to frame, yet there are really some broad rules to be deduced from the wisdom of the ages.

Age.—Were one to attempt to state a general rule, it would appear that the hours necessary to spend in sleep diminish from birth to old age. The newly born infant may be said to sleep well-nigh continuously, and even up to three months old it spends some twenty hours out of the twenty-four in sleep, and from hence up to 2 years of age sixteen to eighteen hours are spent in sleep. Between the 2nd and 5th years twelve hours, and from the 5th to the 12th year ten hours are usual. From the 12th to the 20th year nine hours are required, for this is the period of growth, and naturally a full amount of sleep and rest is necessary. Later on in the most active time of life, between the 21st and 55th year, from seven to eight hours are requisite; but afterwards, from the 55th year to old age, five to seven hours are all that are possible. In very old people a soporific state may prevail, which shows itself in short naps during both day and night.

TABLE OF HOURS NECESSARY TO SLEEP AT DIFFERENT PERIODS OF LIFE.

Age	Sleep required
Newly born	Seldom awake.
1-3 months	20 hours.
4-12 ,,	18 ,,
1-2 years	16 ,,
3-5 ,,	12 ,,
5-12 ,,	10 ,,
12-20 ,,	9 ,,
21-35 ,,	8 ,,
35-55 ,,	7 ,,
55-65 ,,	6½ ,,
65 onwards	5½ ,, or less.

The causes of variation in length of sleep taken or required are many.

Ventilation.—An ill-ventilated room is one of the chief causes of disorders in sleep. A close room may do one of four things: it may prevent falling to sleep, or, on the other hand, it may induce sleep rapidly; it may cause a person to wake up after sound sleep for an hour or two and prevent further sleep; or it may cause deep sleep continued for an indefinite period until, in fact, the sleeper is called or roused from bed. A close room means one in which the atmosphere is saturated by carbonic acid gas, which is prevented from escaping owing to lack of ventilation. The only way for each individual to acquire an exact knowledge of how many hours he personally requires is to sleep in the fresh air. This is approximated in well-ventilated tents in summer time, and is actually achieved in a hut with one side removed, as in the open-air treatment for tuberculosis. It will be found in such cases that the time required for sleep can be gauged to minutes, or even to seconds. A man may find that, taking a month's average, he sleeps nightly 7 hours 5 minutes and 20 seconds when sleeping in a tent with the curtain up and door open, or in a hut with one whole side removed. Again, in a hivouac is the time less, when the average is reduced in the case of the same individual to six hours; so as sleep in a house is to a tent or hut, so are the latter to the bivouac, and the proportion in each case would be as eight (house) to seven (hut or tent) to six (bivouac). The house, the tent, and even the bivouac, are presumed to be well ventilated, for even a bivouac may be ill ventilated, as in the case of the Arab, who, as he lies down in the sand after having scooped a depression for his pelvis and made a heap of sand as a pillow for his head, wraps himself up in the ample mantle he constantly wears so that his head is completely enveloped, and the escape of carbonic acid gas and the entrance of air around his head depend on the texture of the enveloping garment. The difference, therefore, between the time spent in sleep in an ordinary bedroom and that spent in the open air, as in hut, tent, or hivouac, denotes the amount of extra sleep a close atmosphere entails; and if this is the case in a so-called well-ventilated bedroom, the effect of a badly-ventilated room on the sleep and health of the individual can be imagined.

Quality of Sleep.—Light, sound, and deep sleep are common terms applied to different kinds of sleep. Some advocate that two to three hours' very sound sleep are better than four to six hours' light sleep. It would appear as if the soundest sleep was obtained during the first two to three hours after going to bed, and that after that the sleep is lighter. Whether the recuperative effects of sleep are proportionate to its relative depth or lightness is doubtful, but it would seem probable that the depth of the sleep should be the better restorer.

Observers, such as Dr. G. Wiln Robertson, maintained that insomnia is not so terribly pernicious in its effect as one is apt to believe, but that rest is the great thing. Dr. Robertson's words are: "Insomnia is said to cause exhaustion. It has been the writer's observation that in the absence of fear, morbid anxiety, and loss of the attentive control as associated with insomnia there is no exhaustion. He has not seen a case of nervous or mental exhaustion result from uncomplicated insomnia. He points out that the patient's idea that he cannot sleep becomes an obsession; he broods over this one thought so that nothing else can make any impression on his mind, and as his memory goes he cannot fix his attention on any subject. The writer believes that if we would explain to our patients that they go to bed to rest and not to sleep, and that if they rest quietly throughout the night they can accumulate a store of nerve energy for the stress of the following day even though they do not sleep, but if they retire with the idea of resting and not sleeping, sleep will come to them unsought."

Too much Food.—This is a well-known factor in producing insomnia. Late suppers or going to sleep too soon after a full meal is always followed by some disorder. Although the sympathetic system of

nerves are presumed to act during sleep, it would appear as if it were necessary that some cerebral function co-operates with the sympathetic during digestion, or that the sympathetic system does function less completely during sleep. According to the neuron theory (Duval and Cajal), it is believed that the dendrites of the cortical cells contract, and there arises thereby an interruption of their connection with the cells which receive in the cortex the sensory impressions. This, it may be stated, is a belief or a suggestion, not a proved fact. The character of sleep when the stomach is full is heavy and the state of unconsciousness very deep, and after one or two hours wakefulness succeeds which is apt to be prolonged.

Too little Food.—More people suffer from insomnia from too little than from too much food: moreover, sleep to starved persons is not a refreshing sleep, and is followed on waking by a state of apparent physical fatigue which is difficult to rouse oneself from. Want of sufficient food will induce fatigue under which one may fall readily asleep, but the craving of the stomach, especially in dyspeptics with an irritable mucous membrane, will after a time cause wakefulness, which it is difficult or impossible to overcome. Under such circumstances the best hypnotic is food; a glass of milk or of water and a biscuit or bread and butter will often induce sleep when drugs fail, or if they do not fail, soporifics once taken may induce a habit difficult to get rid of. The wise practitioner is aware of the effect of food taken during the night as a means of re-inducing sleep, and never fails to advise his patients on these lines.

In the Tropics sleep is often a trouble, and the practitioner is constantly brought face to face with insomnia amongst his patients. The condition may become so acute that nothing but a change will do good; and it not infrequently happens that long leave to Europe is necessary. A lowered vitality due to insomnia will pave the way to inroads of disease which, especially in the Tropics, is ever ready to develop. There is not much to learn from any discussion on sleep that we are acquainted with. In disease drugs are and ought to be resorted to, but in a general way, in cases short of actual disease, they are not to be commended.

"The habit" is so dreaded that the doctor is afraid of advising drugs, although he well knows that his patient's condition is a temporary one and drugs would do no harm, could they be administered without the patient knowing. Were 5 gr., or even 2½ gr. of Dover's powder, taken when a wakefulness due to fatigue, want of food, worry, &c., occur sleep or restfulness speedily ensues, and a great disturbing factor and producer of illness is overcome. Than Dover's powder there is no better way of inducing sleep amongst the many preparations of opium; morphia, codeia and other alkaloids are disappointing; opium itself, not its derivatives, is *the* best of soporifics, and in the form of Dover's powder we have yet a better preparation than when opium by itself is given in either solid or liquid form.

Annotations.

Suggestions and Technique in Surgery of the Large Intestine.—Schoemaker (*Archiv für klin. Chir.*, vol. cvii, Part II) first speaks of the ileus of old people which simulates true obstruction. He reports three cases operated by himself in which no pathology was found. There was in the colon a collection of fluid and gaseous material which he drained off by means of a small tube (a catheter, size 24, Charriere); one case died as the result of operation, but the other two recovered with good function. He could find little in the literature about this subject, and does not agree with Nothnagel, who says that such cases should be treated by medical measures.

Schoemaker then reports two cases of perforation of appendices epiploicæ. In both the symptoms were left-sided; at operation the perforations were hard to find because of their fine calibre.

To the technique of resection of the large intestine he contributes this manœuvre. In order to avoid leakage of colonic contents he circumcizes the gut, strips back the serosa and muscularis, and applies a special clamp to the cuff of mucosa which is left. The mucosa is cut between clamps with the cautery; this process is repeated at the other end of the segment to be removed, and after its removal the two ends are brought together. The suture is applied through all coats before the clamps are removed. The writer warns against roughness in the handling of the clamps, as in this way the mucosa may tear and the purpose of the technique destroyed.

Operating during the Puerperium.—Hussey (*Amer. Journ. Obstet.*, June, 1916) reports a series of forty cases in which plastic operations for the repair of old lacerations of the cervix and perineum were done during the puerperium. This procedure was originally advocated to save the time of patients who would otherwise be unable to enter a hospital for subsequent repair. In the series of cases reported there were no fatalities, no important complications, and excellent plastic results in the majority of the cases. The author believes this procedure justifiable and worthy of further trial under the following conditions:—

(1) That the patient has lesions that are causing or will cause trouble, and are of a nature amenable to relief by the operative procedures which may be instituted at this time.

(2) That the patient's social or financial condition is such that she is unable to choose the time for her operation.

(3) That the recent labour shall have been uncomplicated and conducted under aseptic conditions.

(4) That the puerperium up to the time of operation shall have been normal.

(5) That the patient can have the benefit of the same degree of operative skill and judgment which she would get in the gynæcological operating room.

Life-history of Ascaris lumbricoides (F. H. Stewart, *British Medical Journal*, July 1).—The life-history of *Ascaris lumbricoides* presents an alternation of hosts. Eggs develop mature embryos in the outer world in a damp atmosphere, preferably at a temperature of from 25° to 30° C. When ripe eggs reach the alimentary canal of the rat (*Mus decumanus*) or mouse (*Mus musculus*) they hatch. The larvæ liberated enter the bodies of their host, a few only escaping in the fæces. Between four and six days after infection they are found in the blood-vessels of the lungs, liver, and spleen. The host is seriously ill with symptoms of pneumonia. On the sixth day they have passed from the blood-vessels into the air vesicles of the lung, causing hæmorrhage into them. On the tenth day they are found only in the air vesicles of the lung and in the bronchi. If the disease does not prove fatal the host recovers on the eleventh or twelfth day. On the sixteenth day the host is free from parasites.

It is obvious that the transfer of the parasite from the bronchi of the rat and mouse to the intestine of man and of the pig could be readily effected. The intermediate host might readily contaminate the food of the definitive host or the dust and earth of his surroundings.

Nervous Diabetes (Silvestri, *Riforma Medica*, March 13).—In a case of diabetes in which there were no pathologic anatomic findings capable of explaining the diabetes nervous origin is assumed, as the neurasthenic man of 53 had a family history of much nervous and mental disease.

Four other cases also apparently confirm the nervous origin of diabetes. One patient was a neurasthenic man with inherited psychopathie taint whose urine was found to contain sugar after a period of much worry. The urine after a medical examination always contained sugar. In the course of a few years the neurasthenia subsided, and the urine became normal. At present there is no further trace of the neurogenous "diabetes" of eight years before, although no attempt at dietetic treatment had been made. Another patient was a woman with a family history of diabetes. After an attack of pneumonia she had mild glycosuria, which yielded promptly to restriction of carbohydrates until her son developed typical diabetes, which ran its course to a fatal ending in three years. After this the mother's glycosuria became permanent, unmodified by dietetic measures. In the two other cases the glycosuria came on directly after a severe grief or fright. These experiences testify that diabetes may occur for the first time or be roused or aggravated by nervous shocks.

Treatment of Traumatic Detachment of the Retina (Bonnefon, *Bulletin de l'Académie de Médecine*, May 12).—Detachment of the retina following a trauma is relatively harmless in comparison to that of endogenous origin. The condition is indispensable, however, that treatment be applied at once. The retina loses its vitality so rapidly after detachment that it must be restored to place on the spot. By the time the man reaches the base hospital the retina is injured beyond repair. He has cured completely three cases of extensive detachment of the retina with reduction of vision to perception of light. The rectus muscles are cut as for an advancement operation. The region of the equator thus exposed is punctured deep at one or two points with the fine tip of the actual cautery at red heat. Two stitches are taken, including musele, aponeurosis, and conjunctiva, to repair the breach, then absolute rest in bed, immobilization and atropin. The suture threads are removed the fifth day, and a few sub-conjunctival injections of saline after the eighth day may aid. In one case vision had been reduced to perception of light, but by the sixth day there was no visible trace of the detachment and visual acuity was $\frac{3}{10}$, and became finally $\frac{8}{10}$, and has persisted unimpaired during the three months since. This ignipuncture is also useful in treatment of contusion of the eyeball with intra-ocular effusion. It promotes absorption of an effusion either on the retina or in the vitreous body. In conclusion, promptness is important; treatment of detachment of the retina is the only intervention on the eyes which should be undertaken at the front.

Contribution to the Study of Adiposis Dolorosa.—P. G. Pizarro (*Semina Medica*, No. 13, 1916) summarizes the history and literature of Dercum's disease, and describes a case which seems to throw light on its etiology and treatment. His patient was a woman, aged 52, who had menstruated early and borne a child young. The child died in two hours, and there has been no pregnancy since except one possible early abortion. At 46 the first sign of the adiposis dolorosa developed, and menstruation ceased at 48. At the age of 52 the disease, in the mixed form of adiposis, was extreme, as also the pains, but the urine was normal. On one occasion the repeated Wassermann test elicited a positive response, and on the basis of the single Wassermann reaction vigorous mercurial treatment was applied, and improvement was promptly evident. The blood findings on repeated examination confirmed the clinical improvement. The masses of adipose tissue retrogressed almost entirely. The patient had no further spontaneous pains, and instead of the huge unwieldy adipose, she became thin and alert. She had been given ovarian treatment at first, and this was kept up with iodide after suspension of the mercurial treatment. Is it possible that adiposis dolorosa is of syphilitic origin? Has syphilitic treatment been tried before in this disease? If it has been tried, and no benefit resulted, could this have been owing to inadequate dosage or other defective technique? In this case were the adiposis dolorosa and the syphilis independent or not of each other? Is it not a common

occurrence that syphilis aggravates dystrophies and other manifestations of defective functioning of the ductless glands?

Neuritis of the Sympathetic (*Presse Médicale*, April 20).—The burning type of neuralgic pain has certain features which suggest that it is the result of irritation at some point of the sympathetic innervation of the limb involved. The most convincing argument in favour of this assumption is the success of therapeutic measures based thereon, aiming to modify the peripheral sympathetic. The sympathetic is stripped from the peripheral arteries, supplementing this by severing the perivascular nerves and, when possible, removing the entire sheath of the vessel over a certain extent.

In one case of agonizing neuralgia from a gunshot wound, the humeral artery was denuded and its sheath excised for 12 cm. Improvement followed at once. The pains were materially reduced, the vasomotor phenomena subsided, and the relief has been permanent. In a second case there was complete paralysis of the left arm after a gunshot wound with fracture of the clavicle. The arm was constantly cold and various trophic disturbances developed, with paroxysms of burning pain in the hand. The neuralgia by the sixth month was most distressing. The humeral artery had no pulse or blood in it, and was reduced to a cord scarcely 2 or 3 mm. in diameter. The neighbouring nerves were soft; the arterial sheath was removed for a distance; there was no hæmorrhage. The next day there was formication in the hand and it felt warmer. The trophic blisters and other disturbances retrogressed, and in a fortnight the man could move his arm a little. The pains had been materially mitigated from the first.

The resection of the arterial sheath modifies the perverted sympathetic innervation by acting on the peri-arterial nerve plexuses involved. The mechanism and effect are similar to those of section of the cervical sympathetic in treatment of trigeminal neuralgia: suppression of certain diseased elements of the sympathetic innervation restores freedom of action to the other vasomotor ramifications. In both cases the clammy, livid hand grew warm and normally pink, showing that the upset vasomotor balance had been restored.

This method of treating the peri-arterial sympathetic will relieve in many cases of sympathetic neuritis causing painful vasomotor troubles, especially after wounds of the hand and forearm in which the trunk nerves themselves are free from all injury. Possibly the procedure may benefit also certain cases of reflex contracture and paralysis suggesting a vasomotor element.

Experimental Investigation on Diarrhœa and Vomiting of Children (E. Mellanby, *Quarterly Journal of Medicine*, London, April).—The results obtained in this research from a practical point of view are as follows: First, as regards the absorption of toxins from the intestine: There is a marked delay in the absorption of toxic substances, normally in the intestine, when animals are injected with large quantities of fluid. Water in the intestine delays the absorption of toxic substances. During the digestion of foodstuffs generally, meat, milk, sugar and fat, there is a delay in the absorption of toxic substances. The presence of bile in the intestine delays the absorption of toxic substances. Magnesium sulphate, of a concentration of 2 per cent or over, delays the absorption of toxic substances from the intestine. A less concentration of magnesium sulphate has no effect. Morphine, below the point of being a serious menace to the respiratory centre, has no effect on the absorption of toxic substances. Secondly, as regards the resisting power of the animal toward absorbed toxic substances: The resistance of an animal against toxic substances is very greatly increased by the injection of fluid into the circulation. An animal with a diminished amount of fluid, and particularly after the loss of a small amount of blood, has little power of resistance against toxic substances. An animal's resistance is greatly increased after it has absorbed from the intestine food, and more particularly meat. During the digestion of fat, toxic substances absorbed from the intestine have a diminished action, at least for some hours. Clinically, a child suffering from diarrhœa and vomiting owing to loss of fluid, loss of bile salts, with an empty intestine, and in a starving condition is in an ideal position for allowing toxic substances normally present in the alimentary canal and mucous membrane to be rapidly absorbed and have their full toxic action. The association of this disease with a high atmospheric temperature in an epidemic form is to be explained largely by the additional loss of fluid due to evaporation of water, whereby the child keeps down its body temperature. Hence, of all treatment in this condition, the one thing essential is to get the volume of body fluids of the child back to normal or above normal by intravenous or subcutaneous injection of saline solution.

Abstracts.

RECENT PROGRESS IN THE OPERATIVE TREATMENT OF EMPYEMA OF THE THORAX.[1]

By H. Lilienthal and M. W. Ware.

General Management of the Cases: X-ray.—With few exceptions all patients were examined with the aid of the Röntgen plate or screen, and this is of incalculable value in selecting the type of operation. Also, some interesting observations have been made in the course of these radiographic studies. In the encapsulated cases, and also in the more chronic general empyemata, the affected side is apt to show contraction of the chest instead of distension, the ribs being closer together than on the healthy side. This appearance has often been accompanied by the presence of tough peripleuritic confining mem-

[1] Abstracted from *Medical Record*, July 15, 1916.

branes, so that at operation the lung did not expand and required mobilization by the division or removal of the exudate.

Encapsulation is often beautifully demonstrated so that the most favourable point for drainage can be determined before the operation. Two distinct sacs containing pus of different appearance and consistency would have been overlooked without the X-ray. Secondary collections of pus have been demonstrated after the first operation and these sacs emptied promptly because of the accuracy of their localization. In two cases the secondary abscess was in front, on the right side close to the mediastinum near the base of the heart. They were evacuated from the front with the greatest ease and precision.

During convalescence the degree of pneumothorax can be made out and its gradual disappearance observed. The presence of areas of consolidation can sometimes be determined in cases in which there is doubt between residual empyema and pneumonia. Without the Röntgenogram unnecessary and possibly dangerous punctures would have been made. In two instances the X-ray enabled the diagnosis of foreign body in the lung or trachea to be made when clinically the case appeared to be one of atypical empyema. These patients were bronchoscoped and the foreign bodies removed. In one case pneumonia and pneumothorax were demonstrated after puncture made outside the hospital had yielded a few drops of pus, the patient being admitted for the treatment of empyema. There was no empyema, and the patient recovered without thoracotomy.

This list comprises a few of the possibilities of X-ray diagnosis in empyema. The question of intrapulmonary disease is not here gone into.

Diagnostic Puncture.—After study of the physical signs and the radiograph the final proof, that of the aspirating needle, should not be made until the patient is on the operating table or within a few hours of operation. Repeated puncture several days before the operation may do harm. For example, some cases suffered from spreading infection of the tissue planes of the thoracic wall as the result of needle punctures. This, to be sure, is often a danger avoidable by early operation and by Röntgenography before the aspiration. The danger of puncture is much greater in lung abscess in which it is absolutely contraindicated.

Most of the patients had been punctured before they entered the hospital, and came with the established diagnosis of endothoracic suppuration. These patients, however, were X-rayed just the same, unless their condition was so precarious that immediate relief was demanded.

Anæsthesia.—When the empyema is secondary to pulmonary disease, as is usually the case, ether should be avoided because of the possibility of its irritating action upon the lungs. Therefore, employ either local, regional, or nerve-blocking anæsthesia, or nitrous oxide and oxygen narcosis.

Selection and Type of Operation.—To obtain a final cure an active pneumonia, a perforating subphrenic abscess, hepatic or other, or an infecting bronchiectasis, might require medical or surgical treatment more than the consequent empyema; yet a patient coming to the hospital cyanotic and gasping, the heart embarrassed by dislocation, had to be immediately relieved. His complete restoration might be a matter for later consideration. Accordingly, these cases were treated by minor thoracotomy.

(1) *Minor thoracotomy*—except for its name—is nothing new. The procedure is described as follows:—

Under local anæsthesia a small incision is made, preferably in the seventh or eighth interspace, in the posterior axillary line, and carried through the pleura. The ribs are separated by spreading the blades of a dressing forceps or a pair of scissors and a small tube is slipped into the chest. Or, after the short skin incision, a trocar and cannula are made to enter the pleura, and a drainage tube is pushed through the cannula, which is then withdrawn, leaving the tube in place. There are various devices to prevent pneumothorax. We have found the simplest to be a permanent syphon to keep the tube full of fluid and so arranged that the level of the liquid in the water supply bottle is lower than the patient's chest, while the tube leading from the chest has its end submerged in weak antiseptic fluid in a vessel on the floor.

In favourable cases this operation is all that will be necessary. The lung expands, the discharge lessens, and recovery follows.

During the two years twenty-four cases were operated on by this method with four deaths, or 16 per cent. These deaths were due to pneumonia or general severe sepsis—often with persistent diarrhœa—median suppurative otitis and metastatic abscesses, the patients being in too low a state for more thorough surgical work.

When these minor thoracotomy patients were improved but showed no sign of prompt healing, they are suitable subjects for major thoracotomy. This operation, however, was performed at the first sitting whenever the case did not look absolutely desperate.

(2) *Major Intercostal Thoracotomy with Exploration and Lung Mobilization.*—(The procedure has been described in an article by Lilienthal, *Ann. Surg.*, September, 1915.) Briefly, the steps of the operation are as follows: (*a*) Skin and muscle incision in the seventh or eighth interspace. Line of incision from the angle of the ribs to the anterior axillary line, more or less, and close to the upper border of the lower rib, to avoid nerves and vessels. (*b*) Pleura entered carefully to avoid possibly adherent lung. (*c*) Rib retractor inserted and the ribs separated from 4 in. to 6 in. or more. If still greater room is needed cut a rib or two above or below the wound at the posterior angle. (*d*) Exploration. Removal by suction or sponging, of all pus and coagula, then inspection and palpation of lung and pleura.

Adhesions to the chest wall should not be disturbed unless they separate easily. If the lung expands and fills the chest when the patient strains, and if no sign of lung abscess or fistula is present,

the soft parts of the wound may be approximated with chromocized gut and the skin partly closed by suture.

Because of the division of the intercostal muscles the ribs will not at once fall together. There will be a space of 1½ in. or more (in adults) which will persist for some days. Drainage openings of suitable size anteriorly or posteriorly or both may be left, but it is not often necessary to put in tubes or gauze. Should an inoperable pulmonary suppurating lesion be encountered—bronchiectasis or lung abscess—it is better to resect a piece of rib with the periosteum so as to permit of long-continued drainage without a tube, and without the danger of valve formation and tension pneumothorax.

If the lung is bound down by tough exudate upon the pleura this should be divided by a long vertical incision, when the lung will usually try to force its way out of its confining membrane. Peeling this away with the fingers, the lung may be further freed by incisions at right angles with the first one. Hæmorrhage is moderate, often absent. A slight wound of the lung tissue is not serious. Tough adhesions of the lung to the chest wall had better not be disturbed unless they are capable of being divided between ligatures. The loose flaps of membrane peeled from the lung may be cut away, but there should be no special effort made to denude every portion of the lung's surface.

During the procedures just described secondary abscesses may be found and turned into the main cavity. Sometimes the lower lobe of the lung is adherent to the diaphragm. This adhesion should be loosened with the greatest caution for fear of entering the abdominal cavity. We have several times encountered between lung and diaphragm collections of pus which must have caused serious complications had they not been emptied.

Having mobilized the lung the wound is closed with tubeless drainage, as just described.

This mobilization and exploration through the large incision—or major thoracotomy—is not advised as a primary procedure for the desperately ill patients. It should follow minor thoracotomy, the operation for immediate relief. Doubtless, in cases without confining membranes one of the various suction apparatuses with a fixed paracentesis cannula will prove efficient.

Of twenty-six major thoracotomies with five deaths, or 20 per cent., the fatal endings may be classified as follows:—

(1) A. S., man, aged 35 (one stage), gangrenous pleurisy.

(2) Bessie T., girl, aged 3½ (one stage), pneumonia, six weeks after operation.

(3) O. W., man, aged 55 (two stages), sepsis (X-ray, suspicious of tuberculosis, but the pus showed the pneumococcus).

(4) N. T., boy, aged 2 (one stage), sepsis; diarrhœa.

(5) L. C., girl, aged 1 (two stages), pneumonia; sepsis.

The operation gives a far better opportunity than any other for thorough exploration and rational treatment. Pockets of pus are discovered which could not otherwise be found. In two cases subphrenic abscesses—evidently the determining cause of the empyema—were discovered, though in both instances the patients died weeks afterwards of the pylephlebitis with the liver abscess which caused the empyema.

During the after-treatment it is easy to explore the chest digitally when retention is suspected, or, if necessary, to reopen the whole wound for more thorough visual examination.

This operation secures the enormous exposure with little danger and little hæmorrhage, and the deformity following multiple rib resection is absent. It avoids the great thoracoplastic operations, which seek to bring a rigid chest wall down to the collapsed lung by mobilizing the lung and bringing it out to the normal thoracic limits. Out of an unselected series of sixty-three cases there was not one thoracoplasty.

(3) *Thoracotomy for Encapsulated Empyema.*—When the physical signs and the radiograph indicate the presence of localized intrapleural abscess, whether interlobar or not, the operation must be planned according to the situation of the disease. Often the costal pleura forms one wall of the abscess, and in these circumstances we have resected ribs directly over the pus, trying to avoid infecting the general cavity. The case is then treated as an ordinary abscess. It has been found effective to remove a section of at least one rib with its periosteum, so that this abscess can be treated by packing with gauze, and later, if necessary, by drainage with a short tube. The removal of the periosteum with the rib prevents the rapid growth of deforming bony bridges which so frequently interfere with proper drainage. Four of these cases dealt with all recovered.

SMALLPOX IN GERMANY.

Medizinal Statistische Mitteilungen aus dem kaiserlichen Gesundheitsamte.

Year	Total	Number of outbreaks	Fatal	Per cent.	Amongst foreigners				Per million of population exclusive of foreigners	Remarks
						Per cent.	Fatal	Per cent.		
1911	288	138	35	12·15	119	41·32	15	13·45	2·58	25 contact cases occurred in hospital from 8 cases.
1912	340	139	35	10·29	153	45	10	6·54	2·80	46 contact cases occurred in hospital, 24 in one.
1913	90	45	12	13·33	39	43·33	5	12·82	0·76	Almost all cases originated outside Germany.

LONDON SCHOOL OF TROPICAL MEDICINE.

51st Session. May—July, 1916.

Front Row Sitting.—H. R. Newham (*Director*), Dr. W. M. Willoughby (*Lecturer*), Col. A. Alcock, C.I.E. (*Entomologist*), Dr. C. W. Daniels (*Lecturer*), Col. J. J. Pratt (*Lecturer*), R. P. Cockin (*Assistant Helminthologist*), Miss I. N. Clough.

Middle Row.—Louise (*Laboratory Girl*), J. A. Beels, J. Forbes (*House Surgeon*), F. L. Flood, C. H. Sills, K. T. Jungalwalla, R. T. Leiper (*Helminthologist*), G. B. Warren (*Laboratory Assistant*), Emma (*Laboratory Girl*).

Back Row.—Robert (*Laboratory Assistant*), H. L. Cumming, G. T. Makhijani, J. B. Flamer-Caldera, M. M. Uhrenholt, S. C. Biswas.

Absent.—J. T. Watt, J. G. Thomson (*Protozoologist*).

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(UNIVERSITY OF LONDON),

Under the Auspices of His Majesty's Government.

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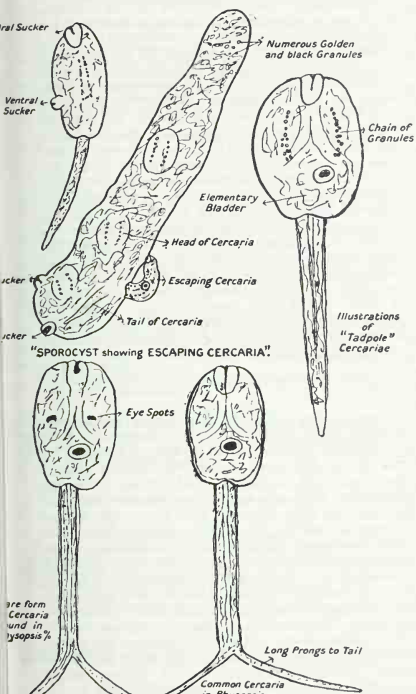
Original Communications

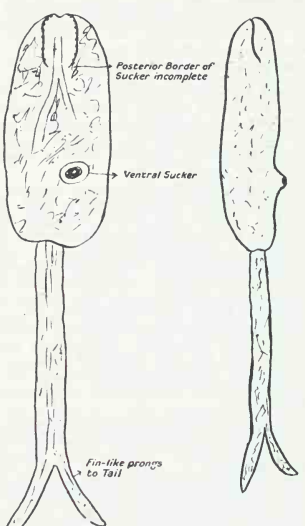
"THE CERCARIÆ OF NATAL."

By F. G. Cawston, M.B., B.C.Cantab.

Several forms of cercariæ are present among the various molluscs inhabiting the fresh-water pools of Natal. "Tadpole" forms are common to several species. So far sporocysts containing cercariæ with bifid tails have been found only in *Physopsis africana*, a common black mollusc with a blunt-pointed, sinistral shell. The proportion of specimens infected with these latter cercariæ is found to be greater among those molluscs which have been kept in water contaminated with the urine of Bilharzia patients. The liver of an infected mollusc is yellowish in colour when it harbours cercariæ with bifid tails; the sporocysts containing "tadpole" forms more often colour the liver orange. The cercariæ found amongst the molluscs at the coast are larger than those met with at inland towns. Some of these larger forms are coloured. Most of the cercariæ show an absence of pharynx, but occasionally one comes across a sporocyst containing cercariæ with bifid tails and a muscular pharynx at the commencement of the œsophagus. Sporocysts containing cercariæ with eye-spots are rare. As far as I know, only one of these has been found in Natal, and that in a young specimen of *P. africana*.

Until the cercariæ are fully developed, it is impossible to differentiate the distinctly human form from the other common forms of cercariæ with bifid tails. It would seem that human cercariæ are present in about 5 per cent. of the specimens of *P. africana* found in the freshwater bathing-places.





Human form of Cercariæ, found in about 5 per cent. of the specimens of *Physopsis africana* collected from Natal fresh-water pools during April and May, 1916.

The following table indicates the prevalence of infected molluscs in Natal at this time of the year or the close of the bathing season:—

Date	Species	Number healthy	Number harbouring "tadpole" forms	Number harbouring cercariæ with bifid tails
April	*Physopsis africana*	159	13	30 (5 distinctly human forms)
	Limnæa natalensis	87	2	—
	Planorbis pfeifferi	17	7	—
May 1-15	*Physopsis*	174	7	34 (11 distinctly human forms)
	Limnæa	54	3	—
	Planorbis	110	53	—

DERMATITIS DUE TO THE SECRETION OF A BEETLE IN BRITISH EAST AFRICA.

By PHILIP H. ROSS.

Director of Laboratories, East Africa Protectorate.

RODHAIN and Houssiau (*Bull. Soc. Path. Exot.*, October, 1915) have recently described an epidemic of dermatitis at Leopoldville due to a beetle of the family of the *Staphylinidæ*. A similar epidemic having occurred on the other side of Africa, it seems worth while to record the fact.

In July and August, 1915, many cases of an acute dematitis due to contact with a small beetle occurred in Nairobi. To Dr. G. H. Chell I am indebted for a large number of these beetles, from one of which he was himself a sufferer.

The local beetle appears to be slightly larger than that of the French writers, being about 1 cm. long as against their 7 to 8 mm. The head is deep black in colour, the thorax is a reddish brown, the elytra are a deep metallic blue. The anterior segments of the abdomen are of the same colour as the thorax, but the two last abdominal segments are deep black, the same colour as the head.

The greatest width of the beetle is 2 mm. across the elytra.

There is a well-marked constriction behind the head, and another constriction of the thorax immediately anterior to the elytra. The elytra are 2·5 mm. long.

Some specimens were sent to Professor Nuttall, who has had them identified by Mr. G. A. K. Marshall, of the Bureau of Entomology, as *Pæderus crebripunctatus*, Epp. Rodhain and Houssiau sent specimens of their beetles to M. Bondroit, who described them as belonging to the genus *Pæderus*.

The history of Dr. Chell's attack is probably fairly typical. He was in bed in hospital, the head of his bed being against the wall, when one of the beetles, in flying about the ward, hit the wall above his head and fell on to his forehead, across which it walked from side to side. Apparently it left an irritating secretion behind, as by next day there was a bright vesicular streak, looking very much as if a brush dipped in strong acid had been drawn across.

It would seem that the beetle only excretes the fluid when irritated, for the writer has frequently flicked one from hand or wrist without suffering any ill-effects. On the other hand, there has been a local case of a man who did not believe that the beetles were harmful, and, having the courage of his convictions, rubbed one hard on his forearm. He is now a convert to the belief in their noxious properties.

The French writers' description of the lesions is entirely descriptive of those met with here. There is a vesicular dermatitis, either in patches or in lines. Where the lesion occurs as a patch it is the result of a beetle having been immobilized on the skin during removal; where it occurs as a line, the beetle had either been annoyed and then allowed to continue its progress, or has been dragged across the skin in the process of removal. The lesions, naturally considering their origin, occur on exposed parts. They are painful, feeling like a burn.

As regards the seasonal prevalence of the beetle, it would appear that in Nairobi, as in Leopoldville, there must be a special hatching season. Dr. Chell collected many specimens at the European hospital, and their presence in numbers during the months of July and August was notorious. These two months are the coldest in the year. Since then the writer has not seen a single specimen, although constantly on the look-out for them.

Vaccinations in the Russian Army (Tarassevitch, *Bulletin de l'Académie de Médecine*, May 9).—Antityphoid vaccination was made compulsory in the Army, and more than 20,000 litres of vaccine had been used in military and civilian circles by February, 1916. A monovalent vaccine was used at first, and later one made from six or eight strains of typhoid bacilli. Vaccination against cholera was also introduced, and over half a million men have already been thus vaccinated, but without official consecration. Encouraged by experience in Japan, and by Castellani in Italy, attempts have been made to vaccinate at one time against both typhoid and cholera. The reaction was no more intense than to one vaccine alone. After two injections the serum agglutinated typhoid bacilli at 1:500 or 1:800, or even 1:2,000. Agglutination of cholera germs occurred only at 1:200. One entire army in the Caucasus was vaccinated in this way. A group of 25,000 men at Moscow were vaccinated the same day against small-pox, typhoid, and cholera, and only 5 per cent. presented a moderate or severe reaction.

Up to November, 1915, the losses of medical officers in the German Army were 1,491; of the Austrian Army, 1,722.

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THE JOURNAL OF

Tropical Medicine and Hygiene

SEPTEMBER 1, 1916.

A VISIT TO THE CASUALTY CLEARING STATIONS AND HOSPITALS AT THE FRONT.

INTRODUCTORY.

THE writer has recently had the privilege of being allowed to see and become acquainted with the medical arrangements of a large section of the British Army in France and Belgium from within a mile or two of the trenches to the hospital ships on the French littoral.

A short account of the visit will prove interesting to those who have not seen the work of the medical service of the British Army in the field. The account the writer gives will no doubt disappoint many, for little reference is made to the surgery seen in the hospitals, clearing stations, &c. Everyone knows, however, that British surgery stands on a pinnacle of unassailable excellence, be it in our civil hospitals in Britain or in our military hospitals at home or abroad. This being taken for granted, it is unnecessary to dilate upon the theme, for, at war work at present, the combined talent of many civil and military experts in surgery and, let it be carefully noted, in medicine and in all the so-called "specialties" also, is engaged in helping the sick and wounded soldiers. The Mother Country and all the Overseas Dominions have given of their best to the Army, and fallen loyally into line under the Department of the Director-General of the Imperial Medical Service. Without this co-operation under a definite central authority all would be chaos; with it a machine-like system has resulted which is a marvel of organization, admirable in its results, and salutary to a degree.

The perfection of the system and of the medical and surgical work at the Front being taken for granted, it leaves the writer free to deal with a less known, but no less important, aspect of medical work in the field—namely, the organization of the transport of the wounded from the Front to the base, the sanitation and hygiene of the casualty clearing stations, hospitals, ships, and trains in which the sick and wounded are accommodated on the journey over land and sea until they reach their destination in Britain.

Before dealing with details, one initiation of great importance and meaning has been introduced through the wisdom of the Army medical authorities. Physicians of eminence have been chosen from amongst the civil profession to go to the Front as consultants, and a certain number are attached to the several armies in the field. A wise step this, for disease in war as a rule claims more victims than do wounds; yet up to now this well-known fact has not been attempted to be dealt with systematically or practically. Surgeons selected from civil life have been sent to the Front in recent wars in profusion, but not so in the case of physicians. Civil assistance has not been called in for purely medical work, although this department in military, as in civil life, far exceeds in extent that of surgery.

The innovation shows wise counsels to prevail by Headquarters, and they are to be congratulated upon their forethought. Nor does the matter end here, for from amongst the civil profession have been selected experts in all the recognized phases of medicine, including those who have devoted themselves specially to the study of the brain, heart, eye, ear, skin, &c. Well-known anæsthetists are at the Front engaged in their own department

of work. The dentist's chair is a familiar object at all hospitals, from the casualty clearing stations to the base. X-ray rooms are here also, and the work is done, as it should be, by medical men who have devoted themselves to this delicate and important work, and not by so-called "trained" privates or corporals of the R.A.M.C. X-ray work is but begun when the plate is produced; the difficult part of this work is the interpretation of the plate or the photograph. No medical man, unless he has devoted his life to X-ray work, can interpret what is seen on an X-ray plate with the accuracy necessary to guide the surgeon in his work or the physician to a sound conclusion. The surgeon or the physician who is his own interpreter in X-ray work has a fool for his adviser, and the patient an ignoramus for a doctor, and it is well it is not so at the Front or in our civil hospitals.

With all these provisions the wounded man and, what is as important, his parents or his family, may rest satisfied that everything that can be done has been and is being done for those who are suffering in their country's cause; they will be comforted also to know that where death occurs every respect is shown to their dear ones, for every hospital and clearing station has its mortuary chapel, reverently attended to and decorated as becometh a soldier's resting-place. The graveyards which are scattered throughout the North of France and in Belgium are well kept, well protected, and beautiful in their simplicity.

This introduction has exceeded the space intended to be devoted to it, for the real subject matter in hand has not been touched upon. This consists of the work in the collecting area, along the lines of the communications, and in the distributing area, the three spheres into which the conveyance of the wounded soldier, passing from the front to the rear, are divided. Each of these spheres is under a separate command, and upon the harmony with which these commands work the comfort of the sick and wounded depends.

J. CANTLIE.

(*To be continued.*)

Annotations.

Statistical Study of Rabies in California (J. C. Geiger, *California State Journal of Medicine*, July).—From April 1, 1913, to March 31, 1914, 427 examinations of the brains of animals for rabies have been made. Of these, nine were in such a state of decomposition as to make examination impossible. Seventy brains gave negative results and 348 were found positive. Three hundred and thirty-nine of the positive cases were diagnosed by the finding of Negri bodies and the balance by inoculation into rabbits and guinea-pigs. The animals affected were as follows: 317 dogs, 14 cows, 11 cats, 4 horses, 1 goat, 1 coyote.

Four hundred and thirty-six persons were treated with virus. The infection came from the bites of dogs in 403 instances, in nine cases from the bites of cats, and in four cases from the bites of coyotes. Six people were exposed to rabid cows and three to horses. Nine persons took the treatment as a precaution against exposure while doing laboratory examinations for rabies. The two remaining cases were inoculated with virus from human cases, one because of a bite and one because the saliva contaminated a fresh open burn.

Of the cases of rabies in human beings, three were true failures of the Pasteur treatment, all being severely bitten, two near the central nervous system. Eliminating all persons treated who were not bitten, the percentage of failures with virus supplied by this bureau was 0·491, less than $\frac{1}{2}$ of 1 per cent. This is important and unique, because in over 98 per cent. of the persons bitten the animals doing the biting were checked by laboratory examinations, with positive results. There were few ill-effects following the Pasteur treatment during the period under consideration. In one patient some weeks after treatment there was a peculiar twitching of the muscles of the right side of the neck. In another patient eleven days following the completion of the treatment there was severe pains in the left eye, later affecting the side of the face. This was present at intervals for about a week. In one of the patients there was vomiting. This occurred every day for a short period of time and stopped after the completion of the Pasteur treatment. In another patient the local reactions that usually appear on certain days of the treatment from different strength virus occurred after each injection. In four instances subcutaneous abscesses developed. The only serious complication reported was a slight paralysis of the lower limbs, with prodromal symptoms of nausea and diarrhœa, which occurred several days after the completion of the Pasteur treatment.

Causes and Treatment of Perthes' Disease (Kidner, *Amer. Journ. of Orthop. Surg.*, June, 1916).—This disease of the hip (osteochondritis deformans juvenilis) consists of an irregular atrophy of the sub-epiphyseal portion of the neck of the femur, resulting in flattening of the head of the femur and shortening of the neck. In the case which was operated on a staphylococcus aureus of low vitality was recovered from the broken-down bone just below the epiphyseal line. The cavity was cleaned out, filled with salicylic acid bone wax, the wound closed tight. The patient wore a plaster spica for five months. The result was very good, there being no measurable shortening of the leg, and normal motions. The author believes (1) that the clinical entity best called osteochondritis deformans juvenilis is really a mild infection of hematogenous origin of the neck of the femur at the epiphyseal line; (2) that the logical treatment to hasten recovery and limit destruction is the cleaning out of this focus; (3) that the mechanical treatment

which preludes weight bearing should be faithfully carried out until the normal structure of the tissues of the head and neck of the femur has been completely restored, in order that deformity may be avoided.

The Fate of those Nephrectomized for Hypernephroma.—Paschen (*Archiv. für klin. Chir.*, vol. cvii, Part II) holds that the cells of this tumour do not really resemble those of the adrenal and that the tumour is of nephrogenous origin.

The three ways of transmission of this tumour are: Continuity, lymph channels, and veins. A bad prognosis may be given if the tumour masses project into the vein, if the adjacent glands are enlarged, or if there is a varicocele. Of 268 operations done by others. 51—19·03 per cent.—died as the result of operation, 77—28·73 per cent.—died of recurrence or metastasis, 23—8·58 per cent.—died of other causes within three years, and 46—17·17 per cent.—were well after three years.

Of his own cases—54: 6 died as a result of operation, 17 of metastasis, 6 of other causes. After three years 19 remained well, and without sign of recurrence.

Branchiogenic Carcinoma.—F. Warner (*Annals of Surgery*, July) reports a case of epidermoid carcinoma, seemingly taking its origin from epithelial embryonic inclusions of the second gill cleft. The tumour was removed. It showed microscopic evidence of very rapid growth, in that the epithelium presented many mitotic figures, and the cancer cells having very little supporting connective tissue. It re-occurred within three weeks, and another surgeon operated less than three months after the first operation, and a little over three months since the first manifestation of the disease. The patient died on the operating table. No secondary manifestations had declared themselves. No *post-mortem* was obtained. Any hard swelling in the region of the branchiogenic clefts should immediately arouse suspicion of branchiogenic carcinoma, especially if associated with pain as a prominent symptom.

War Wounds of the Tongue (A. M. Nikolsky, *Russky Vrach*, vol. xv, No. 15).—Gunshot wounds of the tongue have occurred only in the proportion of 0·2 per cent. of all other wounds in war time. The tongue wounds are accompanied by severe hæmorrhages which may be fatal. The hæmorrhage can be checked sometimes only by ligation of the vessel in the wound, or at some distance. Tamponing gives merely temporary relief, and is, as a rule, hard to carry out. In deep wounds of the tongue the bleeding vessel can be found by enlarging the wound, when the vessel can be more readily ligated. In case this does not succeed, the artery should be ligated at some distance on the neck in Pirogoff's triangle.

Abstracts.

INFANTILE PARALYSIS.[1]

The Clinical Types.

Henry Koplik said that Poliomyelitis is primarily an epidemic disease and as a sporadic condition it had attracted very little notice. All the epidemics which had thus far been recorded resembled each other very closely. An attempt to connect this disease with the occurrence of cerebrospinal meningitis had developed into a belief that poliomyelitis was an entity, cliuically occurring in epidemics in the late spring to late autumn, and following the regular sporadic occurrence of the disease in limited numbers in the months following the winter, and reaching into the late spring up to the time of the epidemic outbreaks. Epidemics of this disease had been known to skip a year and to always crop up again in the place of the original occurrence, which should give the thoughtful hint as to the possible cause of its epidemiology. In all the epidemics thus far recorded the symptomatology had been much the same. Though most of the scientific knowledge of the clinical types of poliomyelitis was borrowed from Swedish and Norwegian observers, Medin and Wickman, the first inkling of the epidemic nature of the disease was voiced by Colmer, an American physician, who in 1841 observed some form of paralysis in a child, and obtained the history that in the locality in which the patient lived several similar cases had occurred, and most of them had recovered. Aside from these observers, much of the clinical knowledge at present was due to Medin, who described the clinical types of acute epidemic poliomyelitis in 1884 before the International Congress, much to the astonishment of most pediatricians who still retained the simple picture of poliomyelitis anterior as retained in older text-books—as a simple infantile paralysis. In all, forty-two epidemics had been observed in America and the Continent, and this alone should establish the tendency of poliomyelitis to occur in epidemic form at certain seasons and remain sporadic until the time arrived for a new outbreak. This disease selected the young as its victims. Out of 886 cases in the epidemic of 1907, 571 were below 3 years of age, 771 below 5 years, and three were under 6 months of age. In the present epidemic the youngest case Dr. Koplik had seen was 4½ months old and absolutely breast-fed. The most susceptible period was from 1 to 3 years of age. There were four principal types which could be clinically described and proved by laboratory methods: (1) the abortive; (2) the bulbospinal; (3) the cerebral and meningeal; and (4) the bulbopontine types. Wickham had described a neuritic type. These types could all be understood when poliomyelitis was regarded from the standpoint of an acute,

[1] Abstract of papers read before the New York Academy of Medicine, July 13, 1916.

infectious disease, involving certain parts of the general nervous structures, causing certain definitely marked pictures and there stopping, or going on at one stroke to involve the whole cerebrospinal axis, and in this way causing a debacle of the whole substratum of the nervous economy.

(1) *The Abortive Type.*—It was through the abortive type of the disease that these cases were spread to others. This type was that which did not go on to paralysis, recovered, and did not leave the host injured so as to leave no doubt as to its distinct identity. A child of 5 years of age was attacked with a headache, slight malaise, and an attack of vomiting lasting five days, intense pain in both lower extremities radiating to the soles of the feet and worse at night, slight pain in the nape of the neck, lassitude, cerebellar gait on walking, increased reflexes in the lower extremities, rectal temperature above 100·5° F. In ten days the pains had disappeared, the child was well, and wanted to go out and play. The abortive cases presented prodromata, such as headache, weakness, diminished reflexes, and pains in the nape of the neck, with or without vomiting and fever, and still did not present paralysis, and recovered.

(2) *The Bulbospinal Type.*—This was the most common type and gave the disease its name. The patient would have an attack of vomiting and slight fever, and within twenty-four hours the mother would observe that the child could not move one or the other extremity. These forms might have no fever, but it was possible in giving the history the mother might have overlooked the symptoms of fever, malaise, and such indisposition as peevishness, which might have preceded by a few days the paralysis. In other cases the paralysis appeared gradually. Pain might continue to be quite severe, especially when the extremities were moved. The paralysis might spread and involve not only the remaining lower extremity, but the upper extremities, the muscles of the back, the respiratory muscles of the thorax, and possibly the muscles of the abdomen. As a rule, in the purely spinal cases the paralysis appeared, and did not spread in the great number of cases. In others, it might spread from the extremities and involve the whole trunk, even to causing bulbar paralysis of the respiratory centres. But after the tenth day paralysis was not apt to spread to the bulbar medulla, though cases had been known to die after the fifteenth day.

(3) *The Cerebral and Meningeal Types.*—Both the meningitis and cerebral types should be combined because of the cerebral symptoms which gave rise to a picture closely simulating meningitis. The meningitic form of poliomyelitis ran its course with cerebral symptoms. A child of 3 was taken with vomiting for forty-eight hours, followed by rigidity of the neck with pain on flexion of the head, Brudzinski's sign and reflex, Kernig's sign, and Macewen's symptom which might be slightly marked; also diminished reflexes. Some patients might improve after a day or two, the fever might abate, and they might even be about and then have a recrudescence of fever, sopor, rigidity, delirium, irritability, extreme hyperæsthesia, and pain in the nape of the neck. In some cases the only palsy might be ocular; in others a slight facial palsy might be present which might be combined with a weakness in one or other extremity. After a week the patient became brighter. There was still, however, marked ataxia and Romberg's sign. As convalescence was established, the ataxia was the last symptom to disappear. The hydrocephalus and abnormal mental state might remain for some time after the temperature was normal. On recovery there was a slight strabismus, ataxia, or optic neuritis. In one group of cases he had seen unilateral ophthalmoplegia with hæmorrhages into the retina. In lumbar puncture lay the differentiation of this form of poliomyelitis from cerebrospinal meniugitis.

(4) *The Bulbopontine Type.*—The bulbar or pontine form of the disease deserved notice as a distinct form. An infant, breast-fed, 13 months of age, was attacked with fever and vomiting. The fever continued into the afternoon of the following day, when the mother noticed a flatness on the right side of the face. The temperature continued at 102·4° F., the infant was bright, laughed, and played in the crib, but there was a tired look about the face and eyes. The knee reflexes were increased; otherwise there was no paralysis that could be demonstrated. In another case, ten days before the patient, aged 21 months, was seen, he was taken with high fever and vomiting, and there were some green movements. The fever continued, in a less degree, to the ninth day, when the mother noticed that the right side of the face was flat; there were tremulous movements of the head and arms, and the patient was restless. There was constant jactitation of the head and insomnia; there was rigidity of the neck, but no palsies of the extremities; on the contrary, the patient exhibited great strength in both the upper and lower limbs. In other cases the outcome was not so favourable; there was an involvement of the nuclei which controlled deglutition and respiration. In these cases the patient might be lost by paralysis of the respiratory centres. The neuritic type included those cases in which pains in the extremities became a leading feature of the clinical picture. Some of these cases developed paralysis; others did not. They were referred to under the head of abortive cases. The symptoms given justify a lumbar puncture in order to establish the character of the fluid which in poliomyelitis showed a lymphocytic cytology and an increase of globulin. The examination of the blood was very uncertain. As to prognosis, the low mortality of 10 per cent. applied to children below 11 years of age, and 27 per cent. among older children and adults. Twenty per cent. of all cases recovered, and the younger the child the better the prognosis.

It was very difficult to speak about the treatment of a disease the cause of which was still under investigation. The treatment of the disease could at this time be only symptomatic. The patient should be isolated and kept absolutely quiet. This

was most important. Anyone in attendance on the patient should wear a gown and cleanse his hands after leaving the patient. Together with absolute quiet, the patient should have plenty of fresh air and an easily assimilable diet. The bowels should be attended to. No particular remedies except those supposed to have an effect on the general nervous system. Liberal doses of urotropin had been employed, but the utility of this drug had not as yet been definitely established. Lumbar puncture offered certain advantages. In the first place, the mere mechanical removal of a certain amount of toxic spinal fluid might be of some benefit. In the second place, it gave an opportunity to make a diagnosis; and in the third place, it relieved pressure. This was of benefit because the fact that we got the Macewen sign showed the presence of pressure. If paralysis started in the patient's limbs, they should be kept absolutely quiet, and in some instances a cast might be applied to prevent contracture of the muscles. When the case was removed it could sometimes be seen that it had been instrumental in diminishing contracture. This contracture might return later, when the patient should be referred to the orthopædist. Chloral and bromides might be administered for symptoms referable to the nervous system. Opium should not be used unless absolutely necessary. Charcot had recommended the intramuscular injection of strychnine as soon as the pain and fever had stopped. One-fortieth of a grain might be given daily for thirty days, different groups of muscles being selected for the successive injections. Many cases, however, had regained their power without the injections, and many did not, so that it was very difficult to give an accurate judgment as to their value. Warm baths sometimes proved a great blessing, if they could be given without moving the patient too much. Massage sometimes seemed to aggravate the condition; in other instances it seemed to relieve the pain. Iodide of potassium in large doses seemed to relieve the pain to a greater extent than any other remedy. In a few cases its effect was almost miraculous. There should not be too much activity in the treatment of these cases. No attempt should be made to increase the tonicity of the muscles until the active stage of the disease was passed.

The Importance of the Present Epidemic.

H. Emerson said that the Health Department was not able at the present time to present statistics in a complete form. The records showed the date on which the cases were reported, and not the date of onset. For instance, in May only five cases were reported; since May, fifteen additional cases had been reported that had their onset in May. In June the incidence of the disease rose rapidly. The increase in the number of cases was observed about June 20, and rose rapidly until July 11, when the highest point was reached. Since that time there appeared to have been a recession, but it could not be said, as yet, that it was permanent. The statistics for diphtheria, scarlet fever, measles, and diarrhœal diseases during the past six years, and the first six months of the present year, for New York City, contrasted with the number of cases and deaths reported from poliomyelitis; they showed that both the morbidity and mortality rates of poliomyelitis were low in comparison with the above-mentioned diseases. During the first six months of 1916 there were 884 deaths from diarrhœa and 57 from poliomyelitis. The community looked with complacency on the former, while it was panic-stricken in the presence of the latter. The psychological state of the lay public was interesting at this time. The panic that had resulted from reports with reference to infantile paralysis was probably due to the fact that this was the first epidemic of this disease in which it was reportable in New York City. It was also the first time that there had been a concerted effort at hospitalization of the disease. The present method was frankly an experiment. At the onset the Health Department was confronted with two alternatives. The one was to attempt quietly the medical control of the cases; the other was the method of publicity. They had decided in favour of the latter as offering the better prospect of real control of the disease. This method also offered the opportunity of giving the city a lesson in cleanliness and the control of infection. This was the first epidemic of poliomyelitis in this city that had been studied while it was in progress. The epidemic of 1907 was not studied until November, when the Neurological and Pediatric Sections of the New York Academy of Medicine appointed a committee to investigate that epidemic. In that epidemic there were probably 2,500 cases. The average mortality, as estimated in foreign epidemics, had varied from 7 to 10 per cent. During the epidemic of 1907 the mortality was 5 per cent. During the present epidemic about 2,600 cases have been reported. Investigation showed about 1,600 of these to be true poliomyelitis. The mortality thus far in this epidemic was estimated to be 18·7 per cent. The most important factors in dealing with infantile paralysis were early diagnosis and the institution of methods by which they were able to prevent the spread of the virus among the healthy, and putting all cases under neurological and orthopædic observation. This might save the individual and the public from the future burden that permanent crippling implied. Infantile paralysis was essentially a disease of early childhood. At least 99 per cent. of the children affected had been born since the last epidemic. Of the cases of true poliomyelitis reported it was estimated that 917 have been under 5 years of age, and that 99 per cent. have been under 10 years. About 403 cases have shown paralysis. In 50 per cent. of the cases the paralysis made its appearance in the course of a few days after the onset of the disease. The longest period after the onset at which paralysis made its appearance was sixteen days. In from 5 to 8 per cent. of the cases, secondary or subsequent cases have occurred in the same family. When one gets a second or third case in the course of three or four days after the onset

of the first one it is safe to classify it as a secondary case. These facts were important, since the public had not previously been impressed by the infectious nature of the disease. The person suspected of being a carrier of infantile paralysis presented a difficult problem, since they could not prove definitely that a person was a carrier, as could be done in diphtheria or typhoid fever. This epidemic has also presented the opportunity for concerted action on the part of hospitals. This would probably result in some definite plan for dealing with such emergencies in the future that would greatly benefit the public and would favour scientific study of the disease. There was another point of importance in connection with this epidemic, and that was that it had shown the extent to which medical men would sacrifice themselves and their financial interests to the public welfare. Many instances had come to his knowledge where physicians who had been taking care of these cases of infantile paralysis had, for the time being, lost their practices, and were actually suffering in consequence, their patients being afraid to come to their offices. Other physicians should do all in their power to discourage this attitude on the part of the patients, and to see that such physicians did not suffer because of their willingness to sacrifice themselves. Finally, it should be remembered that no health department, however efficient, could control an epidemic and secure proper police enforcement of its regulations without the support of the medical profession.

DIAGNOSIS AND TREATMENT.[1]

By Adam H. Wright.
Toronto.

Old and New Methods.

When Herophilus organized his medical school a little more than 2,200 years ago, he attached special importance to the cardinal points in the teaching of the great Hippocrates—acute observation and careful interpretation of symptoms. In addition, he paid great attention to the sciences, especially anatomy, physiology, chemistry, and botany, and the Ptolemies assisted him by erecting great buildings, museums, laboratories, libraries, and botanical gardens. Their aims and methods compare fairly well with ours at the present time.

The writer desires in this paper to refer to certain phases in some serious diseases.

Certain Forms of Cancer.

About twenty-five years ago a diagnosis of condyloma was made at the Toronto General Hospital. A consultation was deemed advisable, and, as it turned out, there was a serious difference of opinion. Two competent men pronounced it epithelioma, and advised amputation. A specimen was sent to the laboratory, and the report given—epithelioma. The microscopist only expressed his opinion, and did not pretend that this should be accepted without doubt. No operation was performed. After treatment, local and constitutional, the growth or growths melted away, and the man left the hospital in good condition. When a specimen is sent to the laboratory, a full clinical history should go with it. The microscopist gave a wrong opinion in this instance, but in a majority of cases his opinion would be both correct and helpful.

Two cases of hysterectomy will now be considered. A woman supposed to be near the end of the menopause had some hæmorrhages which caused alarm. After a slight curettage the scrapings were examined with negative results. The symptoms were so serious, however, that the consulting surgeon advised hysterectomy. The operation was performed and a good recovery ensued. She is now happy and well, better than she could ever have been without the operation. The only criticism I should think of offering is that the curettage was unnecessary in this case and should not have been done. But one may ask, Is that not going too far? In such a case surely a thorough investigation is advisable, and a slight curettage can scarcely do harm. The reply is, that it can do much harm. This patient for over twenty years was troubled with "nerves," and this "slight operation," although done gently and skilfully, gave her great pain and upset her seriously. As it turned out, it was useless, and in such a case, therefore, worse than useless. If the surgeon intends to operate regardless of what the laboratory may discover, surely curettage is unnecessary.

In the second case the patient was 53 years old, and had ceased to menstruate fifteen years before. She had serious hæmorrhage for three months. Examination of uterine scrapings gave negative results, but because of the clinical symptoms the uterus was removed, and with the annexa was sent to the pathological laboratory for examination. After a few days a report came saying that decidual remains were found in the uterus, and a corpus luteum in one of the ovaries. This was considered "a good joke" on the surgeon, and reports spread through the city. The surgeon demanded a thorough investigation, which was allowed. Two pathologists of unquestioned reputation examined the specimen, and reported positively that there were no decidual remains, no corpus luteum, and that there was cancer. Apart from this incident, evidence had been accumulating for years that laboratory men in Toronto were constantly belittling the work of the clinicians as to their interpretation of symptoms. Of course, a simple glance at the clinical report in this case would have prevented the possibility of such an enormous blunder, which might have blasted the reputation of an able surgeon, and also that of a decent woman.

A brief reference will be made to another case much more pleasing to contemplate. A few weeks ago a prominent physician of Toronto had symptoms of inflammation within the abdomen. After section

[1] Abstracted from *New York Medical Journal*, July 22, 1916.

a lump was found connected with the colon. Judging from the clinical symptoms it seemed likely that it was inflammatory in character. The laboratory findings were at first doubtful, and sarcoma was suspected. Then four pathologists took hold, and after efficiently studying the specimen, decided that it was inflammatory.

Probably all connected with this case were inclined to thank Providence for the modern laboratory, which even in these days contains many men who are as careful and thorough in their methods as were Pasteur and Lister in their best days.

Vascular System.

One of the scientific instruments which, as everyone knows, has come into pretty general use is the sphygmomanometer, and along with it a good many remedies for the treatment of abnormal blood-pressure.

Very careful laboratory investigations were conducted in various countries with a view to discovering a remedy for high blood-pressure. The different forms of treatment which developed may be placed under three headings:—

(1) Administration of medicines that reduce blood-pressure, such as potassium iodide and the nitrites. A favourite combination in some parts of England is:—

R	Sodii nitritis	...	...	gr. ss.
	Erythrol tetranitratis	...	...	gr. ½
	Mannitol nitratis	...	...	gr. ½
	Ammonii hippuratis	...	...	gr. 1
M.	Ft. mistura.			

(2) When the heart begins to fail because of these depressing remedies, some therapeutists endeavour to build up with digitalis, strophanthus, &c.

(3) Avoid certain kinds of food, overeating, constipation, tobacco, alcohol, and change of climate. Many found, through clinical observation, that the pressure reducers, especially the nitrites which lower pressure by vasodilatation, do more harm than good. It is also thought the proper plan is to treat the serious condition itself and not one of its symptoms.

Probably most now agree that No. 3 contains the most important if not the essential features.

One patient, a woman aged 62, has had arteriosclerosis for eight years (perhaps more). The blood-pressure, from 1910 to 1915, averaged 230 to 240. Up to 1912 she took at various times such medicine as mannitol nitrite and erythrol tetranitrate. Neither did any good; each did actual harm. She has had nothing of that sort for the last four years. She avoids as far as possible all the causes of high pressure. She takes cascara, rhubarb, salines, phenolphthalein, with occasional doses of calomel or blue pill. Her favourite laxative is a pill made up of blue mass and compound rhubarb; a pill of 2½ gr. each is taken at bedtime on three consecutive nights.

For some years it was supposed that by the serum diagnosis (Wassermann reaction) in the later stages of syphilis, whether active or latent, the disease could be detected. A little more than a year ago a patient was in the Toronto General Hospital. For some reason he was subjected to the Wassermann. The laboratory finding was positive. After an interval a second positive was declared. The patient, a married man with a family, was then told that he had latent syphilis. He was much astonished and greatly worried. Now it happens that we have recently been able to tell him that he has never had any symptoms of syphilis, and this statement has given him unbounded comfort. Even at that time it was recognized in many hospitals and laboratories that the Wassermann reaction was "merely an auxiliary to the diagnosis of syphilis, which must ultimately stand or fall by the clinical examination" (Fönss). Freudenthal could have told them some time before that he sent specimens of the same blood to four institutes in Berlin; in two the reaction was found to be negative, in the third it was doubtful, and in the fourth it was markedly positive.

It is unfortunate that the clinician and the laboratory men do not work these cases out together with the hope that they may finally agree. Although there may be some doubt about the significance of certain findings, it seems to have been established that the reaction cannot be positive in the absence of syphilis unless through technical error. On account of the number of such errors, especially in Berlin, this work has been for some time carried out exclusively in the State Institute in Holland.

Digestive System.

A report is given of an ordinary everyday patient with symptoms easily discoverable by ordinary methods. A girl, aged 15, was brought to me by her father a few weeks ago. An appendicectomy had been performed by an excellent surgeon in Montreal more than a year before with apparently good immediate results, allowing her to be removed from the hospital to her home in two weeks. For months, however, she did not appear to be well, and numerous and varied laboratory investigations had been made. After a time she got fairly well, and was sent to one of our best boarding schools in Toronto. Reports as to her physical condition not being favourable, the father came to Toronto and placed her under my care. He told me she was run down, got tired easily, and suffered from headache and constipation. I found out from the patient that she also had disorders of menstruation, and one other symptom to which she attached importance, viz., heartburn after every meal. The father told me that the laboratory findings showed "thin blood," but nothing else "very bad." For anæmia she was getting iron tonics and plenty of good nourishing food. He wished me to look after the meals, and see that she got plenty of hot meat at least twice a day. I went to the school a couple of days after and found that she was getting three heavy meals a day, and in addition three full glasses of milk, and chocolate and cocoa at various periods of the day. The bowels had not been moved

by a laxative mixture which I gave her when I first saw her. The combination of meat and milk is particularly vicious.

Here was a charming, handsome, strong girl with good physique with an appetite which caused her to eat more food than she could properly assimilate, and her whole system was being poisoned because of defective elimination. It was just a plain old-fashioned case with clinical manifestations sufficiently clear to indicate proper simple treatment. There was no albuminuria or glycosura in any form. A restricted diet was ordered, and after some days the bowels were properly evacuated. After this she felt better, but more hungry than ever; and now the big fight has begun. She demands the hot meat twice a day, and she gets it, although she is submitting to most of the other restrictions. In this case, as so often happens, the doctor and the indulgent, kind woman in charge, have opposed to them the strong wills of a forceful father and a determined girl. Who will fail in this case, for failure means that the girl will suffer and come into mature womanhood crippled and perhaps broken down. Surely the so-called older methods of diagnosis and treatment in this case are the all-important ones, although great assistance may be derived from careful laboratory investigations in the future.

Is it true, as many of our best physicians fear, that the tendency for the young practitioners who have received admirable courses in well-equipped colleges is to neglect the human side, and to treat the disease instead of the patient, forgetting or overlooking the important fact that the latter always is a personality which should be carefully considered? Are we becoming mere mechanics, neglecting the higher and more intellectual means of drawing conclusions by inductive reasoning? Are the men who are trying to divorce science from practice, to exalt the laboratory investigators and belittle the clinicians, working in the interests of our profession or of suffering humanity? No, and at the same time it would be better to work loyally together, and thus be in a position to put forward strong and united efforts to do the best we can for the patients placed under our care. In doing so we go back to Hippocrates, and carry out his advice by paying very great attention to acute observation and careful interpretation of symptoms.

THE TREATMENT OF AMŒBIC DYSENTERY.[1]

By J. P. Bates.

The conclusions following in this paper are from an experience with amœbic dysentery in the Department of Sanitation in the Canal Zone in Panama, covering the period from 1904 to 1913 inclusive. During that time various therapeutic measures were tried. First, the treatment with quinine irrigations; later, treatment by large doses of bismuth subnitrate, and, finally, the use of ipecac after its reintroduction by Rogers in India, to which was subsequently added bismuth as a correlative treatment for the purpose of hastening the process of healing the ulcerations present in the intestine, left only partly healed after ipecac had served the purpose of eradicating the amœbæ.

It is important that all ulcers in the intestine must be healed entirely before one can expect permanent results from any treatment, and that one must also expect a considerable lapse of time before this is safely accomplished in cases of such extensive ulcerations as are found in amœbic dysentery.

Interest in the subject of the treatment of amœbic dysentery has arisen because of reports in the recent literature of recurrent cases after repeated treatments with ipecac or emetine, and because a small number of recurrent cases have come under my immediate observation.

Judging from experience since the arrival of the use of ipecac, it appears that recurrences ought not to take place, if all of the problems entering into the treatment of amœbic dysentery are considered and the treatment necessary to meet these problems is carried out—that is, treatment to aid the action of ipecac is an amœbicide, treatment to hasten the complete healing of the ulcerations in the intestine and the allowing of ample time for these ulcerations to heal entirely before patients are discharged as well. In short, a co-operative or correlative treatment to ipecac.

The treatment of amœbic dysentery with powdered ipecac was begun in Colon Hospital, Panama, in 1909, and its use continued until 1912. During this time a sufficiently large number of cases allowed definite conclusions to be formed as to results obtained under this method. While it is not possible to follow after-results in all patients discharged from a hospital, some were followed, and two of these patients especially. One, a negro, a year after treatment, had had no recurrence of symptoms during the year, and there were no amœbæ present in the stools after repeated examinations. The other, a native of Panama, became an orderly in the wards after his discharge, and was under immediate observations for two years. He had no recurrence of symptoms during this period. His stools were examined at various intervals, but each examination was entirely negative for amœbæ. With such results as these two men showed, men belonging to a class of patients low in the mental scale and always unfavourable, it is safe to assume that other patients treated in the same manner and discharged as well must also have remained well.

The Cause of Recurrences.

Most writers attribute the cause of recurrences to the formation, under the action of the ipecac, of "encysted" forms of amœbæ. This may be true to some extent, but this phenomenon is not the sole cause, but rather because, as soon as the amœbæ are reduced below the limit of microscopic

[1] Abstracted from *Journ. Amer. Med. Assoc.*, July 29, 1916.

detection, all treatment is discontinued, at a time when the ulcerations are only partly healed, and when a few living amœbæ are no doubt still present, though not detectable, to find lodgment again in half-healed ulcers and thus renew the symptoms of the previous attack. A recent patient stated that throughout a period of twelve years he had suffered from numberless attacks of dysentery. In these attacks he had been treated with different forms of ipecac by various men, each of whom had dismissed him as well as soon as his immediate symptoms had disappeared. After variable intervals of time from these treatments the symptoms had recurred. It may be of interest to note that this patient is now well, and has remained uninterruptedly well for a period of seven months after the treatment to be outlined presently. It is from this man's statement, and from the lack of any statements in the literature to the contrary, one concludes that the treatment of amœbic dysentery as now practised is incomplete, and that too much dependence is placed on ipecac alone, to the exclusion of such useful correlative treatment as rest, diet, enemas, bismuth, and, most of all, time, to complete the healing of the ulcerations in the intestine.

Some Problems in this Disease.

Before entering into the details of "correlative treatment" it is best to review some of the problems confronting us in this disease. Some of these problems are practical, some more or less theoretical.

One of the practical problems, which is, of course, obvious, is the destruction of the amœbæ. This is largely done with ipecac, and hence needs no discussion here. One of the theoretical problems is a biologic property of amœbæ—namely, symbiosis, which may be discussed with the idea that by taking advantage of this property we can enhance the action of ipecac in destroying amœbæ. Another practical problem is the pathology of amœbic dysentery.

Symbiosis.—It is well known that amœbæ live and multiply through symbiosis; that is to say, they are dependent on other low orders of life for their maintenance. This is probably accounted for in two ways: First, other bacteria disintegrate food particles in such a way as to make the food available for amœbæ to incorporate into themselves; and, secondly, in some instances, these lower organisms serve to liquefy their surrounding mediums so that amœbæ can move and find food held suspended in this liquid, for it is impossible for amœbæ to live except in fluid surroundings unless they are in the dormant or "encysted" stage. The dependence of amœbæ on other low orders of life for existence is well shown by the locations selected by amœbæ in the human economy for their habitat.

Thus we first find the amœbæ located in the mouth around the teeth and gums, where moisture and bacteria are both abundant. They next pass through the stomach and small intestines in the "encysted" forms, for in this stage they are enabled to resist the deleterious action of the digestive juices and ferments and to find lodgment finally in the large intestine, especially about the sigmoid flexure and rectum. Here again they are favoured, as bacteria are abundant, and moisture, though less in amount, is still sufficient. They are no doubt favoured again in this location by the comparative stasis of this portion of the large intestine. These "encysted" forms, now finding all conditions favourable, begin anew their normal life-cycle by budding or gemmation, the process of "encystment" being a property reserved in amœbæ to preserve their existence when too closely pressed or menaced.

This property of symbiosis of amœbæ can be used to advantage in treatment by teaching us to reduce the bacterial flora of the intestine to the minimum, and thus place the amœbæ in an unfavourable condition for reproduction and growth. While it is not expected that one shall be able to destroy all bacteria in the colon, nevertheless frequent enemas will reduce the number of bacteria to a great extent, and thus place the amœbæ in such an unfavourable condition for existence that their power of resistance will be proportionately reduced, and the effect of the ipecac on the amœbæ enhanced in inverse ratio. However, if enemas do not accomplish all one could wish in this respect, they will at least wash away large quantities of surface amœbæ, and hence reduce the amount of work required of ipecac or emetine. From this, then, it is clear that enemas are one of the important factors in the correlative treatment of amœbic dysentery.

Pathology.—As I have just stated, the intestinal amœbæ are located principally in the sigmoid and the rectum. Therefore, one would expect to find this area of the large intestine bearing the brunt of attack in amœbic dysentery, which is usually the case. But in patients who suffer so severely from the ravages of this disease as to come to necropsy the lesions are far more widely distributed. All the large intestine is invaded, together with the head of the cæcum, and ulcerations sometimes extend for a foot or more into the ileum. The ulcers are closely approximated, and they frequently erode the surrounding tissue, joining several small ulcers into one large irregular area. They vary in size from that of a pin head to areas larger than a silver dollar. Some are round, some are irregular in shape, nearly all are excavated more or less, and the edges of the mucous membrane tend to roll into the crater-like area. In some places tunnels underneath the mucous membrane connect one ulcerated area with another. The ulcers usually pass through the mucous membrane; some extend down into the muscular coat and have irregular floors. In one instance the perforation took place in the sigmoid flexure; in the other the perforation took place in the cæcum. In the more acute cases the mucous membrane is red and very much thickened, but in the chronic forms the mucous membrane is often pale and is thinner than normal, and the rugæ are largely obliterated. The largest

ulcers are usually first in the rectum and the sigmoid, but large ulcers are again noted in the head of the cæcum. The latter fact, the tendency for the cæcum to bear a heavier part of the invasion than the other upper portions of the colon, has reference to occasional cases intractable to all medicinal treatment.

In cases not so severe as to refuse to yield to treatment one would hardly expect such extensive destruction of tissue as that described above. But one must infer, if the case has been of any considerable duration, that destruction of tissue will be rather large, and that some of the ulcers must be deep in the structure of the intestine. Therefore, in instituting any kind of treatment for the relief of such extensive ulceration, one must expect a considerable lapse of time before these lesions can heal.

Treatment.

One of the first and most necessary factors in treatment, whether the case is mild or severe, is complete rest. The patient is put to bed and given a saline purge or castor oil. He is kept in bed until all the acute symptoms have subsided. After the purgative has acted emetine or ipecac is begun. One-half grain injections of emetine daily for an adult until 2 gr. are given. Then increase the dose to 1 gr. a day, and continue until all amœbæ are cleared from the stool, as shown by microscopic examination. This will usually require a total of from 5 to 6 gr. of emetine. If one does not have access to the microscope, it is well to give a total of at least 6 gr. of emetine. At this time the emetine is discontinued, and bismuth subnitrate in large dose is begun. Bismuth acts in two ways: first, as a sedative on the intestinal tract and as an aid toward the healing of the ulcers present; second, bismuth itself acts as an amœbicide, and is an added help in destroying such amœbæ as may be left after the discontinuation of the emetine or those that may be formed from the "encysted" stage. Bismuth is usually given in 1 dr. doses every four hours during the waking hours until the stools are well formed, and until some constipation is present. It may then be reduced to 1 dr. three times a day until the patient is discharged as well.

Enemas of normal saline solution, two or three quarts at a time, are begun as soon as the effect of the salts or castor oil has subsided, and are used every four hours during the waking hours, and continued in this quantity throughout the entire period of the administration of ipecac or emetine. They may now be reduced to two or three a day, and later to one a day, merely to prevent the constipation following the bismuth. It is well to remember that in flushing the bowel it is necessary to use a short tube in order to avoid the ulcers that may be low in the rectum. At first it will be found that the bowel will tolerate only a small quantity of fluid; it finally becomes more tolerant, and a quart or more will easily be retained. In attempting to examine stools for amœbæ after these large enemas, it will be necessary to retain the whole stool—that is, the enema and such fæcal matter as may be present. Out of this one should select particles of mucus, shreds of necrotic tissue, or flecks of bloody material, and at least six or more separate examinations of this material should be made before one concludes that the stools are negative for amœbæ.

Experience has shown that sweet milk is the best food in amœbic dysentery. It may be given every two hours during the day in quantities of from 4 to 8 oz. at each feeding. After the more acute symptoms have passed and the stools are beginning to be partly formed, the milk may be gradually increased in amount and the time between the meals lengthened. At this stage eggs, soft-boiled or poached, may be added to the diet with one slice of dry toast at each feeding. As the improvement continues, the food may be gradually increased until the patient is finally returned to a full diet.

To carry out this management until one is reasonably sure that all ulcers are healed and replaced by new tissue, will require in the acute cases at least four weeks time. In the more severe cases it will require a total of from six to eight weeks before one should feel safe in discharging the patient as well.

The management just outlined will effect a cure of amœbic dysentery, and my experience has proved this to be true in a large majority of all the cases. Nevertheless, it must be expected, especially in the Tropics, that some cases will be encountered which have advanced so far that no kind of treatment can be of any help. Occasionally there will be others, though rare indeed, that will have relapses in spite of the treatment outlined. It will be recalled that the cæcum sometimes seemed to bear the brunt of the attack, and that ulcers often extend well up into the ileum. It is this class of cases that offer the greatest resistance to treatment, and may present relapses in spite of any management, on account of the inaccessibility of this area to repeated enemas. In cases of this kind, when two or three efforts at treatment by medicinal means have failed, appendicostomy will have to be advised. After this the colon should be flushed out several times a day with saline solution, followed by powdered ipecac suspended in some bland material, such, for instance, as mucilage acacia

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NEW METHOD OF MAKING ANTI-HOG CHOLERA SERUM.

According to the U.S. *Journal of Agricultural Research*, a slight amount of an extract from ordinary white navy bean is added to defibrinated hog cholera immune blood. This agglutinates the red cells; they separate on centrifugizing into a stiff jelly-like mass. To the clear serum is added a small amount of ordinary salt, and is heated to 60° C. for thirty minutes; 74 per cent. of clear serum is obtained safe from foot-and-mouth disease even when the donor hog is infected.

Original Communication.

EQUINE AND BOVINE STREPTOCOCCI AS CAUSAL AGENTS OF HUMAN INFECTIONS.

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and
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Introductory.—The valuable work performed in England by Andrewes and Horder, by Gordon and by Houston, and in America by Winslow and Palmer, Hopkins and Lang, Fuller and Armstrong, and by Stowell, Hilliard and Schlesinger, and last, but by no means least, by Broadhurst, with regard to the origin of streptococcal infections of man, having, notwithstanding its great hygienic importance, not awakened any marked response on the part of workers in the Tropics, as far as the literature at our disposal in Khartoum indicates, we feel that a few remarks on the sources of *Some Streptococcal Infections* met with in the Sudan may possibly arouse interest in this subject, and therefore we bring forward the following remarks, which form the fifth of a series of short notes upon the Streptococcal Infections of the Anglo-Egyptian Sudan.

Table I.—Puerperal Fever Streptococci.

1	Source	I	II	III	IV	V	VI	VII
2	Strains	1	2	3	4	5	6	7
3	Chain formation	Short	Short	Short	Short	Short	Short	Short
4	Gram	+	+	+	+	+	+	+
5	Anaërobic growth	+	+	+	+	+	+	+
6	Pigment	O	O	O	O	O	O	O
7	Agar-agar	Ty	Ty	Ty	Ty	Ty	Ty	Ty
8	Blood serum	Ty	Ty	Ty	Ty	Ty	Ty	Ty
9	Broth	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.
10	Gelatine growth	±	Slight +	±	±	Slight +	Slight +	+
11	Gelatine liquefaction	O	O	O	O	O	O	O
12	Glucose	A	1·2	2·6	3·6	2·8	2·9	5·1
13	Saccharose	A	2·3	2·4	3·4	2·7	2·8	4·0
14	Lactose	A	2·2	2·6	2·9	2·9	2·7	3·0
15	Raffinose	A	A	4·0	3·6	2·9	2·8	3·5
16	Salicin	O	2·7	0·1	0·0	2·3	1·9	3·4
17	Mannitol	O	0·0	0·0	0·0	0·1	0·3	2·1
18	Inulin	O	O	O	O	A	O	0·1
19	Milk	A	AC	AC	AC	AC	AC	AC
20	Neutral red	O	O	O	O	O	O	O
21	Hæmolysis	O	O	O	O	O	O	O
22	Bile test	O	O	O	O	O	O	O
23	Sulphuretted hydrogen	O	O	O	O	O	O	O
24	Name	*S. salivaris*	*S. bovinus*	*S. salivaris*	*S. salivaris*	*S. bovinus*	*S. bovinus*	*S. versatilis*

Table II.—Pathogenic Throat Streptococci.

1	Source	I	II	III	IV	V	VI
2	Strains	1	2	3	4	5	6
3	Chain formation	Long	Short	Long	Short	Short	Short
4	Gram	+	+	+	+	+	+
5	Anaërobic growth	+	+	+	+	+	+
6	Pigment	O	O	O	O	O	O
7	Agar-agar	Ty	Ty	Ty	Ty	Ty	Ty
8	Blood serum	Ty	Ty	Ty	Ty	Ty	Ty
9	Broth	G.T.	G.T.	Deposit	G.T.	G.T.	G.T.
10	Gelatine growth	O	+	+	O	O	+
11	Gelatine liquefaction	O	O	O	O	O	O
12	Glucose	4·5	3·7	5·1	4·9	3·3	5·1
13	Saccharose	2·0	1·0	4·4	3·2	3·9	4·1
14	Lactose	3·4	3·6	5·4	3·5	3·1	2·5
15	Raffinose	2·5	4·9	3·5	3·9	3·8	2·9
16	Salicin	1·9	3·7	3·3	2·4	4·2	3·5
17	Mannitol	0·1	3·5	0·2	0·2	2·8	2·2
18	Inulin	0·7	5·6	4·6	2·7	2·1	0·0
19	Milk	AC	AC	AC	A	AC	AC
20	Neutral red	O	+	O	O	O	O
21	Hæmolysis	O	O	+	O	O	O
22	Bile test	O	O	O	O	O	O
23	Sulphuretted hydrogen	O	O	O	O	O	O
24	Name	*S. bovinus*	*S. versatilis*	*S. actuosus*	*S. bovinus*	*S. versatilis*	*S. versatilis*

Reference to the work performed by other authors is not included in the present short note, but will be found in the four preceding notes (see references at end), or will be referred to in future communications.

In the present paper we shall endeavour to trace to their sources the pathogenic streptococci found in puerperal fever and in sore throats. The streptococci which we have so far identified as causal agents of these two conditions are set forth in Tables I and II given below.

The results set forth in these tables were obtained by the methods sufficiently described in our previous communications and need not be repeated here.

Some special features of the tables, however, require explanation, and they are as follows:—

+	means	*positive.*
O	,,	*negative*
Ty	,,	*typical*
G.T.	,,	*general turbidity*
A	,,	*acidity*
AC	,,	*acidity and clot*

The figures indicate the number of cubic centimetres of $\frac{N}{20}$ KOH required to neutralize 5 c.c. of the carbohydrate medium after deducting the amount necessary for the control.

The seven cases of puerperal fever are due to:—

(1) *S. salivarius* Andrewes and Horder 1906.

(2) *S. bovinus* Broadhurst 1915, synonym *S. bovis* Chalmers and Atiyah 1915.

(3) *S. versatilis* Broadhurst 1915.

The six pathogenic throat streptococci belong to the following species:—

(1) *S. bovinus* Broadhurst 1915, synonym *S. bovis* Chalmers and Atiyah 1915.

(2) *S. versatilis* Broadhurst 1915.

(3) *S. actuosus* Chalmers and Marshall 1916.

We thus have four streptococci to trace to their source, but before starting to do so we will consider their classification, and this can be done by examining the Provisional Diagnostic Table given below, in which we alter the names previously given to Groups V and VI as follows:—

V. Mastitidis Group becomes *V. Gasogenes Group;*

VI. S.H. & S. (I) Group becomes *VI. Non-fermenting Group;*

as we believe that this change of name will prevent confusion in future references.

By an unfortunate printer's error, which has only just come to our knowledge, Group VIII was entitled *Erysipelatis Group* in previous communications; it should, of course, have been *Erysipelatos Group.*

PROVISIONAL DIAGNOSTIC TABLE OF STREPTOCOCCAL GROUPS.

A. Parasitic on plants. Grow in broth but not on agar or gelatine		*I. Sphagni group.*
B. Parasitic in animals. Grow in broth and on agar and usually on gelatine:—		
F. Obligatory anaërobes ...		*II. Fœtidus group.*
G. Aërobes, facultative anaërobes:—		
M. Pigment present ...		*III. Sanguineus group.*
N. Pigment absent:—		
R. Gelatine actively liquefied		*IV. Gracilis group.*
S. Gelatine usually not or rarely slightly liquefied. Inulin usually not fermented:—		
I. Gas produced ...		*V. Gasogenous group.*
II. Gas not produced:—		
Non-fermenters	(a) Glucose and other sugar media not fermented ...	*VI. Non-fermenting group.*
Monosaccharide fermenters	(b) Glucose usually and other sugars generally fermented:—	
Equine fæcal type	1. *Glucose* alone or with *saccharose* and *salicin*, but not with lactose, *fermented* ...	*VII. Equine group.*
Disaccharide fermenters	2. *Lactose, glucose, saccharose and salicin*, but not *mannitol fermented*	*VIII. Erysipelatos group.*
Human fæcal type	3. *Lactose, glucose, saccharose, salicin, mannitol, and sometimes raffinose fermented* ...	*IX. Fæcalis group.*
Trisaccharide fermenters.	4. *Raffinose, lactose, saccharose, usually glucose, sometimes salicin and rarely inulin*, but not mannitol *fermented* ...	*X. Salivarius group.*
Bovine fæcal type		

When this table is examined it will be seen that *S. salivarius, S. bovinus* and *S. actuosus* belong to X, *The Salivarius Group,* while *S. versatilis* is classified under IX, *The Fæcalis Group.*

In order to make the classification clearer we give details of the Salivary Group, but in doing so we have not specially regarded the fermentation or non-fermentation of inulin, as we think that this is a new character at present only being acquired by the streptococci.

Salivarius Group.

Definition.—Streptococci parasitic in animals, facultative anaërobes, growing in broth and on agar without pigment or gas formation, with slight or no growth at 22° C. in gelatine which is not liquefied and capable of fermenting glucose, saccharose, lactose, and raffinose, and may ferment inulin but not mannitol, and generally capable of clotting milk. Habitat: Human saliva, human fæces, bovine and equine fæces.

Classification.—This group can be divided into a typical subgroup and an atypical subgroup containing varieties of the typical group in which there is

suppression of some important character which is not inulin fermentation.

Typical Subgroup.

Glucose, saccharose, lactose, and raffinose, and at times inulin fermented.

A. Salicin not fermented:—
I. Hæmolysis marked ... *S. anginosus.*
II. Hæmolysis absent ... *S. salivarius.*
B. Salicin fermented:—
I. Hæmolysis marked ... *S. actuosus.*
II. Hæmolysis absent ... *S. bovinus.*

Atypical Subgroup.

Contains varieties of *S. anginosus, S. salivarius, S. actuosus,* and *S. bovinus* in which there is suppression of some character, but as these suppressions are generally only temporary it is not necessary to specially characterize them.

The classification of the Fæcalis Group has been sufficiently set forth in the third paper, and need not be repeated here.

It may perhaps be useful to give a definition of the new species, *S. actuosus* Chalmers and Marshall 1916, before proceeding further with our subject.

"*S. actuosus.*—Streptococcus living parasitically in a human throat in which it caused severe inflammation of the pharynx and tonsils, a facultative anaërobe capable of growing in broth in long non-encapsulated chains which are not soluble in bile or salt solutions, and which give rise to small, discrete, translucent colonies on agar-agar, but never produce pigment or gas in any medium, and capable of growing on gelatine without liquefaction at 22° C., and of producing acidity in glucose, saccharose, lactose, raffinose, salicin and inulin, but not in mannitol, also producing marked hæmolysis and clotting of milk, but not reducing neutral red, and not forming sulphuretted hydrogen." Etymology—*actuosus* = very active.)

With these preliminaries we may now proceed to attempt to find the natural habitats of the above-mentioned pathogenic streptococci.

Natural Habitat.—Most streptococci are found as parasites (or saprophytes) of the nose, naso-pharynx, and alimentary canal of vertebrate animals, but they can also be found in the alimentary tract of the invertebrata, and apparently also, but to a less extent, living on or in plants.

From these natural homes they may pass to air, soil, milk, or water, and so be conveyed from one animal to another, as they are extremely resistant against heat and drought, as we shall presently show.

It therefore behoves us when searching for the natural habitat of streptococci pathogenic to man to examine first of all the fæcal matter of man and his domestic animals, but in this paper we restrict our attention to human, equine, and bovine fæces, with the derivative of the two last named, viz., "zibla," and human saliva, as being most important, and leaving to a future communication further researches into the domestic animal.

(*To be continued*).

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SEPTEMBER 15, 1916.

A VISIT TO THE CASUALTY CLEARING STATIONS AND HOSPITALS AT THE FRONT.

(*Continued from p.* 204.)

THE REGIMENTAL AID POST

is situated immediately behind the firing-line or at the mouth of the evacuating trench in trench fighting. The wounded are brought to the post by soldiers of the battalion in action; these men have been trained in time of peace to do stretcher-bearer work and to apply first-aid to the wounded. At this post the surgeon attached to the battalion, generally a Lieutenant R.A.M.C., inspects the dressings applied by the bearers and either passes them or reapplies them when necessary, and the patient is handed over to the

FIELD AMBULANCE.

The work of the Field Ambulance commences at the Regimental Aid Post and extends as far back as the Main Dressing Station. The Field Ambulance is a mobile unit, which advances or retires

as the position of the Army demands. It occupies what is termed the collecting area of the Field Army, as its sphere of action is to collect the wounded from the various battalions of the brigade to which it is attached. The *personnel* consists of 251 officers and men divided in three sections, A, B, and C, each section being complete in itself. Ten ambulance wagons are attached to the unit, and at the present moment seven of the wagons are motor ambulances and three are horse ambulances. From the Regimental Aid Post the wounded are taken to the

ADVANCED DRESSING STATION

which is situated as close to the firing-line as some shelter or comparative safety from bullet and shell fire permits. Here the dressings are again inspected, and restorative nourishment given when that is urgently demanded; but as speedily as possible the stretchers with their burdens are placed within ambulance wagons and taken to the

MAIN DRESSING STATION,

which is situated as far back as the nature of the available transport and configuration of the country allow. At the Front, in France where the roads are good and where motor ambulances are available the Main Dressing Station may be as far as four to six miles behind the trenches or firing-line. Yet so perfect is the organization that within sixty minutes of the trenches, or thirty minutes of the Advanced Dressing Station, the wounded man is housed, placed in bed, fed, and looked after by nurses, and if necessary placed on the operating table and dealt with. These Main Dressing Stations at the Front in France are no mere makeshift establishments. The buildings are usually of wood, specially planned and erected for the purpose they are devoted to. Large wards with wood flooring; beds, often with spring mattresses; operating theatres with everything possible a surgeon can require, including special anæsthetists. Around the long buildings (huts) are flower beds, gravel paths, or paths of wood raised from the ground on account of the mud the water-logged soil develops in wet weather. Here assemble the men who have just endured the excitement of battle and the shock of wounds. The fresh arrivals, gassed or wounded but an hour previously, look pale, rather worn and sallow, and, as a rule, they maintain silence, due partly to the shock or pain of wounds, to the reaction after the excitement of battle, and to the discipline which a military ward entails. Sleep does not come at first, but the silence of the men makes itself felt, and imposes a restraint upon a visitor to speak words of inquiry or even of comfort. The inclination on approaching one of these wounded men in bed is not to speak, but to sit beside him and be silent, or to speak almost in a whisper in monosyllables, asking no questions. This is no place for the fussy visitor, and in course of time the veriest chatterbox is reduced to silence. The climax of the soldier's life is passing; the strong man, vigorous in strife but an hour before, is brought low and the eternal realities of things are upon him, and wonderment as to the present and the future holds his thoughts. Silence, yes! a sacred silence, for this ward is full of men who have, in the defence of their hearths and homes, but recently faced death, and were ready to make the supreme sacrifice in their country's cause.

At the Dressing Station the stay of the wounded man is but short, for the " front " must be cleared; and a day, or a week or two at the utmost, is the limit of stay, the time being regulated according to the condition of the patient. From hence he is conveyed to

THE CASUALTY CLEARING STATION

or the C.C.S., as it is styled. This is the hub of the surgical world at the Front; the centre of activity, where the wounded are collected, treated, and finally transferred to the railway ambulance wagons at the railhead or railway siding, often specially constructed for the easy transport of the stretcher or lying-down cases to the bunks in the carriages.

The conveyance of the wounded from the Main Dressing Station to the Casualty Clearing Station is accomplished by a department entitled the " Motor Convoy." The work of the field ambulances ends at the Main Dressing Station, and it is by the motor convoys that the interval is covered. The interval may be a few miles only, or it may extend to many miles. Practically the interval is determined by the distance to the nearest railway. As the railways in the part where fighting exists are numerous, the intervals between these stations and the Front are made as short as possible, a fact which is greatly to the benefit of the wounded.

A motor convoy consists officially of fifty motor ambulances; three medical officers are detailed for duty with the convoy, to which are attached sufficient orderlies to accompany the ambulances. These motor convoys are a great feature of this war, whether near the Front or between the railway stations and the hospital ship, or again, between the railway terminus and the base hospital, at home or abroad. These ambulances are for the most part given by private individuals or by societies, and they are a great boon to the soldier, and mean the saving of many lives and the alleviation of a world of suffering.

To attempt to describe a Casualty Clearing Station is, when dealing with those at present to be seen in France, to describe a marvel of perfection which excites admiration at every step. The best buildings in the neighbourhood have been occupied as Casualty Clearing Stations. At —— a palatial building, in times of peace used as the lunatic asylum for a great district, has been given over for this purpose. The station is replete in equipment and satisfactory in its sanitation. In place of permanent buildings where none are available, the buildings are specially built of wood, and laid out as long " huts " around a square, or placed in parallel rows.

At —— is to be seen a Clearing Station, situated in the beautiful private grounds of a château, consisting of canvas and grouped marquees, with wide passage-ways forming admirable wards.

The buildings are raised from the ground as a rule, or with concrete foundations; the walls and roof of wood, carefully constructed with well-fitting doors, so that the "hut" is dry and warm, and well lighted and ventilated. It must be understood that the "hut" is really a long building capable of containing thirty to forty or more beds, with ward kitchen, lavatories, nurses' room, &c.

Several of these buildings are laid out with grass or flower beds round each and carefully kept paths between. An operating theatre capable of accommodating two, three, four or more operating tables, with all necessary appliances; electric or acetylene lighting, sterilizing rooms, wheel-litters for the conveyance of patients, &c.

Water is laid on to these Casualty Clearing Stations sometimes from miles away. At —— the water was conveyed in pipes for a distance of seven miles. Storerooms for meat, with appliances for cooling; quartermaster's stores and counter; pharmacy, with ample supplies of the most recent drugs. Laboratories wonderfully equipped, where expert work is continually being carried on by well-known bacteriologists.

Baths, plunge and shower, are plentifully supplied. In some baths as many as sixty men can have hot or cold shower baths at the same time; three minutes' hot and two minutes' cold being the rule as regards the time allowed for each.

Disinfection has been carried to a high state of perfection at the Casualty Clearing Stations. Scabies is the great scourge at the moment, and it is met with in almost every army. Batches of men are sent down for treatment at a time. They are accommodated in separated buildings and kept there for six or seven days; the infected clothing is received in one room, it is then passed through a Thresh's steam disinfector, and stored in another room for redistribution at the end of the six or seven days' treatment. The soldiers are given baths with sulphur or other appropriate parasiticides, and are temporarily dressed in garments which are systematically disinfected.

Isolation huts or quarters are also provided in cases of suspected infectious diseases, such as smallpox, typhoid, &c.

The sanitation of the camp is raised to a fine art. The British Army taught the world the meaning and practice of sanitation, and we still look to the Army methods as being the type to be followed in both military and civil life. A visit to a Dressing Station, a Casualty Clearing Station, or to a Base Hospital in France is a liberal education in itself. Nothing the writer would advocate more than that the practitioners of medicine in Britain should be taken in groups and sent on a visit to one of the many Casualty Clearing Stations at the Front. The minute care bestowed upon the disposal of excreta, the infinite originality of the medical officers in charge of these stations in providing for the separation of urine and fæces, the evaporation of urine, or the disinfection of the urine by precipitation, by filtration, and by disinfectants, chief among which chlorine in various forms plays an important part.

(To be continued.)

Note.

The Sivewright Prize of £10 for 1915 has been awarded to Albert J. Chalmers, M.D., F.R.C.S., D.P.H., Director, Wellcome Tropical Research Laboratories, Khartoum, for the series of valuable contributions to the Journal of Tropical Medicine and Hygiene for 1915.

The Sivewright Prize, founded by Sir James Sivewright, K.C.M.G., LL.D., is awarded from time to time for the most valuable papers published in the Journal of Tropical Medicine and Hygiene.

All readers of the Journal will agree with the judges in this matter as to the value and scientific importance of Dr. Chalmers's contributions.

July, 1916.

Abstracts.

HEAT EXHAUSTION.[1]

The two conditions due to excessive heat, heat exhaustion and sunstroke, vary in their pathology and symptomatology. Heat exhaustion is a condition resulting from prolonged or continuous exposure to indoor heat or to the heat from the sun without direct exposure to the sun's rays. It occurs commonly in engine and furnace rooms, particularly among stokers on ocean steamers, and in foundries. On hot summer days it may even befall those remaining indoors in hot and poorly ventilated rooms.

Symptoms.

Heat exhaustion is an asthenic condition, and the symptoms are those of depression. It often results in collapse due to circulatory failure. Not only is there a congestion of blood in the splanchnic vessels with a corresponding depletion of the vessels in the brain and periphery, but also the excessive loss of fluids from the body by way of perspiration causes an increase in the viscosity of the blood. There result vertigo, pallor, at first faintness and weakness, and then prostration, the patient becoming semi-conscious or losing consciousness altogether. The hands become clammy, cold perspiration may be present, and the body feels cold. The pulse becomes small and feeble, and the heart action is poor and weak. Often the condition is not allowed to proceed so far, and there are present only the weakness and faintness. With this may also be associated irritability, restlessness, and sleeplessness. Occasionally there is delirium. In heat exhaustion there is hypothermia, the temperature falling as low as 95.

Treatment.

In treating heat exhaustion it must be remembered that there is a depressed and hypothermic condition. Stimulants are indicated, perhaps best as caffeine or coffee. Camphor, strychnine, and digitalis preparations may be given hypodermically if indicated. If the heart is weak, a hypodermic

[1] Abstracted from *Journ. Amer. Med. Assoc.*, July 22, 1916.

injection of $\frac{1}{60}$ gr. of atropin sulphate is good treatment. Friction of the extremities, and even dry heat, may be advisable. The ice bath is absolutely contraindicated in this condition, as a subnormal temperature already exists. A warm bath will be better tolerated.

Sunstroke.

In sunstroke the symptoms are due to causes different from those in heat exhaustion. Besides the action of the prolonged high temperature, it is probable that there is some direct action of the rays themselves. In this condition there is a congestion of the blood-vessels of the cerebrospinal system and the periphery. This is caused by the effect of the heat directly on the brain. There may be premonitory symptoms, such as headache, restlessness, malaise, nausea, extreme thirst, rapid shallow breathing, vomiting, and occasionally diarrhœa. There also may be frequent micturition, and a hot, dry skin. If the exposure to the sun is continued the symptoms are aggravated, and with them the face becomes flushed, the pulse full and frequent, and the breathing laboured. The temperature may rise to 108°, and even to 112° and 113° F.

The pupils are contracted, but become dilated preceding death. Symptoms of cerebral congestion and disturbance of the cerebrospinal centres also manifest themselves. Twitching of the muscles occurs, and often epileptiform convulsions. Later there may result paralysis of the respiratory centre. Preceding death there usually is suppression of the urine. Should there be recovery from a severe sunstroke, there may follow partial or complete paralysis, deafness, disturbance of vision or blindness, constant headaches, or dementia.

Three atypical cases, in all of which there were signs of meningeal irritation and lumbar puncture, showed the cerebrospinal fluid to be under marked pressure. In one case there was only stupor, and in a second, sudden and acute dilatation of the heart with extreme arrhythmia.

Treatment.

In sunstroke there will have to be combated the plethoric condition of the veins both at the periphery and in the cerebrospinal system. Besides this an attempt must be made to reduce the high temperature. The subject of the sunstroke should be brought to a cool, shady place, and the clothing loosened or removed. If there is poor respiration, artificial respiration should be resorted to. It must be cautiously done so as not to encourage possible cerebral hæmorrhage. In cases of marked plethora, venesection, with the withdrawal of from 250 to 400 c.c. of blood, is also of assistance in warding off œdema of the brain, and when asphyxia due to stagnation of the blood in the lungs has persisted for more than two hours.

For the reduction of the temperature there should be tried a cold bath to which ice is added, or cool effusions. An ice cap should be constantly on the head. Friction of the body with pieces of ice will also be found useful. This should be continued until the temperature has fallen to at least 102° F. Often stimuli direct to the naked skin will be of service. This may be done by sprinkling the naked trunk with cold water, fanning the body, or by squirting cold carbonated water from a bottle on the body. Cold-water enemas may also be tried.

Antipyretics aid in the attempts to reduce the temperature, but they should be used with discretion, and the heart should be carefully watched. The antipyretics that are best are antipyrin (Phenazone, B.P.) or acetphenetidin (Phenacetin, B.P.). These, with the cold-water applications, should be continued as long as the high temperature exists.

To aid in the reduction of the cerebral pressure, lumbar puncture should be done. For convulsions or delirium, small doses of some sedative, such as chloral or the bromides, may be used.

After-treatment.

The after-treatment of sunstroke or heat exhaustion is very important. Symptoms of the attack may persist for a long time. The patient should avoid all hot places, particularly those where he would be exposed to the sun. If his condition warrants it, he should bathe frequently in cool or cold water. If there is insomnia, veronal-sodium (sodium diethyl-barbiturate) or chloral may be given. A tonic containing strychnine can also be given. Alcoholic drinks should be avoided. There may be some loss of memory, such as forgetfulness and headache, or irritability. These, however, usually disappear. Occasionally, when the sunstroke has been of an unusually severe character, there may remain permanently signs of brain injury, such as impaired memory, dementia, mania, epilepsy, or partial paralysis.

Heat Collapse.

A common condition from exposure to the sun, very often seen on hot summer days, is heat collapse. This is often called sunstroke, but it is too transient and mild for sunstroke. It is due to a short exposure to the heat of the sun's rays. There may be a transient unconsciousness; the temperature is normal or slightly elevated, and the respiration shallow and rapid.

Treatment consists in removing the patient to a cool or shady place, loosening the clothing, and spraying the face and body with cold water. He should be given a cup of strong tea or coffee. A hypodermic injection of strychnine or camphor may be needed.

PSEUDO-APPENDICITIS.[1]

By F. G. Connell.

The question of chronic appendicitis calls for attention, not because of a high mortality rate, but because of a rather disconcerting morbidity rate, a post-operative persistence of symptoms. When a patient complains of the same symptoms after

[1] Read before the Section of Surgery, General and Abdominal, at the Sixty-seventh Annual Session of the American Medical Association, Detroit, June, 1916. Abstracted from the *Journ. Amer. Med. Assoc.*, July 29, 1916.

appendectomy as before the operation, there is sufficient reason for belief that the original symptoms were not caused by the appendix—that the treatment was based on an incorrect diagnosis. The large and apparently increasing number of these cases calls for close attention and an analysis of all available data, in the hope of arriving at some more definite justification for making a diagnosis of "chronic appendicitis."

The reviewed cases of unsatisfactory results following removal of the appendix exclude:—

A. Acute cases.

B. Cases in which the appendix was removed during the course of an operation for other conditions.

C. Cases in which ordinary sequelæ of laparotomy have occurred, such as hernia, ventral or inguinal, ileus, fistula, phlebitis, &c.

After excluding the foregoing, those remaining are unquestionably due to mistaken diagnosis and may be divided into:—

D. Cases in which the true pathologic lesion, and proper diagnosis, has been demonstrated at a subsequent operation, or is reasonably evident, such as gastric and duodenal ulcer, cholecystitis, pancreatitis, lesions of the genito-urinary tract, and of the uterus and adnexa, tuberculosis, syphilis, malignancy, orthopædic conditions, and spinal cord lesions.

E. Cases to which I shall direct attention—namely, those in which the persistence of the symptoms has not been rationally explained, and which might well be termed pseudo-appendicitis.

After excluding Classes A, B, C, and D between January, 1909, and January, 1916, eighty-seven cases in which the removal of the appendix, for chronic appendicitis, or interval operation for appendicitis, had not been followed by relief of symptoms; 212 patients were operated on during the interval with such a diagnosis.

Review of Cases.

A review of these cases reveals:—

Conditions found at primary operation in forty-eight cases: Appendix "normal," 6; appendix large, swollen, tense, erect, congested, 4; small appendix, 7; small fibroid appendix, 12; appendicitis obliterans, 2; small fibroid appendix "with adhesions," 9; mucocele of appendix, 1; retrocecal appendix, 6; fæcal concretions; 12; free abdominal fluid, 10; enlarged mesenteric glands, 9; Lane kink, 6; general abdominal ptosis, 12; cæcum mobile, 17; pericolic membrane, 15; perisigmoiditis 3; double-colon, 2; hepatic flexure absent, 2; omentum adherent to left round ligament, 1; megaduodenum, 1.

Duration of time after operation before return of symptoms: Less than six months, 39; between six months and one year 27; between one and two years, 8; between two and three years, 4; between three and four years, 1; between four and five years, 1; between eight and nine years, 1.

Noteworthy circumstances which preceded the return of symptoms: Husband in bankruptcy two years after operation, 1; business, law suit two years after operation, 2; pulmonary tuberculosis one year after operation, 1; three years after operation, 1; traumatism to abdomen a few months after operation, 1; "fell downstairs" six months after operation, 1; operation on mother one year after operation, 1; sudden death of husband one and a half years after operation, 1; pregnancy one year after operation, 1; five years after operation, 1.

Conditions found at secondary operation in nineteen cases: Lane kink, 6; double-barrelled colon, 8; general abdominal ptosis, 11; cæcum mobile, 12; cecal torsion, 1; omental adhesions, 3; pericolic membraue, 12; perienteritis (ileal), 1; cholecystitis (noncalculous), 4; mesenteric glands, 7; adhesions between ileum and colon, 1; megaduodenum, 1; "adhesions" absent at stump of appendix, 19.

Secondary operations: By author, 19; by others, 8; pericolic membrane, division of, 12; cecopexy, 8; Lane kink, division of, 6; omental "adhesions," division of, 3; perisigmoiditis, division of, 1; colectomy, 3; enterostomy, 1; ileosigmoidostomy, 1; cecosigmoidostomy, 1; cholecystostomy for noncalculous cholecystitis, 3; dilatation and curettage, 2; tonsillectomy, 2; operation for kidney stone (no stone found), 3; nephrectomy, 1; exploratory laparotomy, 1; hysterectomy, 1; Coffey's hammock operation, 1; gastro-enterostomy, 1; "retroversion" of uterus and ovarian cyst, 1.

Multiple operations: Three, 4; four, 1; five, 2; six, 1.

Results of secondary operations: Unknown, 2; improved, 9; unimproved, 15; death, 1.

Results of cases with no secondary operation: Unknown, 8; improved, 16; unimproved, 36. In three striking instances there was sudden spontaneous unaccountable recovery of health after a prolonged period of disability following secondary, and in one instance multiple, operation. Five improved after pregnancy.

Summary.

These cases of pseudo-appendicitis were usually in young thin adults from 15 to 30 years of age, more common in females, and about equally divided between married and single.

The duration of symptoms varied from "some weeks" to ten or more years. The number of "attacks" varies between one and six to "many," some recurring at regularly stated intervals.

The pain of attacks rarely put the patient to bed, though classed as "severe" in about one-third, and "mild" in one-third of the cases. The pain is frequently described as "continuous" or "side ache," and made worse by exertion. Hypersensitiveness and tenderness are usual, and a "burning" sensation is frequent, but rigidity is not common.

Pain is usually located in the right iliac fossa, though it may occur anywhere on the right side, or at the umbilicus.

Tenderness at the scar of a previous operation is rare.

Temperature elevation is uncommon, subnormal temperature frequent.

Nausea is usual, vomiting rare, "indigestion" and "gas," frequent, with constipation present in two-thirds of the cases.

General abdominal ptosis is very common, iliac tumour, gas tumour, dilated cæcum and gurgling in the right iliac fossa almost constant.

Skin changes are variable, and urinary symptoms occasionally present.

These patients are frequently spoken of as "neurotic" in the history, and complain of "neuritis" in various parts of the body, usually on the right side. Goitre was present in a small proportion of cases.

Blood examinations show leucocytosis absent, lymphocytosis rarely present, the Wassermann in the blood, negative.

Spinal puncture in nine of twelve cases shows increased tension. The Wassermann in the spinal fluid is negative in twelve cases.

There was lack of hydrochloric acid in the stomach contents in one fourth of the cases examined.

Mucus in the stool is not common.

Röntgenoscopy shows ptosis, and delay at ileum or ascending colon.

Sections of the appendix show nothing characteristic. The recent report of Muschowitz is of interest in this connection.

Mesenteric glands on section show simple hyperplasia, and cultures from same are negative.

At primary operation in forty-eight cases the appendix was usually small, and with fæcal concretions in one-fourth of the cases.

There was free fluid in the peritoneal cavity in one-fifth of the cases, and enlarged mesenteric lymph glands in one-fifth of the cases.

Ptosis, cæcum mobile, Lane kink, and pericolic membrane are not uncommon.

The primary immediate result of operation is very satisfactory, but there is usually a return of symptoms within the first year.

Trauma, pulmonary tuberculosis, or "nervous shock" in some cases precede the return of symptoms.

Findings at secondary operation (in nineteen cases) by the author: Adhesion of omentum or viscera to site of appendix is absent. "Adhesions" are uncommon; ptosis, cæcum mobile, and various membranes are constantly present. Mesenteric lymph glands are found enlarged in one-third of the cases.

The remote results of various secondary operations are not encouraging: In twenty-seven cases, unknown, 2; improved, 9; unimproved, 15; death, 1. In sixty cases in which operation was not performed a second time the results were: unknown, 8; improved, 16; unimproved, 36.

Conclusions.

The existence of such a clinical entity as "chronic appendicitis" has been questioned.

Evidence presented shows that the diagnosis is often incorrect and is being made with unwarranted frequency.

After eliminating all demonstrable pathologic conditions that might possibly be confused with "chronic appendicitis," there remains, in certain cases, some cause for pain in the right iliac fossa, other than the appendix, the exact cause of which is as yet not definitely known.

Such cases of pseudo-appendicitis are frequently associated with visceral ptosis, constipation, and neurasthenia.

Appendicitis, either acute or chronic, or an appendix that has been the site of an unquestioned inflammation, calls for surgical treatment.

Pseudo-appendicitis, on the contrary, is in no way related to the appendix, and is a non-surgical condition in which appendectomy is contra-indicated; hence the necessity of a differential diagnosis between these conditions.

Every case of so-called chronic appendicitis that is associated with enteroptosis, constipation, and symptoms of nervous instability should be looked on as pseudo-appendicitis until careful and painstaking study of the history and clinical findings prove it to be otherwise.

In patients unwilling, or unable, to submit to this careful differential diagnosis, the good repute of surgery demands that the facts, as to this uncertainty in diagnosis, and hence in the result of treatment based on such diagnosis should be frankly presented to the patient or responsible relatives.

If it is then decided that the appendix shall be removed the operation will be exploratory, a short cut to diagnosis with the diagnosis and prognosis withheld until after the operation.

The diagnosis of chronic appendicitis presupposes a previous attack of acute appendicitis.

It is often impossible to determine the character of a previous attack of right-sided abdominal pain from the data available at a subsequent time, especially in view of the fact that cases of classical acute appendicitis with damage to the appendix, demonstrable at subsequent operation, are many times entirely free from all symptoms for long intervals.

Hence the advisability of seeing the patient in one of these attacks, the characteristics of which may clear up the case.

Cases characterized by more or less continuous discomfort in the right side of the abdomen, or of mild attacks of short duration, with brief intervals of relief, in which the pain is made worse by exertion and with relief on recumbency, associated with hypersensitiveness of skin and spasm of muscle, gas tumour, cæcum mobile, gurgling, nausea, but rarely vomiting, normal or subnormal temperature, no increase in leucocytes, constipation, enteroptosis, and evidence of vagus irritability, leading to chronic invalidism, are often pseudo-appendicitis, and are not permanently relieved by removal of the appendix. Such cases should, therefore, be given careful consideration before operative measures are instituted.

An entirely satisfactory explanation of this state of affairs has not yet been presented, though intensive study suggests that a lack of balance between the vagus and sympathetic divisions of the autonomic nervous system may be an etiologic factor.

This in turn may be due to abnormal function of some of the endocrine glands.

Much is to be learned regarding this clinical syndrome, but in the meantime accumulating experience strongly suggests the desirability of emphasizing the fact that the diagnosis of chronic appendicitis calls for more justification than is often given it.

Abstract of Discussion.

H. A. Black: There are but few structures within the upper abdomen disease of which may not give rise to symptoms which resemble those of chronic appendicitis. In chronic gastric disorders there is probably greater confusion than in any other condition within the abdomen as applied to chronic appendicitis. In these cases the Röntgen ray, the test meal, even hæmorrhage from the stomach, does not and should not convict that organ of ulcer. The absence of pain and tenderness does not absolve the appendix from possible guilt. Of course, these cases can usually be demonstrated by operation, but it is much more pleasant to confirm rather than to be confounded by our operative findings. Pyloric spasm is probably the chief factor of confusion between chronic stomach disorders and chronic appendicitis. Pyloric spasm is very common in chronic appendicular disease especially that form known as the obliterative type of appendix. Given a case of chronic peptic ulcer *versus* chronic appendicitis, there is required skilled surgical diagnostic ability as well as a very high degree of judicial temperament. The pyloric spasm will often confuse the Röntgen ray findings; not infrequently it accounts for hematemesis, and I believe it is probably the direct cause of so-called "hypersecretion" through retention of the natural gastric secretions, rather than that the glands of the stomach have actually produced an abnormal amount—a hyper-retention rather than a hyperproduction. I would apply the same reasoning to the condition of hyperacidity when encountered in connection with pyloric spasm, for the contraction not only retains the secretion within the stomach, but also prevents the regurgitation of the intestinal secretion which normally takes place, and to a normal degree lessens the acidity of the stomach contents.

E. Laplace: Long before the days of appendicitis we heard of trouble in the right iliac region called typhlitis. In fact, most right iliac conditions were referred to the cæcum. We now know that these troubles start generally in the appendix. As a result the cæcum is now almost forgotten. At the beginning of the colon there are two pouches, one the appendix and the other the cæcum. As the appendix can receive and retain intestinal contents, we have entirely neglected the cæcum which receives and may retain, beyond the proper time, intestinal contents subject to all decompositions. Now the cæcum is coming back into its own. When we operate and find the appendix and remove it because there is trouble there, we have possibly overlooked the real seat of the trouble, the cæcum, and there may be—probably there is—a chronic form of transudation of toxins through the cæcum which leaves no apparent trace of itself. We know that in cases of so-called recovery after a phlebitis on the left side, the insidious poison may have travelled from the right side to the left, and we must conclude that there are toxins which leave no trace behind. It would seem that decompositions take place in the cæcum which do not result in the necessary irritation which produces bands and adhesions and so on, but which does produce a neurasthenia which precedes or follows the enteroptosis, &c. I wish to make a plea against the very small incision in cases of appendicitis. We must explore. Because pain is there we must not conclude that it is due to the appendix only. The whole region should be examined in order to fulfil the indication and not allow a neighbouring lesion to pass unnoticed.

M. H. Fussell: Many of us cannot differentiate between those cases which do not show any pathology and the actual cases of appendicitis giving rise to pain in the right iliac fossa. The reasons for this difficulty in diagnosis are appendix, gall-bladder, and gall-duct disease; stomach conditions, kidney conditions, and so on often are difficult and sometimes impossible to differentiate from true or apparent appendicitis. Now as it is suggested that all the pseudo cases as he calls them, that is, all these cases of pain in the right iliac fossa which are *not* due to an inflammatory condition are frequently accompanied by splanchnoptosis and also practically all of the individuals, man or woman, are neurasthenic. The question of treatment is the great point. What shall be done in these cases? From the medical standpoint all such cases where the diagnosis of appendicitis or other abdominal inflammatory conditions is questionable, or where it is fairly well shown that there is no inflammatory condition, should be put on a diet which will fatten them, on rest that will keep them out of the turmoil of society, and a vast majority will clear up under that sort of treatment, but there still remains a certain proportion which does not clear up under such conditions. Tell the patient you are in doubt about the diagnosis. If you are a surgeon tell the man who sent you the patient that you are in doubt about the diagnosis, but the safest thing to do is to make an exploratory operation, because with all our careful diagnoses there are a number of cases of inflammatory conditions which do give rise to pain in the right iliac fossa without the usual physical signs. It is a great deal better to open the abdomen and find nothing than to allow an old gallstone or a diseased appendix to remain with a possible serious result.

PROGRESS IN ORTHOPÆDIC SURGERY.[1]

Tuberculosis.

In 682 cases of Pott's disease an operation had been performed, the purpose of which operation was to ankylose the spine at the seat of the disease. On 642 cases either the bone graft, after the method of Albee, or the plastic bone operation, after the method of Hibbs, had been performed. In 198 cases, done by Albee himself, he has reported 92 per cent. as improved. In 158 cases done by Hibbs himself 90 per cent. were reported improved, and in 286 cases done by other surgeons there was improvement in 73 per cent. In the whole series there were thirty deaths, or a mortality of about 5 per cent. Three cases developed paraplegia after the operation, five cases developed abscess; there were nine cases of sepsis, and in seven there was necrosis of the graft. Tuberculous meningitis developed in seven, and miliary tuberculosis in three. The conclusions of the author are: (1) The operation may be expected to abbreviate treatment and hasten ankylosis. (2) By hastening ankylosis the tendency to deformity is lessened. (3) The operations are best adapted for caries involving the cervico-dorsal, dorsal, and dorso-lumbar regions—parts of the spine in which limited motion is of little consequence. It is less well adapted for caries involving the cervical and lumbar regions, parts in which limited motion is a detriment. (4) The general opinion of the majority of surgeons is that the operation should be considered only as one phase of the treatment for Pott's disease, and that post-operative support should be continued until all signs of active disease have disappeared.

In the early cases with small kyphoses the bone graft operation of Albee is likely to yield as good results as the plastic bone operation of Hibbs. It is an operation which requires less skill and its technique can be more easily acquired. It can be done more quickly and, especially if the motor saw is used, need induce little shock. If the kyphos is of considerable size, the bone graft operation is more difficult, and the cutting of a simple curved graft or the applying of a series of long, thin, bendable bone splints, consumes time and adds complexities. In spite of contention to the contrary, these grafts cannot in our experience be expected to lessen materially the size of the kyphos. The Hibbs plastic operation, on the other hand, does lessen the apparent size of the kyphos, and where complicated grafts would be necessary, can be done almost as quickly and, we believe, with as reasonable an expectation of ankylosis. In Dr. Hibbs's hands, or in the hands of those who have taken the pains to develop a technique, there seems to be no more shock than in the bone graft operation. These operations are of questionable advantage under four to five years unless it is impossible to provide recumbency followed by ambulatory apparatus, because the results of carefully carried-out conservative treatment are usually so good, and because with soft bones and rapid growth recumbent and protective treatment ought to be continued even after an ankylosing operation for a period approximately as long as that required in an ordinary case for healing by nature, aided by bloodless art. A 5 per cent. mortality is gratifyingly low, but not negligible.

Arthritis and Bursitis.

Hæmophilic Joints.—A boy of 15 was brought to hospital on account of a very painful tumour of the ankle, which seemed to be a sarcoma on the point of ulcerating, except that sarcomata are not, as a rule, so painful. The tibia was not tender, and although there were local heat and fever, yet there was no involvement of glands, no lymphangitis or fluctuation. A small incision brought dark blood, but no pus, and the little cut bled continuously for three days, confirming the final assumption of hæmophilia. Under calcium chloride and diphtheria antitoxin the oozing of blood was finally arrested. His family showed the usual skipping of the second generation and the reappearance of the hæmophilia in the sons of the daughters, three of the five sons being pronounced hæmophiliacs. In treatment the main thing is to suspect the hæmophilia instead of mistaking the joint trouble for acute articular rheumatism or a tuberculous process, as is too often done. Du Pan declares that this error in diagnosis has often proved fatal. He cites various cases in which puncture of the joint for supposed hydrarthrosis has caused bleeding to death. The blood accumulating in the joint causes sudden pain and swelling, and the limb is held as in acute rheumatism. The region feels hot and there may be fever, but the skin keeps its normal colour. There are, as a rule, several successive attacks involving different joints, but mostly the knee or elbow, one at a time, with or without some slight local trauma preceding. The hæmarthrosis may be entirely absorbed, but it usually persists and irritates the joint, resulting in chronic arthritis. In the second phase this arthritis resembles in every respect a white swelling; there is thickening of the synovia, impotence of the limb, and wasting of the muscles. The pain is less in this stage, the swelling becomes more general, and the *culs-de-sac* are distended, but local heat does not increase. There is elastic fluctuation in the synovial *culs-de-sac*, as with a tuberculous process, and partial ankylosis develops. After the inflammation has subsided, insidious destruction may continue, and there is never an abscess or fistula, and never any enlargement of glands, as from malignant disease. There is danger of mistaking hæmatomata in muscles for cold abscesses and of the occurrence of fatal hæmorrhage resulting from incisions. The family antecedents and tests of coagulating power of blood will reveal the tendency to hæmophilia. The first manifestations generally appear before the age of 2, and the hæmophiliacs generally outgrow the tendency by 22. It rarely happens that a hæmophiliac succumbs to hæmorrhage after 22. The most threatening hæmorrhages are during teething or at puberty. The skin covering a hæmatoma is stretched, shiny, and bluish or black, with a peri-

[1] Abstracted from the *Boston Medical and Surgical Journal*, August 31, 1916.

pheral red zone. These hæmatomata never suppurate, but the blood coagulated in them may undergo calcareous infiltration. The literature on hæmophilia and the theories as to its mechanism are discussed in detail. Horse serum thus far has proved more effectual than anything else in the treatment of hæmophiliac cases, but its action is only transient.

Bursitis.—An hygromatous affection of the bursa beneath the insertion of the semi-membranosus tendon does not as a rule communicate with the knee-joint, but is separated from it by only a very thin membrane. From some unknown cause a serous or somewhat gelatinous exudate sometimes develops in this bursa, but this exudate is never as thick as the exudate of a tuberculous ganglion. In about one-third of the cases the thin membrane separating the bursa from the joint is ruptured by the exudate, and a chronic hydrops of the true joint may be set up. Great care must be exercised in excising the bursa, if opening the true joint is to be avoided.

Hemiplegia.—The results of massage, active and passive movements, in restoring motor function in old-standing cases of hemiplegia are very considerable, and restoration of function can be obtained in many cases of hemiplegia by appropriate and persistent treatment. Their subjects were not altogether favourable, in that in several instances mental as well as physical impairment existed.

A "stroke" is looked upon by the public as an immediate forerunner of dissolution, and the immediate results of the shock are supposed to be permanent. Physicians, of course, know that often these patients live many years, and may die of an intercurrent disease without ever having another evident cerebral hæmorrhage, and that often also very considerable recovery takes place. The years these patients do live will be much happier and more useful years if the idea of the hopelessness of the condition is combated, and the idea of a possible return of function under appropriate treatment and individual effort is fostered.

Tardy Paralysis.—Three cases of late paralysis due to chronic progressive ulnar neuritis, developing years after injuries to the elbow. These injuries had produced a valgus deformity and some change in the ulnar groove. The paralysis is apparently due to pressure irritation of the nerve. In one case part of this pressure, at least, was due to a bursal cyst developing in the groove beneath the nerve. Excision of this cyst brought relief of the paralysis. The necessity of differentiating this condition from the progressive spinal atrophies is obvious.

Bone and Joint Surgery.

A series of seventy-five experimental transplantations of the epiphysis consisted of eleven transplantations of an entire metacarpal or metatarsal, ten autotransplantations of the same, four reimplantations of split metacarpal or metatarsal, two autotransplantations of the same, six reimplantations of the epiphyseal cartilage, seven autotransplantations of the same, twelve reimplantations of varying lengths of the epiphyseal end of the metacarpal and metatarsal bones, twelve autotransplantations of the same, and ten two-stage autotransplantations of the same. The following are the conclusions: (1) From the practically uniform failure of increase in length of the bones after transplantation of the epiphyseal cartilage, either alone or with an accompanying piece of the epiphysis and diaphysis, both in reimplantation and autotransplantation, it must be concluded that epiphyseal cartilage loses its power to function after such transplantations. (2) As the degenerative processes were more advanced in autotransplantation than in reimplantation, it can be almost certainly predicted that there would be a more marked degeneration in homotransplantation. (3) Whether a small- or large-sized transplant was taken was of no consequence, as there was the same failure of growth in every instance. Incision into the periosteum or boring holes into the cortex hastened the degenerative process. (4) There was marked disturbance of growth following the two-stage autotransplantation, in spite of the fact that osseous union was secured before severing the epiphyseal transplant from its surrounding and nourishing tissues. (5) The epiphyseal cartilage must be considered as a very vulnerable tissue, its viability being directly dependent upon its blood supply.

Bone Transplantation.—In the first of two cases of extensive osteoplasty of the humerus after removal of bone for sarcoma the upper two-thirds were removed and a piece of the humerus of a 17-year-old girl, who had died from a gunshot wound in the head, substituted for the resected portion. The result was fairly good; the patient became able to move the shoulder up to the horizontal line, and to use the arm for eating and sewing. In the second case the lower part of the diaphysis of the humerus was removed and a piece from the humerus of a young man who had died also from a gunshot wound in the head was implanted. Four days after the operation the patient showed symptoms of tetanus, from which he died. Tetanus bacilli were found in the marrow of the transplanted bone. This unfortunate occurrence makes evident the necessity for a most careful bacteriological examination of the blood and bone marrow in all homœoplastic operations in which the transplant has not been boiled.

A case in which a giant cell sarcoma occurred in a man aged 27, and 2¾ in. of the lower end of the radius were excised. Two days later the lower end of the radius obtained from a suicide was boiled an hour and kept in sterile salt solution for four days. This graft was applied and primary union took place. Subsequent X-rays showed the hand radially abducted and dislocation of the ulna. The function was poor and the hand grasps weak. The graft seemed to have acquired definite contact with the living bone.

This deformity and lack of good function is noticed in certain cases where similar operations have been done.

Subperiosteal Resection in Osteomyelitis.—In young dogs, after subperiosteal resection of the shafts of the same bones that are most commonly affected by osteomyelitis in man, for example, the

tibia and the humerus, there is usually a complete regeneration of the shaft. From the study of the specimens subsequently removed it seems that the periosteum plays a certain part (osteogenetically) in the formation of a new bone, though the particles of bone remaining adherent to the periosteum after the removal of the shaft play a part also. In old dogs after subperiosteal resection, using the same technique, there was almost invariably failure of regeneration. Infection even in young animals greatly delayed or prevented the regeneration. Clinically, also, age is an important factor. In view of the clinical and experimental data now at hand, showing the frequent failure of regeneration, subperiosteal resection should be reserved for selected cases of osteomyelitis in which there has been extensive necrosis of bone, and particularly where this necrosis is located in areas inaccessible to operation, such as the posterior part of the tibia. Its use should be limited to parts of the body in which there is some other bony support (a so-called "splinting" bone), and should almost never be used where there is only one bone in the extremity, as late sequestrectomy gives better results in such cases. The operation should not be performed too early, while the infection is severe, nor before a soft involucrum has formed. On the other hand, it should not be performed too late, after the involucrum is so ossified that an insufficient amount of osteogenetic tissue remains.

Excision of Transverse Process of Fifth Lumbar Vertebra.—In three cases an excision was done after other methods, such as fixation in various ways, had been tried. In these cases the process was exposed, either by direct incision through the erector spinæ muscle or by a curved incision, turning back skin and muscle flaps toward the mid line. Removal was done by blunt dissection and chisel. Very material improvement resulted in all three cases. In one of these three cases symptoms developed on the other side subsequently, and the tranverse process was removed on that side, but too little time had elapsed to admit of any conclusions. From these cases, and from others reported, it would seem that excision of the transverse process of the fifth lumbar must be considered in certain persistently painful backs of the type described.

Expert röntgenological interpretation had diagnosed a malignant sarcoma of the femur, but at the time of operation the macroscopical appearance of the neoplasm suggested a "fibrous cyst," and after removal of the growth the parts were bone grafted, and a long Lane plate fixed. Subsequent pathological study confirmed the wisdom of this judgment.

It is most difficult at times to determine from the X-ray whether to call a bone tumour a cyst or a giant-celled sarcoma, and the question is still open as to just how many giant cells make it a sarcoma, and just how definite a cavity must exist to call it a bone cyst. The "currant jelly" material and the many crossing and irregular trabeculæ belong to more serious so-called giant-celled sarcoma. Neither condition is malignant in the sense of metastasis. Both are usually capable of cure by local extirpation, and there is strong evidence to prove that many bone cysts "cure themselves," especially if they are broken, and certain evidence to suggest that occasionally an apparently typical giant-celled sarcoma may disappear without radical excision. Fortunately, periosteal sarcomata are usually easy to differentiate in the X-ray from the less malignant form, but it certainly is necessary to most carefully investigate as to the malignancy of bone tumours before amputations are performed, especially since the percentage of recurrences in the periosteal sarcomata is so high, even after most radical procedures.

Pseudarthrosis of the Forearm.—Pseudarthrosis of the forearm does not, as a rule, occur when both bones are fractured, while it is most common in compound fractures of the radius or the ulna alone with loss of substance. The separation between the ends of the bone is the cause of non-union, and where the gap is less than 4 cm. Shortening the intact bone by an oblique cut, and thoroughly freeing and freshening the ends of the non-united bone and bringing them into apposition is recommended.

Irrigation of Joints.—Churchman, after laboratory experimentation, has developed a technique by which joints may be irrigated thoroughly and repeatedly under local anæsthesia. His apparatus, which consists of a series of aspiration bottles, is described, and he believes that he has benefited thus a few cases of tuberculous and Neisser joints.

Rickets.

Cases of so-called myopathia rachitica, an affection of the muscles in rickets, which has been known since 1904, are not found very commonly considered in literature. A child of about three months, with typical signs of rickets, had thickening of the epiphysis in both forearms, and both arms were paretic; there were no motions noticeable in the left hand, and only very weak and slow motion in the right hand. There was hyperextension of the elbow. When the arms were elevated they fell down as though paralysed, but fell in a more retarded manner. The muscles seemed to be tender. The electrical examination showed very considerable decrease in the electrical irritability by the faradic, as well as the galvanic current, but the changes were only quantitative and not qualitative. Under physical therapy the conditions improved. Indeed, it has been stated that physical therapy is of such benefit in these cases that the affection of muscles is often cured before there is any apparent change in the bony signs. Histological findings of another case show a very indistinct structure of the muscle fibres. In severe cases the cross stripes are particularly indistinct, while the longitudinal stripes are still seen. The kernels are enormously augmented in number. The differential diagnosis must include: (1) Acute polymyositis. (2) Polyneuritis. (3) Paralysis following acute infectious diseases. (4) Antero-poliomyelitis. (5) Myotonia congenita. (6) Secondary muscular atrophy. (7) Idiocy and myxœdema.

Original Communication.

EQUINE AND BOVINE STREPTOCOCCI AS CAUSAL AGENTS OF HUMAN INFECTIONS.

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(*Continued from p.* 215.)

Equine Fæces.—In Table III we give the results of our investigations with regard to two strains from one mule and eight strains from one horse, and perhaps we ought to invite *special attention* to the fact that in *all our investigations* and in every paper we start a strain from *one single colony*, a portion of which we have examined morphologically to see whether it is pure before making the necessary subculture in order to start the strain.

We thus see that *S. versatilis* is a common denizen of equine fæces in the samples examined, though perhaps a more extended series may show that this is merely a special peculiarity of the strains examined; still, it points out one source of this streptococcus and agrees with Broadhurst's results, who found it in 29 per cent. of the equine fæces examined by her in America, while she found *S. fæcalis* in 13 per cent.

Bovine Fæces.—If Table IV is examined it will be seen that bovine fæces contain:—

S. bovinus Broadhurst 1915.
S. versatilis Broadhurst 1915.
S. mitior Schottmüller 1903.
S. fæcalis Andrewes and Horder 1906.

This again agrees with Broadhurst's results, who found *S. bovinus* to be present in 46 per cent., *S. versatilis* in 16 per cent. of bovine fæces, while *S. fæcalis* was also found in 16 per cent., and *S. mitis* (= *S. mitior?*) in 6 per cent. of the same fæces.

The importance of these findings in the Tropics is due to the extensive use of cow dung as a wash inside and outside dwellings in many tropical countries.

Zibla.—As was mentioned in the paper on *Puerperal Fever*, a mixture containing horse dung, and often cow dung, and entitled "*zibla*," is applied in thick layers to the roofs and walls of houses throughout the Sudan. This mixture dries, and without doubt forms part of the dust which permeates the air of towns and villages, and may therefore be a source of infection.

The result of our investigations upon the dry zibla is shown in Table V, which shows how resistant streptococci may be against heat and dryness.

The species which we have found in this mixture are:—

S. mitior Schotmüller 1903.
S. bovinus Broadhurst 1915, synonym *S. bovis* Chalmers and Atiyah 1915.

It is interesting to note that the last named has also been shown to be a causal element in puerperal

TABLE III.—EQUINE FÆCES STREPTOCOCCI.

		I 1	I 2	II 3	II 4	II 5	II 6	II 7	II 8	II 9	II 10
1	Source										
2	Strains										
3	Morphology	Short	Short	Short	Short	Short	Short	Short	Short	Short	Short
4	Gram	+	+	+	+	+	+	+	+	+	+
5	Anaerobic growth	+	+	+	+	+	+	+	+	+	+
6	Pigment	O	O	O	O	O	O	O	O	O	O
7	Litmus agar	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty
8	Blood serum	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty
9	Broth	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.
10	Gelatine growth	+	+	+	+	+	+	+	+	+	+
11	Gelatine liquefaction	O	O	O	O	O	O	O	O	O	O
12	Glucose	4·2	4·0	4·1	4·0	4·0	3·8	3·8	2·7	3·6	5·0
13	Saccharose	3·5	3·7	3·7	3·1	3·5	4·6	3·4	4·5	4·0	3·9
14	Lactose	2·8	2·7	2·9	2·4	2·9	2·6	2·9	2·7	2·9	2·9
15	Raffinose	0·3	2·4	1·4	2·5	1·6	1·9	2·1	0·0	2·9	1·6
16	Salicin	2·6	2·6	1·6	4·9	3·1	2·8	2·8	2·6	2·8	2·6
17	Mannitol	1·3	2·5	1·5	0·0	1·8	3·5	1·9	1·5	1·9	1·6
18	Inulin	1·3	1·0	0·6	0·0	1·8	2·3	1·9	0·7	1·3	1·1
19	Milk	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC
20	Neutral red	O	O	O	O	O	O	O	O	O	O
21	Hæmolysis	O	O	O	O	O	O	O	O	O	O
22	Bile test	O	O	O	O	O	O	O	O	O	O
23	Sulphuretted hydrogen	O	O	O	O	O	O	O	O	+	O
24	Name	*S. fæcalis*	*S. versatilis*	*S. versatilis*	*S. versatilis*	*S. versatilis*	*S. versatilis*	*S. versatilis*	*S. fæcalis*	*S. versatilis*	*S. versatilis*

TABLE IV.—BOVINE FÆCAL STREPTOCOCCI.

1	Source	I	I	I	I	I	II	II	II	II	II
2	Strains	1	2	3	4	5	6	7	8	9	10
3	Chain formation	Short	Short	Short	Short	Short	Short	Short	Short	Short	Short
4	Gram	+	+	+	+	+	+	+	+	+	+
5	Anaërobic growth	+	+	+	+	+	+	+	+	+	+
6	Pigment	O	O	O	O	O	O	O	O	O	O
7	Agar-agar	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty
8	Blood serum	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty
9	Broth	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.
10	Gelatine growth	+	Slight +	+	+	+	+	+	+	+	+
11	Gelatine liquefaction	O	O	O	O	O	O	O	O	O	O
12	Glucose	5·4	3·4	3·4	3·4	5·8	1·9	5·1	5·4	4·7	5·2
13	Saccharose	4·1	0·9	2·4	1·2	4·0	2·3	0·0	4·4	4·5	3·1
14	Lactose	3·4	3·3	3·0	2·9	3·6	2·3	3·5	3·7	3·3	3·0
15	Raffinose	4·4	1·8	3·5	2·7	5·0	2·0	0·0	4·4	0·0	5·3
16	Salicin...	2·6	2·1	0·0	2·2	2·0	2·4	3·0	1·6	2·5	2·1
17	Mannitol	2·4	0·0	2·6	1·1	2·3	1·0	0·1	2·5	2·4	1·2
18	Inulin	1·8	0·0	0·0	0 0	1·7	1·7	0·0	4·7	0·0	0·0
19	Milk	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC
20	Neutral red	O	O	O	O	O	O	O	O	O	O
21	Hæmolysis	O	O	O	O	O	O	O	O	O	O
22	Bile test	O	O	O	O	O	O	O	O	O	O
23	Sulphuretted hydrogen	+	O	O	O	O	O	O	O	O	O
24	Name	*S. versatilis* (variant)	*S. bovinus*	*S. versatilis* (variant)	*S. versatilis*	*S. versatilis* (variant)	*S. versatilis* (variant)	*S. mitior*	*S. versatilis* (variant)	*S. fæcalis*	*S. versatilis*

TABLE V.—ZIBLA STREPTOCOCCI.

1	Source	I	I	I	I	I	I	I	I	I	I
2	Strains	1	2	3	4	5	6	7	8	9	10
3	Morphology	Short	Short	Short	Short	Short	Short	Short	Short	Short	Short
4	Gram	O	O	O	O	O	O	O	O	O	O
5	Anaërobic growth	+	+	+	+	+	+	+	+	+	+
6	Pigment	O	O	O	O	O	O	O	O	O	O
7	Agar-agar	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty
8	Blood serum	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty
9	Broth	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.
10	Gelatine growth	+	+	+	Slight +	+	Slight +	+	+	Slight +	Slight +
11	Gelatine liquefaction	O	O	O	O	O	O	O	O	O	O
12	Glucose	3·3	4·1	2·8	3·4	3·7	5·0	4·6	4·4	4·0	4·0
13	Saccharose	4 9	4·2	3·8	3·7	4·2	3.5	3·0	4·9	4·6	4·2
14	Lactose	3·0	2·6	3·3	3·2	2·8	3·4	3·2	2·9	3·2	2·4
15	Raffinose	0·0	0·0	0·0	0·5	0·2	1·8	0·0	0·0	2·1	0·7
16	Salicin...	3·5	3·8	3·6	3·8	3·5	4·2	4·1	3·7	3·7	3·5
17	Mannitol	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0
18	Inulin	0·7	0·0	0·0	0·0	0·0	0·6	0·0	0·7	0·6	0·7
19	Milk	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC
20	Neutral red	O	O	O	O	O	O	O	O	O	O
21	Hæmolysis	O	O	O	O	O	O	O	O	O	O
22	Bile test	O	O	O	O	O	O	O	O	O	O
23	Sulphuretted hydrogen	O	O	O	O	O	O	O	O	O	O
24	Name	*S. mitior*	*S. mitior*	*S. mitior*	*S. bovinus*	*S. mitior*	*S. bovinus*	*S. mitior*	*S. mitior*	*S. bovinus*	*S. bovinus*

fever by Chalmers and Atiyah, while *S. mitior* is also well known to be a causal agent of this fever.

Human Fæces.—Table VI shows the results of our investigations with regard to ten strains of human fæcal streptococci obtained from four healthy Sudanese men.

It will be observed that we have recognized:—

S. fæcalis Andrewes and Horder 1906.

S. versatilis Broadhurst 1915.

S. bovinus Broadhurst 1915.

Broadhurst's work showed *S. fæcalis* to be present in 36 per cent. in human fæces, but she did not report *S. versatilis* or *S. bovinus*.

It will also be noted how closely *S. bovinus* is connected with *S. versatilis*. We have considered that low fermentations like 0·1, 0·2, 0·3, and 0·4 may be disregarded, but that from 0·5 upwards they should be held as positive. Sometimes in difficulties of this nature other reactions, such as growths on gelatine, may help, but even here the two species are closely related, and are really only separable by biometrical methods, a remark which holds good for other streptococcal species.

Human Saliva.—Ten strains derived from the saliva of four healthy Sudanese natives were tested with the results set forth in Table VII.

Sudanese human saliva can therefore contain:—

S. fæcalis Andrewes and Horder 1906.

S. bovinus Broadhurst 1915.

S. salivarius Andrewes and Horder 1906.

S. versatilis Broadhurst 1915.

Broadhurst in New York found *S. bovinus* present in 16 per cent., *S. salivarius* in 28 per cent. of the streptococci in the human throat.

Conclusions.—We have thus traced:—

S. salivarius to Sudanese human saliva.

S. bovinus to Sudanese bovine fæces, zibla, Sudanese human fæces, and Sudanese human saliva.

S. versatilis to Sudanese equine fæces, Sudanese bovine fæces, zibla, Sudanese human fæces, and Sudanese human saliva.

We have also incidentally traced out *S. mitior* and *S. fæcalis*, both of which we have met with as pathogenic agents in man, while we have also met the hæmolytic ally of *S. mitior*, viz., *S. erysipelatos*, as a pathogenic agent, but have so far not discovered it in the non-pathogenic Sudanese strains examined.

From these sources the organisms can spread to man by the agency of water, milk, or air, in all of which they are but temporary denizens.

There is one curious point to be noted that so far we have not met with *S. actuosus*, and we note that Broadhurst did not record *S. anginosus* in healthy human saliva and fæces or in equine and bovine fæces. Hæmolytic strains, according to her researches, appear to be most common in the canine alimentary canal which we have not, so far, investigated. The question of the value of hæmolysis in differentiating species also requires consideration.

It is obvious that the number of our records are extremely small and that many more observations are required, but we think that they invite attention to equine and bovine fæces and the mixture "zibla" as sources of pathogenic and non-

TABLE VI.—HUMAN FÆCAL STREPTOCOCCI.

		I 1	I 2	I 3	II 4	II 5	III 6	III 7	III 8	III 9	IV 10
1	Source	Short	Short	Short	Short	Short	Short	Short	Short	Short	Short
2	Strains										
3	Chain formation	+	+	+	+	+	+	+	+	+	+
4	Gram	+	+	+	+	+	+	+	+	+	+
5	Anaërobic growth	+	+	+	+	+	+	+	+	+	+
6	Pigment	0	0	0	0	0	0	0	0	0	0
7	Agar-agar	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty
8	Blood serum	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty
9	Broth	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.
10	Gelatine growth	+	+	0	0	+	0	0	0	Slight +	+
11	Gelatine liquefaction	0	0	0	0	0	0	0	0	0	0
12	Glucose	3·7	4·8	3·5	2·7	4·2	3·4	4·9	3·0	3·9	4·5
13	Saccharose	0·0	1·3	2·3	4·0	1	3·3	3·9	3·1	3·1	2·4
14	Lactose	2·1	2·5	2·7	2·7	3·1	2·9	3·9	2·5	3·4	2·4
15	Raffinose	0·4	0·3	0·0	3·1	3·2	5·1	3·3	2·2	3·3	4·0
16	Salicin	3·0	3·1	2·9	4·9	2·9	2·6	3·8	0·6	1·9	2·9
17	Mannitol	3·2	1·9	2·6	1·0	0·7	0·8	0·4	0·2	0·3	3·0
18	Inulin	1·0	1·0	1·0	2·2	2·6	2·9	1·1	2·4	1·1	2·1
19	Milk	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC
20	Neutral red	0	0	0	0	0	0	0	0	0	+
21	Hæmolysis	0	0	0	0	0	0	0	0	0	0
22	Bile test	0	+	0	+	0	0	0	0	0	+
23	Sulphuretted hydrogen	+	+	+	+	+	+	+	+	+	+
24	Name	*S. fæcalis*	*S. fæcalis*	*S. fæcalis*	*S. versatilis*	*S. versatilis*	*S. versatilis*	*S. bovinus*	*S. bovinus*	*S. bovinus*	*S. versatilis*

TABLE VII.—HUMAN SALIVARY STREPTOCOCCI.

		I	II	II	II	III	III	III	IV	IV	IV
1	Source	1	2	3	4	5	6	7	8	9	10
2	Strain	Short	Short	Short	Short	Short	Short	Short	Short	Short	Short
3	Chain formation	+	+	+	+	+	+	+	+	+	+
4	Gram	+	+	+	+	+	+	+	+	+	+
5	Anærobic growth	+	+	+	+	+	+	+	+	+	+
6	Pigment	0	0	0	0	0	0	0	0	0	0
7	Agar-agar	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty
8	Blood serum	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty	Ty
9	Broth	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.	G.T.
10	Gelatine growth	+	+	+	+	0	0	0	0	0	0
11	Gelatine liquefaction ...	0	0	0	0	0	0	0	0	0	0
12	Glucose	3·9	4·5	4·6	3·9	3·8	3·9	2·6	3·6	3·8	3·3
13	Saccharose	3·9	2·8	4·4	4·1	1·9	3·6	2·9	3·6	4·1	4·8
14	Lactose	3·2	5·0	3·9	3·6	4·5	4·1	3·7	3·8	2·5	3·9
15	Raffinose	0·0	5·3	3·4	5·5	3·3	2·8	2·3	3·5	2·5	2·7
16	Salicin	2·4	2·3	2·0	1·3	0·1	3·0	2·6	2·2	3·7	1·1
17	Mannitol	2·8	0·3	0·0	0·0	0·3	0·0	0·7	0·0	2·0	0·7
18	Inulin	0·5	4·8	3·7	3·7	0·4	1·7	1·9	2·0	1·9	1·5
19	Milk	AC	AC	AC	AC	AC	AC	A	A	A	A
20	Neutral red	+	+	+	+	0	0	0	0	0	0
21	Hæmolysis	0	0	0	0	0	0	0	0	0	0
22	Bile test	0	0	0	0	0	0	0	0	0	0
23	Sulphuretted hydrogen ...	+	0	0	0	0	0	0	0	0	0
24	Name	*S. fæcalis*	*S. bovinus*	*S. bovinus*	*S. bovinus*	*S. salivarius*	*S. bovinus*	*S. versatilis*	*S. bovinus*	*S. versatilis*	*S. versatilis*

pathogenic infections of man with streptococci, and that it would be interesting to observe what variations are found in other tropical countries, as our results agree, in general, with those of the American workers.

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Neuro-muscular Pathology in Wounds.—Bourguignon (*Arch. d'élect. méd.*, July 10, 1916): (1) The form of muscular contraction depends on the state of the muscular fibre, and is independent of that of the nerve and of the nature of the excitant employed. (2) Among the lesions in the various muscular diseases and affections there is only a difference of degree and of evolution, not in the nature of the lesion. (3) Histological alteration of the striped fibre is shown functionally in the alteration of the form of the contraction, which becomes tonic, and that myotonia, non-persistent galvanotonus, &c., are only degrees of the same pathological reaction. (4) Neuro-muscular affections may be divided, from the pathogenic point of view, into two groups, one in which the causes—traumatisms, infections, and intoxications—are accidental, and the conditions may be curable; while the other, the pathogeny of which is still obscure, includes hereditary and familial maladies, apparently dependent on alterations of the internal secretions, and these are the progressive maladies. (5) Myopathies which at the beginning are localized, in reality extend to a much larger number of muscles than they appear to do clinically; the evolution does not appear to be indefinitely progressive in the case of one muscle, but what gives the affection its progressive character is that the processes are extended little by little to an increasing number of muscles, and that, as the result of causes which are obscure, the evolution is not made in all the muscles at the same rate. A purely muscular degeneration occurs without lesion of the nerve supplying the muscle. The form of contraction depends only on the state of the muscle, and not on the state of the nerve. Cold alters the form of a muscular contraction. This is easily seen in the case of small muscles of hands and feet. The slowness of contraction and the galvanotonus disappear when the hand or foot is warmed. This also supports the view that the form of contraction depends only on the muscle and is conditioned by the physico-chemical state of the muscle, illustrated permanently by anatomical alterations, and temporarily by the action of certain physical or chemical agents, one of the most important of which is cold. Electro-diagnosis should never be carried out on a cold subject.

Notices.

BUSINESS AND GENERAL.

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A VISIT TO THE CASUALTY CLEARING STATIONS AND HOSPITALS AT THE FRONT.

(*Continued from p.* 217.)

Of all questions in connection with camp life, whether for a base or stationary hospital, a casualty clearing station, or dressing station, the most serious is that of disposal of excreta, kitchen refuse, bath and lavatory water, &c. Of these, excreta disposal holds the foremost place; and as this must vary with the nature of the soil, the elevation of the area, and the permanency or otherwise of the camp, much is left to the officer in charge to work out according to certain fixed principles, the details being decided according to circumstances. Marked efforts have been made to separate the fluid from the solid excreta in the Casualty Clearing Stations and some clever devices have been instituted for the purpose. Beneath a seat, shaped like that in an ordinary closet, are placed two kerosine tins, placed in proximity one in front of the other. The contents of the urine receptacle is dealt with in several ways: (*a*) The contents are placed in the rubbish incinerator, the heat of which evaporates the fluid of the urine, which escapes by a chimney of some six or more feet high; the incinerator, being placed to leeward of the camp, station, or hospital, does not become a nuisance to the inmates. (*b*) In some camps and stations where the fluid and solid excreta are received in a common receptacle the contents are placed in the incinerator and the urine and fæces dried by evaporation, and the contents subsequently when dried are turned out on to the incinerator and burnt, the fumes being also led to a fairly high chimney. It is evident that the chief trouble in disposing of excreta is with the urine more than the fæces. The latter can be incinerated either directly or after drying, but the presence of urine with fæces favours rapid putrefactive changes, which generates such foul gases as sulphuretted hydrogen, ammonium sulphide, &c. The separate receptacles remove much of the deleterious effects thus produced. (*c*) At some base hospitals near large cities the excreta are run off into cesspools without any disinfectant being added, and the contents of the cesspools sold to civil contractors, who use the materials for manure, a plan much in vogue in Northern France and Belgium. At first contractors were paid so much to carry away the excreta, but some hospital commandants endowed with organizing capabilities and commercial instincts have saved this expense, and by selling the contents of the cesspool have ensured removal and earned money to defray the ordinary expenses of their hospitals.

Utilizing the heat of the incinerator to evaporate urine and dry the fæces is an economy commendable in itself and a plan worthy of being followed from the point of efficiency.

The above do not by any means exhaust the number of devices used to deal with excreta and waste water from hospitals, dressing stations, or casualty clearing stations, nor does it touch upon the ordinary trench latrines in use in more mobile units at the Front; these are fairly well known from text-books.

Reference has already been made to the system of baths in vogue behind the immediate Front. The difficulty is, in a flat country, which in many parts in the northern war area is below sea-level, to get a fall sufficient to supply baths to the multitude of soldiers employed in France and Belgium at the moment. This is overcome in several Casualty Clearing Stations by water brought from

high ground; hut as these points are few and far between such water has to he conveyed in pipes in some cases as many as from seven miles away. Such water, however, can only he used for drinking purposes. Nothing daunts, however, the Medical Department of the Army; pumping stations are actually at work at the Casualty Clearing Stations within a few miles of the Front; the water heing raised from an " in-take " in a neighbouring stream and utilized for shower baths so much in vogue and in laundries. The economy of the shower bath system is real; as many as sixty men, in one establishment visited, have a shower bath at the same time, the water heing hot for the first three minutes and cold for two subsequent minutes. In this way as many as 1,800 to 2,000 men can have haths a day at one hospital.

The laundry work at the Casualty Clearing Stations is done by women in the neighhourhood, and it affords work and payment, especially in the north of France, to Belgian refugees. The laundries are well appointed, and the drying rooms adjacent are heated either hy stoves and have rotating fans to keep the air moving; or occasionally the heating is done by pipes from the engine room.

Incinerators are a constant feature of military camp life, and their variety in shape and size seems illimitable. In addition to acting as a destructor and serving to evaporate urine, &c., the heat of the incinerator was in some instances utilized to heat water in a large " copper " huilt into the incinerator, a most economic step. An interesting piece of improvising was seen at one station, where petrol tins filled with puddled clay were arranged so as to form an improvised incinerator.

The kitchens afforded evidence of cleanliness, thoroughness, and organization as to the supply and distribution of food, which was as carefully carried out as in any long-established institution at home. The ovens were in many instances improvised and afforded scope for the ingenuity of the cook and his assistants.

The waste water from the laundries, bath-rooms, &c., is dealt with at several stations as follows: Channels carry the waste water to concrete tanks, to which a chlorinated lime preparation is added. This causes precipitation and decomposes the materials, so that soapy materials rise to the top as froth, which is skimmed off from time to time and removed; the fluid left is run off into channels, passes through two or more coke filter beds, and finally run off into an adjacent stream. The fluid thus dealt with is free of smell and is practically innocuous. If the water in the stream is not used until some distance helow the entrance of this filtered and chlorinated tank contents no evil consequences result, and even where it has heen inadvertently employed for hrewery purposes no untoward results have been noted. The military authorities are careful, however, not to allow this to take place as far as their jurisdiction is available.

When visiting a camp, a clearing station, or hospital, it is the improvised means of dealing with matters, whether in the wards, the latrines, the incinerators, the kitchens, &c., that is of superlative interest, not only to the officers and men in charge, but also to the visitor. The monotony of camp life grows upon one; and seeing that many of the Casualty Clearing Stations and main dressing stations have neither advanced nor retired since 1914 in many instances, it is this variety in interest, kept agoing by improvising here and there, that attracts one and serves to break the sameness of the daily task when regulation methods only are followed. Just as the monotony of drill in the barrack square is broken for the soldier hy marches and manœuvres, &c., so is improvising to the Medical Department, whether it he in shaping an ambulance out of a country cart, a stretcher out of hay-fork handles and a straw rope, &c., &c. The little additions here, the alterations there, and the constant striving after economy in hygiene and sanitation, stamp the camp with the personality of the commandant or his colleagues, and at the same time serve to endear a place to one which is more or less of one's own creation.

These sketches record the mere fringe of the work being done at the Front. But as the hygiene of the British Army is heing maintained in a way which no army of to-day can surpass, nor has any army in the past ever approached, so the work in the wards, in the operating theatres, in the laboratories, and hy officers and men of the R.A.M.C. in the field and at the hase, is being done in a manner commensurate with the glorious deeds of the Army in the field. The soldiers deserve all the skill in medicine and surgery that Britain can send them, and I am convinced, from what I saw in France and Belgium, that the sick and wounded are having unstinted attention, devoted care, instantaneous relief, often under circumstances that might be deemed impossible hy officers and men of different calihre to those at present enrolled in the Royal Army Medical Corps.

J. Cantlie.

Annotations.

Lesions of the Frontal Lobes.—L. Roncoroni (*Il Morgagni*, July 9, 1916) describes seven cases of wounds of the frontal lobes, in five the wound was penetrating and the pulsation of the meninges could he seen; in one there was, in addition, protrusion of cerebral matter; in two only the outer table was injured. The wounds were caused hy fragments of grenade or rifle bullets. In one of the penetrating cases the wound was suppurating; in another there was localized pachymeningitis in the region of the wound. All the wounds were in the zones of the prefrontal lobes. In all the cases the immediate effect of the injury was loss of consciousness lasting from half an hour to twenty days. If no special conditions are present, as for instance, a marked neuropathological inheritance, or a very extensive injury, lesions of the prefrontal lohes, whether penetrating or not, do not leave hehind them serious

psychic symptoms or other marked signs of cerebral disturbance, as is seen in lesions of other parts of the cortex. This may be due to the fact that the gravity of the brain lesions is not always directly proportionate to the severity of the bone injuries; but it would seem, too, that it depends on the peculiar functional conditions of the various cerebral zones. Objective disturbances of sensibility or of the organic functions are never met with. Mobility was not directly impaired, and there was no paralysis, paresis, cramps or alterations in motor excitability; the pupils and reflexes, both superficial and deep, were normal; in one case only was the knee-jerk somewhat exaggerated. Walk, speech, and writing were normal. In one case, however, there were slight lateral oscillations of the head, slight myoclonus of the limbs, and tremor of the small muscles of the cheek. All the various sensibilities of the skin, including the stereognostic sense, were normal, as were also the special sensations. In two cases, however, in which the olfactory branches were destroyed, there was anosmia. In two cases also there were general subjective phenomena of alterations of sensation—headache and a feeling of heaviness—such as are found in lesions of any part of the head. Vertigo was present in only two cases, but only as the result of circulatory disturbance when the patient bent his head. Pulse, respiration, and gastro-intestinal functions were normal. As regards psychic functions, perception and the content of the ideative processes were always normal both in rapidity and abundance; so too, were the affective and moral sentiments and consciousness. Memory of events before the wound was normal; in one case only were there disturbances in the fixation of images. The psycho-motor reactions might also be considered normal. In three cases, however, there were observed phenomena which possibly were not specific, and might perhaps be met with as a consequence of lesions of any part of the cortex—a tendency to speedy exhaustion, difficulty in grasping the sense of what is heard and effort in attending to it; slowness and uncertainty in the performance of acts such as writing; a kind of inertia which makes the patient abstain from speech and action. The easy fatigue is sometimes accompanied by a feeling of heaviness and pain affecting the injured region and headache, especially in those engaged in difficult occupations, whereas light work to which he is accustomed does not tire the patient. Psychic changes may be wanting in lesions of the prefrontal lobes in cases in which these are not extensive and in persons whose education is not above the common standard. The facts observed show that the prefrontal lobes have not motor or sensory functions in the strict sense.

Wounds of the Skull.—H. Hartmann (*Paris méd.*, June 24) describes 152 cases of wounds of the skull by projectiles. In certain cases the whole skull cap is smashed, and on feeling the scalp one has the impression of squeezing a bag of nuts. In other cases simple contusion is found when the bone is exposed. This difference is due partly to the projectile—shell, shrapnel, or bullet—partly to the distance from which it comes. A bullet at less than 800 metres smashes the skull, while one from more than 3,000 metres causes only a contusion. The soft brain obeys the laws of hydrostatics: pressure at one point of the skull is transmitted to all points with the same intensity. The lesions also differ according to the direction of the projectile. In tangential wounds the projectile makes a gutter in the outer table, while the internal table is pushed inwards; the brain lesions are moderate. On the other hand, when the projectile strikes at right angles, it may perforate the skull through and through or cause a starred fracture; in such cases the brain lesions are generally very severe. In the 152 cases there were only 25 incomplete fractures, and this proportion may be too great, since there are fractures apparently incomplete which seem limited to the outer table and yet are accompanied by lesions of the internal table. Generally speaking, bone lesions are more extensive than they seem to be on a superficial examination. The dura mater was injured in 85 of 130 cases. Contrary to what is seen in civil practice, intradural hæmatoma is in war surgery more frequent than extradural. In general, lesions of the dura mater are less extensive than those of the skeleton and the brain. The brain matter may be in pulp under a dura only slightly injured. Sometimes lesions of the brain are found at a distance from the seat of wound; this can only be explained by *contre-coup*. In some cases of severe wound of the skull there is no functional disturbance; the man walks and speaks without difficulty, and does not even complain of headache, as there is nothing visible but a tiny wound of the scalp. The patients are often sent to ambulance stations as cases of slight wound. In other cases there is profound coma; the man lies on his back with pale face, closed eyes, stertorous irregular breathing, and abolished sensibility. Sometimes there is excitement and even delirium; dilatation of the pupil and amaurosis may be observed. There may be aphasia, Jacksonian epilepsy, hæmianopsia. It is important to ascertain if the coma has come on immediately after the wound. If there has been a lucid interval the case is one of compression of the brain. The mortality is considerable. Death in the early stages is caused by hæmorrhage and destruction of the brain. Later it is most often due to meningo-encephalitis, which sometimes comes on at a distance from the zone where the man was trephined. In that case it may be attributed to insufficient drainage, which is made very difficult by the depth and length of the intracerebral tracks. Infection may also occur through fissures, which sometimes extend to the base of the skull and open up septic cavities (nose, ears). Fragments of projectiles in the brain do not cause infection so frequently as has been said. Several cases in which the projectile was encysted remained aseptic without suppuration, and this is not exceptional. In 1,137 cases of old brain lesions from wounds a foreign body was found in 31 cases. In only 2 cases were there epileptiform crises; in 29 the only symptoms were hemianopsia, headache,

vertigo, giddiness, and scotoma. The projectiles were discovered only by systematic radiography. Every cranial wound should be treated immediately, even when it is apparently only the soft parts that are hurt. The bone should be exposed. If nothing is found the intervention does not go further. It does the wounded man no harm, whereas if the bone is not exposed a lesion threatening life may be overlooked. Local anæsthesia is preferable to general anæsthesia. The crucial incision has certain advantages. It allows the surgeon to see the direction of the fissures and may be gradually extended as far as is necessary after the direct examination of the subjacent bone. Whatever incision is used the edges of the wound should be resected. In general terms the surgeon should be guided in the extent of the craniectomy not by the length of the fissures, which may run to the base of the skull, but by the state of the underlying dura. The bone must be resected until normal dura is found. If there are splinters above the dura they should be carefully removed so as not to open the dura, a proceeding which makes the prognosis much worse. If dura is injured the wound in it must be incised and the lacerated fragments cut away, when a lesion of the brain may be found, often more extensive than that in the dura. Splinters should be removed. As regards the treatment of later accidents, in the case of abscess incision is necessary, but is sometimes very difficult as the abscess as a rule forms at a distance from the wound and is deep and often difficult to reach. There are sometimes several of them. One is incised and drained, yet the temperature continues to go up, and it is only at the *post-mortem* examination that the others are found. In epileptic crises the patient should be given the chance of a cure by a limited intervention.

Abstracts.

A CASE OF ULCERATING GRANULOMA SUCCESSFULLY TREATED BY INTRAVENOUS INJECTIONS OF ANTIMONY.[1]

By George C. Low and H. B. Newham, M.D., M.R.C.P.

History of the Case.—The patient, a man aged 36, had served on the Gold Coast with usual leaves home since 1908; on the whole he had enjoyed good health there.

Previous Illnesses.—Pneumonia left lung 1914, ill six weeks; gonorrhœa 1913, malaria once, no dysentery; climatic buboes fifteen months ago; both groins operated upon; bubo in left groin when young. As far as he is aware has never had syphilis.

Present Illness.—In the beginning of 1916, when on the Gold Coast, he had a casual connection with a black woman, about whom he knew nothing, never having seen her before nor since. Two days after this a small sore appeared on the under aspect of the glans penis beside the frenum. As this spread, and showed no signs of healing, it was treated with mercury perchloride washes. This did not do very much good, but four and a half months afterwards apparent healing had taken place. Six weeks later, however, when in England, another sore appeared just in the same place. A diagnosis of syphilis was made; three injections of salvarsan, and seventeen injections of mercury were given, but had not the slightest effect on the lesion. It progressed, and two other sores appeared, one on the point of the glans just below the meatus, the other on the skin of the body of the penis a short distance above the glans. Destruction of tissue in all of these was rapid, especially in the initial sore, which soon burrowed into the substance of the glans, and almost penetrated the urethra.

Condition on Admission, May 1, 1916.—The patient was healthy looking; there was nothing abnormal in the heart, lungs, or abdomen. The liver was not enlarged, the spleen was perhaps slightly enlarged, but nothing of importance. There were old scars in the groins. The urine did not contain albumin, blood, or sugar. The skin was perfectly healthy, and there were no eruptions or spots.

Penis.—A deep crateriform ulcerated and eroded area, over $\frac{1}{2}$ in. in its longest diameter, was present on the under surface of the glans penis. This passed into the substance of the organ for a considerable depth, the edges being raw and irregular, with a semi-purulent to purulent discharge coming from the interior. The sore on the point of the penis was circular, ulcerated, but not to any great depth. The sore on the skin of the body of the organ was just commencing. It was oval, and quite typical of ulcerating granuloma. At this time the condition distinctly resembled a rodent ulcer, and, as a matter of fact, this diagnosis had been actually made. Epithelioma was also suggested, but the age of the patient and the history were against this. Former experience of the condition in British Guiana enabled us to diagnose the case correctly as ulcerating granuloma. Wassermann's reaction was negative. The treatment was begun on May 1, 1 gr. of antimonium tartaratum dissolved in 2 oz. of normal saline being injected intravenously on that day.[2] The patient fortunately had large veins, and the injections could therefore be given directly into the vein, dissection being unnecessary. By this method also the same vein has been used time after time for the different injections. The injections have always been well borne; no rise of temperature has followed them, and, apart from a general feeling of lassitude amounting to a definite seediness on the day of the injection, other symptoms have been negligible. Slight coughing, which so often follows these injections, was not observed in this case. The following table shows the number of injections given, with notes on the appearance of the lesions from time to time. From this it will be seen that the injections were given bi-weekly.

Abstracted from *British Medical Journal*, September 16, 1916.

[2] Two oz. = 56·8 c.c.—roughly, 60 c.c.

Date	Dose of Ant. Tartaratum injected intravenously	Remarks
1916		
May 1 ..	gr. 1	
,, 4 ..	gr. 1 ..	Condition looks a little better if anything
,, 8 ..	gr. 1½ ..	Distinct improvement of sore on point of glans
,, 11 ..	gr. 1½	
,, 15 ..	gr. 2 ..	Both sores on glans healing now fast; one on body of penis cleaner, a tendency to healing
,, 18 ..	gr. 2 ..	Sores about the same, tending to heal, but slowly
,, 22 ..	gr. 2½ ..	Condition seems a little worse
,, 25 ..	gr. 2½	
,, 29 ..	gr. 2½ ..	Sore on body of penis in very good condition, that on the under surface looks worse. That at meatus healing at one side, but poor at the other side
June 1 ..	gr. 2½ ..	Sore on body healed, that at meatus much better, epithelium spreading in at side. That underneath also much better
,, 5 ..	gr. 2½ ..	Progressing favourably, epithelium bas spread further in, sore at meatus almost half covered; that underneath also much better
,, 8 ..	gr. 2½ ..	Progress continuing
,, 12 ..	gr. 2½ ..	Progress continues, but very slow
,, 15 ..	gr. 2½ ..	Improvement more noticeable to-day after dry dressing
,, 19 ..	gr. 2½ ..	Slight improvement since last time
,, 22 ..	gr. 2½	
,, 26 ..	gr. 2½	
,, 29 ..	gr. 2½ ..	Practically cured, only two little places open now
July 3 ..	gr. 2½ ..	Only one tiny place open at side of sore on under surface. That at meatus healed
,, 6 ..	gr. 2½ ..	Place still open
,, 10 ..	— ..	Tiny spot size of pinhead
,, 13 ..	— ..	Same condition
,, 18 ..	— ..	Place still open, and looks a little inflamed round edge
,, 20 ..	gr. 2½ ..	Place if anything a little larger, and looks as if it might spread. Begin injections again to-day
,, 24 ..	gr. 2½ ..	Place looks better again—almost healed
,, 27 ..	gr. 2½	
,, 31 ..	gr. 2½ ..	Place completely healed now
Aug. 3 ..	gr. 2½ ..	Place completely healed now
,, 7 ..	gr. 2½ ..	Place completely healed now
,, 17 ..	— ..	Place completely healed now. No signs of breaking down

An examination of the table shows that the case under discussion was a stubborn one, for it was necessary to give 53½ gr. in order to effect a complete cure. A halt was made at 43½, but as it looked as if the small unhealed place would break out again it was considered advisable to go on with the injections. Four other injections (10 gr.) were therefore given, and complete cure resulted, but two additional injections were given as a precautionary measure.

Since writing this paper a review of a thesis by Dr. de Souza Araujo has appeared in the *British Medical Journal* (July 29, 1916, p. 146). In this it is stated that the author and his colleagues have used the method of intravenous injections of antimony in twenty-five cases of granuloma, with three relapses; two patients, old and grave cases, dying. Good results are also stated to have been obtained by means of X-rays. We purposely did not employ X-rays in our case, as we wished to try the pure antimony treatment alone.

That the treatment by antimony alone may succeed is thus proved, and this is saying a great deal, as granuloma up to the present time has been a most intractable disease. In the present instance it meant much to the patient, as otherwise, apart from X-rays, there was nothing left but amputation of the penis.

A judicious combination of X-rays and antimony injections might be worthy of trial, and might shorten the length of the treatment, which is, of course, very prolonged, and requires a fairly long stay in a hospital. After it was seen that the injections did not cause the patient any great inconvenience, however, he was allowed up the day after the injection, and only took to bed again just before having the next.

It is, perhaps, too early to say yet that relapse may not occur in this case, but the places are so perfectly covered with new epithelium that it seems by no means likely.

ON SOME WORK AT THE RED CROSS AUXILIARY NAVAL HOSPITAL, HAMBURG.[1]

By H. G. Beyer.

Operative Union of Fractured Bones, or Osteogenesis.

Indications.—The operative union of bony fragments is not called for in every form of fracture. Whenever the surgeon succeeds in securing an accurate coaptation of the bony fragments, in fresh fractures, especially of the tibia and femur, nothing besides a well-fitting plaster-of-Paris dressing will be required. The operative union of fractures of the shafts of long bones is indicated: in transverse fractures, in multiple fractures with intervening soft parts between the fragments, in cases in which two neighbouring bones would form an unnatural union, and where bony protuberances with important and powerful muscular attachments (olecranon, patella, calcaneum, trochanter major) have been torn off. There is at present no military hospital in Europe in which a very large percentage of time is not given up to the treatment of just such fractures.

Time.—Wait at least one week after the injury before attempting the operation. The periosteum, as well as the soft parts surrounding the injury to the bone, must be given time to recuperate before they can be expected to take their full share in the production of the necessary callus.

The chief considerations in favour of this early operation are: (1) That the periosteum, torn from the surface of the bones, is more easily distinguished than after it has become embedded in thick and firm cicatricial tissue; (2) that the margins of the bony fragments can be more accurately fitted into one another; (3) that the early removal of bloody accumulations relieves the pressure upon the tissues, encourages the restoration of a normal circulation and nutrition in them and, at the same time, prevents the undue formation of adhesions between the soft parts, all of which would tend to a slow and imperfect formation of callus.

[1] Abstracted from *Johns Hopkins Hospital Bulletin*, September, 1916.

In all gunshot injuries it is safest to wait for the end of cicatrization as the best granulating surfaces and the smallest granulating points still harbour infectious germs seriously interfering with the process of healing. Imperfectly healed granulations, therefore, forbid the operation.

Bony Splints Preferred.—A firm and enduring position of the fragments of a long bone is best secured through splints placed either inside the marrow cavities or, externally, upon the surfaces of the shafts of the fragments. As material for internal splints pieces of long bones are employed, either freshly removed from either the same patient (autoplasty), or freshly amputated limbs (homoplasty). Such material is better than any other. Ivory, steel, silver and magnesium splints under certain circumstances are useful. Splints should be of a size sufficient to completely fill the marrow cavities and to be driven, first, into one of the fragments with a few strokes of a hammer, and then, under extension, counter-extension and extreme flexion, the projecting end of the splint is slipped into the prepared marrow cavity of the other; finally, the margins of the fractured ends are pushed into the closest possible contact. In case the marrow cavity of a long bone should be found filled with callus, it is to be hollowed out by means of a sharp chisel. Boring it out electrically is to be avoided on account of heat, thus produced, injuring the substance of the bone.

Even for the purposes of external splinting living bones are preferable to all other forms of splints. The union of bony fragments by means of living bone is for me the ideal to be pursued in all operative measures on fractures of the long bones, internally as well as externally. Freshly transplanted pieces of bone form an easy attachment to the surrounding soft parts and their blood-vessels, thus promoting, instead of retarding, the formation of callus. Just as the external bony splints unite organically with the periosteal callus, just so do the internal bony splints unite with the myelogenic callus. Another, and not the least important, advantage in the method of using living bone depends upon the fact that it can be used to replace lost bone, thus practically excluding shortening.

Disadvantages of Foreign Material.—Foreign material must first become encapsulated before organic union can take place with the bone. The development of callus and its transformation into bony tissue is consequently retarded, or even altogether prevented. These disadvantages may not become so apparent where foreign material is used for intramedullary splinting, because the periosteal callus grows over the fractured portion and unites the ends of the fragments. But even here frequent failures occur, due to post-operative myelitis, induced by the presence of these foreign bodies. In cases in which metal, ivory, horn, or boiled bone from cadavers, was used, suppuration as late as a year after operation has been known to occur and compel the removal of the offending substance. These disadvantages are eliminated when living bones are used as internal or external splints. Subsequent suppuration in such cases is due, in his opinion, to faulty technique and not to the splints employed.

Important Relation of Soft Parts to Periosteum.—It is a very serious error to separate the soft parts from the ends of the fragments in the wound and from the periosteum adherent to the already formed callus covering the bone. Such a procedure damages the reproductive functions of the periosteum very greatly, as may be seen at once when its blood supply is taken into consideration: The diaphysis of a long bone receives its blood supply through the nutrient artery. The metaphysis and epiphysis receive theirs from the vascular networks of their respective joint-capsules, while the periosteum depends for its blood supply exclusively upon the soft parts immediately surrounding it. That portion of the blood supply which comes to the periosteum from the bone-marrow through anastomoses in the cortical substance is diminutive, when compared with that received from its connections with the soft parts immediately covering it on the outside. All reproductive power of the periosteum, as also that of the endosteum, depends upon new formation of blood-vessels.

If we produce, subcutaneously, fractures in animals and, later, at intervals (one to six weeks), inject into the blood-vessels a turpentine-quicksilver emulsion, so as to render these visible in the röntgenogram, it will be easy to observe a gradually increasing new formation of blood-vessels, not only near the seat of the fracture, but also in the neighbouring portions of the fractured bone. This new formation of blood-vessels becomes noticeable about one week after the fracture and continues to increase well into the fourth week of callus formation, but then gradually subsides. This newly formed blood-vascular supply takes its origin in the periosteal network of capillaries and *not* in that of the nutrient artery. This artery is torn and therefore may co-operate, though very slightly at first, through anastomoses with the periosteal network of vessels and, later, through the production of new vessels of its own. Callus formation having come to an end all the vessels resume their normal appearance, so that at the end of the sixth week scarcely a difference is noted between the fractured and its corresponding uninjured bone.

It has become a firmly established fact that the lion's share in the process of the repair of a broken bone is contributed by the periosteum, through its increased blood-vascular growth greatly assisting in the formation of callus and, thus, of new bone. Hence it follows that during all operations for the union of fractures the periosteum must, first, never be separated from its connection with the soft parts while the fragments are being exposed; and, secondly, laceration of the periosteum itself must be guarded against. These same principles underlie the formation of the sequestrum after an osteomyelitis. Here the nutrient vessels have become thrombotic or have been partly destroyed in the suppurative process. The periosteum remaining adherent to the soft parts, wherever its vessels have survived, there also promptly begins the formation of the sequestrum.

In gunshot injuries received at close range, where even undeformed bullets produce an explosive effect, large tracts of periosteum remain adherent to the surrounding soft parts, a fact of great significance and to be taken advantage of in bone transplantations. Even the largest defect, an entire diaphysis or section of skullbone, may be replaced by bones of any sort or source, whether it be living periosteal or dead bone, whether of autoplastic or of homoplastic origin; even foreign substances, as ivory, metal, or horn, may thus be used with perfect clinical success, *as long as the periosteum in the wound remains intact and in connection with the soft parts.*

Moreover, whenever we are confronted with the problem of having to replace a large bony defect we shall be successful only when the freshly obtained, periosteum-covered bone-transplant finds rapid contact with the surrounding soft parts, that is, when placed in such a position that primary agglutination can occur. If this organic fusion fails to materialize, being prevented by hæmorrhage or inflammatory exudates, the transplant is doomed to die and can never be expected to replace the lost bone. The first and foremost function of the periosteum adherent to the transplant, is that it facilitates a close attachment to the soft parts. Its specific callus-forming function follows as a secondary event in the process of repair. Freshly obtained transplants from the same subject, covered with uninjured periosteum, give the best results.

Causes of Failures.—The chief cause of a break of a transplant, whether placed internally or externally, at the seat of the fracture is always an erosion of the transplant by granulations that destroy the cortical substance after the disappearance of the periosteum. Connective tissue, rich in blood-vessels, always appears in those places in which blood has accumulated between the transplants and the soft parts surrounding them; where, in other words, the close contact between the two has failed to occur. With intramedullary splints this sometimes happens where the ends of the fragments have not been freshened sufficiently or where a too prominently projecting tooth has interfered with the accurate coaptation of them. A dead space is thus left, exposing the transplant between the two ends of the fractured bone. This space is first filled with blood and afterwards with connective tissue, the destructive activity of which progresses *more rapidly* than the reparative, callus-forming activity of the periosteum.

Exactly identical conditions would be met with in cases in which transplants are used for the purpose of replacing defects in long bones to prevent shortening, as well as to assure a firm position of the fragments, were it not for the fact that in all such cases transplants, protected by their own periosteum, are here used. All that remains to be done here is to provide such conditions as will assure the close contact between the soft parts and the periosteal surface of the bone-transplant.

The Operation.—A deep incision is made down to the bone. The soft parts, *including all the cicatricial tissues and periosteum*, are gently pushed aside. The bared ends of the fragments are lifted out of the wound, the walls of the wound cavity are then carefully freed from the cicatricial tissue, care being taken to avoid as far as possible any injury to the periosteum. The latter is easily recognized by the presence in it of thin layers of callus or by its colour alone, which differs somewhat from the whitish appearance of the cicatricial connective tissue. When this procedure is carried out, large tracts of living periosteum remain in vital connection with the soft parts, on the one hand, while the removal of the cicatrices from the walls of the wound facilitates the new formation of blood-vessels between it and the bony surface on the other.

Source of Splints.—In all operations for the union of broken bones, by means of living bone transplants, the source of the transplants is of paramount importance. For short splints, pieces of rib from the same patient, the outer sides of which have retained their periosteal covering, are the simplest material that can be employed. Longer splints had better be taken from the periosteum-covered spine of the tibia: A long, slightly convex, incision is made through the skin on the outer side of the spine of the tibia; the tibialis anticus is gently pushed aside outwardly, until the external surface of the tibia lies, everywhere and to the extent of about 2 cm., freely exposed. After the periosteum on both sides of the spine has been incised and the desired length and breadth of the future transplant has been marked out, a narrow groove is cut along the whole line of the periosteal incision into the cortical portion of the tibia by means of a fine V-shaped chisel. This circumcised plate of bone is then easily chipped off by inserting the sharp end of a wide, flat, thin chisel into this groove and driving it in with a few light strokes of a hammer at different places as well as at both extreme ends of the line of the incision, until the plate separates from the underlying bone. Even long plates do not splinter when broad and rather thin chisels are used that are sharp on both sides. Electrical saws must be avoided.

The plate of bone thus removed is at once wrapped up in sterile gauze soaked in warm normal salt solution and kept until used.

In fractures of the long bones in which the transplants are to serve not only the purpose of securing a firm position between the fragments but also that of replacing lost sections of bone the employment of external splints are not recommended. They have been used successfully on the lower jaw. For intramedullary splints homoplastic material is employed, when available, of the thickness of the entire fibula, ulna, radius, or long strips of the femur or humerus, occasionally also metacarpal and metatarsal bones. As autoplastic material the fibula alone comes into consideration whenever they are to serve exclusively for giving the fragments a firm position and, consequently, need not be covered by periosteum. The regeneration of the fibula begins after the third or fourth week of its removal from the sleeve of periosteum left in the wound cavity.

Points Deserving Special Attention.—Esmarch's

bandage should never be employed, since the hæmorrhage in the wound must be most carefully controlled by the ligation of all bleeding vessels in order that the wound may be closed perfectly and tampons and drainage tubes avoided. Broad hooks covered with sterile gauze will prevent injury to the tissues. Incisions over bones lying directly under the skin must be curvilinear, so that the skin-cicatrix shall remain free from connection with the bone. Whenever it becomes necessary to proceed cautiously and to have regard for important anatomical structures, before making incisions down to the bone, the tissues are divided layer after layer. Such a procedure is called for in the arm on account of the radial nerve, in the forearm on account of both the tendons and nerves. After thus reaching the last layer of connective tissue over the periosteum the knife is carried down to the bone through both. In the case of a fractured femur that is covered with a very thick musculature, smooth wounds are very desirable. Here the knife is made to enter on the outer side of the thigh and pushed straight through until its point touches the bone. The tissues are slowly divided, the point resting steadily on the surface of the fragments. The knife, having reached the seat of fracture, sinks in deeper, passing on to the second fragment. The periosteum, as well as any possible callus, having been divided throughout, a broad elevatorium is introduced and both are pushed aside.

The free end of the fragments appearing at the bottom of the deep wound are now seized with strong bone forceps and slowly drawn out, while strong flexion is maintained between the fragments to assist in this act. In fresh cases the bloody coagula collected behind the fragments are pressed out of the wound. In the older cases the still adhering periosteum and masses of callus are pushed off from them, so that they may remain at the bottom of the wound and retain their connection with the soft parts unimpaired.

The next step is to search the surfaces of the wound for old cicatrices. These are found mostly over places where the periosteum has been destroyed or where torn pieces of muscular tissue have covered the bony stumps. Such tissue has a whitish appearance and bleeds but little. Finally adhering bony splinters had better be left, providing they exert no noticeable pressure on important nerves and do not tend to produce bony union between two neighbouring bones. Even projectiles or portions of them may be left undisturbed when their removal would be attended by injury to the periosteal vessels.

The next step in the operation consists in the preparation of the stumps. In transverse fractures it is usually considered sufficient to saw off a thin disc. In irregular oblique fractures, where tooth-like projections are desirable for dovetailing the ends of the fragments into one another, a fine sculptor's chisel best serves the purpose of freshening the stump. The marrow cavities must be cleared out so as to make the splint fit snugly. At this stage of the operation the fragments are replaced to the bottom of the wound, bleeding vessels are ligated, the cavity is packed with hot salt-compresses to arrest and to absorb the results of capillary oozing. An examination of the condition of the fracture having, moreover, resulted in giving the necessary information as to what sort of splint is needed, whether it is to be covered by periosteum or not, the required transplant is sought and introduced into the prepared marrow cavities of the stump. Supposing this to be a fracture of the femur, the splints being taken from the fibula, being about 10 cm. long, the first half is driven into that fragment which was broken off transversely, or nearly so. The end of the splint projecting from this fragment can, naturally, not be introduced into the other by extension and counter-extension alone. We must, in addition, make use of strong flexion and pull the stumps apart by means of strong bone forceps before we shall succeed in slipping it into the marrow cavity of the remaining fragment.

In fractures of the leg and forearm in which but one bone has been fractured, flexion is, of course, out of the question. In such cases it becomes necessary to chisel out a narrow piece from the second fragment in order to enable the operator to place the projecting end of the bolt into its cavity. In all such cases wiring is also necessary.

The Closure of the Wound.—Suturing of the soft parts begins close over the bone with fine catgut. Periosteum must lie snugly over the bone and all around it. On the femur, from four to six such sutures, one over the other, are necessary. If muscles, tendons and nerves have been displaced during the operation they are returned to their normal position after the first periosteal suture has been completed and kept there by sutures, if necessary. In this manner, muscles, fascia, and fatty tissues are united with continuous catgut suture, and, lastly, the skin with silk.

After the skin has been cleansed with peroxide of hydrogen, silver leaf is spread over the suture and its immediate neighbouring skin surface, according to the method of Halsted. A fenestrated plaster of Paris dressing is used for the leg, a pasteboard splint for the arm. These dressings remain undisturbed for at least three weeks; providing all goes well, the fragments show perfect coaptation and the limb is in the correct position.

Finally, and in order to complete this account, a few words must be added with regard to the preparation of the field of operation. Tincture of iodine is not used in every aseptic operation. Useful as may be the painting with tincture of iodine in emergency cases and in suppurative cases, it accustoms the entire personnel to merely superficial cleanliness, a cleanliness that is insufficient for all operations in which absolute aseptic conditions must prevail. In wounded who have little or no opportunity for bathing for weeks or months, over places where the hardened and dried epithelial scales have peeled off and have been pushed into a fresh wound, leaving the undisinfected skin surface exposed; in these cases tincture of iodine cannot give the required security from infection.

Original Communication.

THE DISEASES OF CHINA.

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The space allowed for this article will permit only a very brief review of diseases which are commonly associated with tropical lands. It would be well, however, to state some facts about two common ailments concerning the distribution of which among the Chinese the most extraordinary and diverse statements are made. These are tuberculosis and syphilis.

Tuberculosis in all its forms is rife in China. Phthisis is probably the commonest cause of death in the cities of South China, and it is doubtful if the North can show much better statistics. The causes are self-evident. A hatred of light and ventilation in bedrooms; in the South a common bed surrounded, by a thick native mosquito net; in the North a common brick heated platform, on which the inmates crowd together, sick and healthy alike, for greater warmth.

Syphilis is extremely prevalent, and is probably more severe than in England; bone affections, especially of skull, sternum and long bones, are certainly more common. Para-syphilitic affections of the nervous system are, however, remarkably rare. There is reason to believe that they are becoming more common, especially at the treaty ports, where the Chinese consume a good deal of foreign liquor. Owing to the lack of ordinary cleanliness and of the most elementary treatment primary venereal sores sometimes assume most bizarre forms, and may lead to an appalling destruction of tissue.

Tropical Forms of Disease.

(1) First in importance come the so-called *Epidemic Infections*:—

Plague is endemic through the southern third of China, especially in Yunnan, Kwangsi, Kwangtung, and Fokien. The epidemics trespass but little north of these provinces, except to a few places in the Yangtse Valley and, to a very limited extent, to Shanghai. There appears, however, to be a separate plague centre in or about Niuchwang. The prevalent type of the disease is bubonic; though some pneumonic, and not a few septicæmic, cases are met. The recent Manchurian epidemic was an exception to this rule, being purely of pneumonic type. Except in this case, the association of rats with the disease has been so evident that the scourge is known among the Chinese as the rat-plague.

Dengue periodically invades the South, and during the hot months travels through Central to North China. It is of the ordinary text-book type.

Undulant (Malta) Fever is present throughout the Southern two-thirds of China. It is but rarely diagnosed correctly, but a sufficient number of properly authenticated cases have been reported to make the above certain.

Enteric Fever is common everywhere, if we include paratyphoid cases. In the tropical region, where other fevers are common, it often passes undiagnosed, as the type on the whole is a mild one, and the eruption is generally absent.

Typhus Fever is confined to Northern and Central China; it is very rare in the tropical and sub-tropical regions. Possibly this is merely because these areas include all the districts most affected by famine and flood.

Cholera is extremely widespread, occurring as virulent epidemics. In 1820-21 it seems to have swept over the whole Empire, causing an incalculable mortality. There is probably not a city of importance which has escaped cholera during the past half-century. Shanghai has had twelve severe epidemics during this period.

(2) A large number of *Endemic Diseases* occur, chief among them being the following:—

Leprosy.—Under the ægis of a great English leprologist, the statement became current that leprosy was absent from North China. The statement is incorrect. From Kansu and Manchuria in the north, to Yunnan and Kwangtung in the south, everywhere lepers are to be met with. It is, however, true that, with the exception of Manchuria, Shantung, and possibly the Tibetan border of Kansu, leprosy is less common in the north than in the south, where it is terribly rife, in places sometimes rising to ½ to 1 per cent. of the population. On the other hand, in the south the disease, though mutilating cases are not rare, is on the whole milder than in Central and North China. Pure macular and pure anæsthetic cases are met frequently, though mixed cases form the majority. The regard paid by the Chinese to leprosy differs widely. In places the leper is a shunned outcast; in others, he lives in the house and often cooks the family meals.

Beriberi is found along the coast, especially in the south, and encroaches on the hinterland only along the course of great rivers. The types of disease do not differ from those met elsewhere.

(3) The following are the chief *Diseases caused by Protozoal Organisms*:—

Malaria is ubiquitous in China. Tertian and quartan fever are present nearly everywhere and frequently accompanied by subtertian. This is specially the case in the south, where subtertian fever is endemic.

Blackwater Fever has never been proved to exist in China, though suspicious cases have been reported. The Japanese in South Formosa are said to suffer from it, but the writer has never seen a case.

Kala-azar has of recent years been reported with increasing frequency. Its distribution has been lately elucidated by Cochran. Roughly, according to his map, the endemic area lies between the Yangtse Valley as far west as Wuchang on the south, and Pekin on the north. Children are commonly attacked, though adult cases are met.

Relapsing Fever has been a common sequel to flood and famine in North China; apart from these, the distribution is probably wide, but we are without accurate knowledge.

Phlebotomus Fever has been reported from Hong-Kong, Pekin, and the Yangtse. Distribution is probably wide.

Yaws is imported from time to time by coolies returning from the Straits. Occasionally these give rise to further infections, but the disease soon dies out.

(4) Among the more important *Diseases caused by Metazoal Parasites* the following should be noted:—

(i) *Worms inhabiting the Lungs.—Paragonimus westermani.*—This is the cause of endemic hæmoptysis. Previously reported from Formosa and Korea, where, in some places, the large majority of the inhabitants are affected. It is only reported from China as single and rare cases. We are now able to add another infected locality, viz., a small area north-west of Foochow; probably other places in China will be found to be centres of infection.

(ii) *Parasites of the Circulatory and Lymphatic Systems. Filaria bancrofti* has a wide distribution along the coast of South and Central China and the Valley of the Yangtse, yet its distribution even there is most irregular. South Fokien is the most highly infected area. Amoy 10 per cent. (Manson), Changpoo 25 per cent. (Maxwell). *Schistosomum japonicum* is extensively present in the valleys of the Yangtse and its tributaries, and there only. In the early stage it gives rise to urticarial fever, later to dysenteric symptoms, enlargement of spleen and liver, and ascites.

(iii) *Worms inhabiting the Alimentary Canal and Liver:—*

(*a*) *Nematodes. Ascaris lumbricoides, Trichocephalus trichiuris, and Oxyuris vermicularis* are universal, and the percentage of infections is approximately the same everywhere, viz., for ascaris, 80 per cent. and upwards; trichocephalus, 30 to 40 per cent.; oxyuris, about 20 per cent. or less. *Strongyloides intestinalis* is widely distributed but comparatively rare. *Ankylostomum duodenale* and *Necator americanus* are ubiquitous, and the cause of untold invalidism in China. In the central and southern regions they are a terrible scourge, affecting, roughly, 40 per cent. of the people.

(*b*) *Trematodes.*—North Chekiang is the one great endemic centre for *Fasciolopsis buski*. Apart from this the worm has a wide distribution, as single parasites in man, not in these cases causing disease. The writer has found three specimens in the examination of several thousand stools for ankylostomum worms. In no case could more than one be found. Where it produces disease the symptoms are diarrhœa ending in dysentery, wasting, anæmia, and extreme debility. Several species have been described, but it is doubtful if this is justified. *Clonorchis sinensis* is common in Canton Province and Hong-Kong, in the Yangtse Valley and in Korea. It is rarely found elsewhere.

(*c*) *Cestodes.—Taxnia solium* and *T. saginata*. Owing to the thorough way in which meat is cooked by the Chinese tapeworm is rare, except in special localities where meat raw, or very much underdone, is eaten. The most important of these areas are Korea, Manchuria, and among the aboriginal tribes of Yunnan. *T. echinococcus* is practically absent from China.

Systemic Disease in China.

Among *Diseases of the Alimentary Canal, Liver, and Spleen*, the following are the chief:—

Dysentery is common all over China. Roughly speaking, amœbic dysentery is the disease of North and Central China, while amœbic, bacillary, and mixed dysenteries are common in the south. Infection probably takes place through food soiled by fæcal discharges or by flies.

Sprue, though fairly common in the coast ports and the Yangtse Valley, is a disease of foreigners rather than Chinese, who are almost, if not quite, exempt.

Non-malignant Stricture of the Rectum is a relatively common disease in South China. In Formosa the cases number about 0·2 per cent. of hospital patients. The commonest cause is tertiary syphilis. Except in cases where a very long indurated stricture is present, it yields well to a free posterior proctotomy with subsequent prolonged passage of bougies. Many cases are thus completely cured.

Tropical Abscess of the Liver is more common among the Chinese than among the native populations of other countries; we treat some half-dozen or more cases every year in our hospital in Formosa. These are all amœbic, and now, with the exhibition of emetine, comparatively rarely call for active surgical treatment.

Tropical Febrile Splenomegaly is beginning to emerge from the maze of malarial and other splenomegalies. It is the disease in South China which at the moment calls most loudly for systematic investigation. It closely resembles Banti's disease, and terminates in most cases with extensive cirrhosis of the liver and ascites. Splenectomy in the pre-ascitic stage seems to be the only certain cure. In Formosa, and probably through South China, it is very common. Of its ætiology we are in total ignorance, but the poorer classes are mainly affected.

Among *Skin Diseases* the following must be mentioned:—

Ulcus tropicum (Ulcerating Granuloma) is relatively common in South and Central China.

Parasitic Ringworms are ubiquitous. *Tinea imbricata* is met with only in the south, especially in South Formosa, where it is common.

Sterilizing the Water of the Tigris.—Water is put into large canvas tanks in which alum is suspended, this causing the settling of the mud. Chlorine water is then added in the proportion of 2 fluid oz. to 10 gall. of water, and in an hour it is safe to drink.

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PUTTEES.

THE adoption of puttees in the Army is not without interest from a historical and a physiological point of view. In more modern times the usefulness of the puttee, especially in war, found its justification in India, where troops have to march through stretches of sand, and where insects of all kinds abound. Its use amongst native troops extended to British soldiers in India, thence it was adopted first for soldiers in other British tropical domains, and then for soldiers in Britain. That puttees existed in times gone by is well known, and perhaps some form of rolled cloth was the earliest covering of the legs, whether of the labourer or soldier. As far back as Anglo-Saxon times the legs were encased in bands known as "scanc-beorg," but before cloth bands were in vogue, straw twined into ropes was used to envelope the legs, and especially for warmth in winter. Protection for the legs must have been an early feature in bodily covering, so that the lower limbs might be shielded from insects, thorns, nettles, snake bites, &c. A piece of cloth laid on and held in place by thongs of ox hide or vegetable fibre fancifully crossed in pattern up the lower limb was no douht the prototype of the puttee.

But the use of puttees or bandages in much the same form as used to-day was in vogue many centuries ago amongst soldiers, and passed *out* of fashion in part as long ago as the fourteenth century. Civilians continued to wear them, however; some trades, such as that of the butcher, found them useful until well within the sixteenth century. It was not until the Boer War, however, that puttees were universally used in the British Army, and they may be said to have come in with khaki clothing. The stocking, as we know it, is a recent feature of our clothing. The art of knitting was not so well understood formerly as it is to-day; the heel seemed to have been a stumbling-block to make, and the ending at the toes was rudely fashioned. The earlier stockings were, of course, not knitted at all, but merely pieces of cloth cut more or less to the shape of the foot and leg and sewn together. These produced badly fitting stockings as a rule, and the seams chafed the feet.

The materials of which puttees have been made will be found to vary with fashion and with the wealth of the wearer. Royalties are figured in France as wearing puttees of cloth of gold when in court dress, whilst the texture of the puttees of the laity were of wool. Priests in some instances bound their legs with strips of linen as a distinctive mark of their calling. Horsemen have found puttees useful both abroad and at home, and before the Boer War they were occasionally seen in our midst. The puttee itself varies in shape; the commoner variety is one in which the cloth is cut straight like a roller bandage. Its application may be as a simple spiral bandage when the limb is not endowed with a large calf, but when the calf is very muscular and prominent, reverses, as in a reverse spiral bandage, have to be resorted to, otherwise it does not lie close to the limb. In this respect the Indian troops, Sikhs, Pathans, &c., find the simple spiral sufficient, as their legs are markedly flatter and smaller in the calf than those of the British folk. In fact, the lower extremities of the native Indian soldiers are so slender that it is difficult to imagine whence comes their strength of limb and their endurance; yet that they are endowed with power of accomplishing prolonged marches in war is a well-known fact. In place of a reverse spiral, a figure-of-eight pattern is by many soldiers adopted in applying the puttee. Yet another modification in the nature of application is the fact that the

Canadians commence applying the puttee below the knee and work downwards towards the feet. This has little to recommend it and a good deal against it, for when begun from below upwards the overlapping turn prevents rain getting so readily into the folds, whereas when commenced above the upper edge it forms a catch for the water as it falls.

As to the physiological and anatomical effects of puttees, there is a good deal to be said in support of those who condemn them, and *vice versâ*.

The claims in favour may be stated to be: protection from wet, from sand, from insects, from thorns and snake-bite; support to the veins of the legs, especially when these threaten to become varicose. Pressure upon the muscles prevents venous blood accumulating in the large muscles of the calf, and thereby prevents or lessens fatigue. There is no doubt also that the puttee keeps this part of the soldier's dress more tidy than it otherwise would be.

On the other hand, there is much to be said against the puttee, and with more or less justification.

It is not a normal or natural condition of things to have the legs bound round with a tight bandage; it must impede the action of the muscles, and either lead to atrophy of the muscles or to a disturbance of the circulation in the legs and feet. Were one to judge by the size of the legs, and especially of the calf muscles, of the native Indian soldiers one could associate their very small size with the untoward effect of constant bandaging. In Britons, however, the muscular development of the calf of the leg is much in excess of that of the Indian, and it may be, therefore, that what is suitable for one may not be, or is not, suitable for the other. To apply a puttee tight enough to keep up means pressure upon, and limitation of the action of the calf, thereby hampering the movements of the calf muscle and interfering with full efficiency in walking, &c. The negro has an apparently flat calf owing to the great protuberance of the os calcis backwards. The Chinese, on the other hand, have small feet, but enormous calves to their legs. The Chinaman does not bind his legs, and one cannot conceive him doing the extraordinary amount of physical labour he does with his calf bound and hampered by a bandage.

The effect of the puttee upon the circulation is attended by increasing difficulty of supplying the feet with blood; so that cold feet due to a deficiency of blood results, owing to interference with the passage of blood through the arteries, and also in the return of blood by the veins.

An elastic-sided boot causes cold feet, due to the slight compression the elastic exercises upon the bony ankle; how much more, therefore, is the circulation affected when the whole leg is compressed by a puttee where only muscles can afford any protection to the blood-vessels?

Trench feet are due in great measure to the arrest of a free supply and return of blood to the feet, and the attendant numbness is partly caused by vascular disturbance and partly to the pressure upon the nerve supply to the feet.

We have not yet arrived at an ideal covering for the lower limbs, and the puttee is rather a setback than an improvement upon anything hitherto brought to light.

Annotations.

Splenectomy for War Wounds.—Depage (*Paris méd.*, June 24, 1916) reports that he had twelve cases of splenectomy at the La Panne ambulance, with four cures and eight deaths. Of four cases in which the spleen alone was injured three were cured; in the remaining eight, in which the wound of the spleen was associated with lesions of other organs (kidney, liver, stomach, colon) there was only one recovery. These figures show that the special gravity of splenectomy depends particularly on concomitant lesions of other organs.

Two Methods for Mercurial Treatment of Syphilis (Blechmann, *Paris Médical*, May 6).—Mercury can be administered by applying a lump of mercurial ointment to the sole of the foot before pulling on the sock or stocking. The constant stepping on it forces the drug into the tissues, and absorption is so complete that he has had stomatitis follow in some cases. Mercury can also be given in the form of a cocoa-butter suppository. It may induce transient diarrhœa, but has no other inconvenience. Both of these methods are effectual and discreet, while they are convenient for troops on active service, or under other exceptional conditions.

Complications and Sequelæ of the Operation for Inguinal Hernia.—Davis (*Journ. Amer. Med. Assoc.*, August 12, 1916) finds a gross mortality of ·53 per cent. in a series of 1,500 cases; several cases, however, died of entirely non-related diseases, and could fairly be counted out, thus making the mortality much lower. There were only 158 cases in which any infection developed. The percentage of sepsis in cases operated under local anæsthesia was 17 per cent. Respiratory complications were in 92 per cent., and this complication was by no means abolished by the use of spinal or local anæsthesia. This probably was partly due to the fact that these forms of anæsthesia were selected on account of chronic bronchitis or cough. Respiratory complications occurred in 25 of 170 cases, in which spinal or local anæsthesia was used, or nearly 15 per cent. The results of the operation are, on the whole, good—better than might be expected under the conditions. The operation has a definite, though low, mortality and should not be undertaken in the old or infirm without good reason. Sepsis probably plays an unimportant rôle in recurrence. A strikingly large number of patients anatomically cured complain of pain, probably due to nerve traumatism. General anæsthesia is still best in the routine case. Local anæsthesia is very satisfactory and has a wide application in cases in which inhalation anæsthesia is contraindicated, but carries a slightly greater risk of sepsis, and hence probably of recurrence, too,

although the latter conclusion is not borne out by figures. Spinal anæsthesia, on account of its greater danger and serious sequelæ, should have little place in the operation.

The Pathological Diagnosis of Diseases of the Appendix based on the Study of 1,500 *Specimens.*—Moschcowitz (*Annals of Surgery*, June, 1916) concludes from his examination of this number of cases that the pathological lesion of acute appendicitis represents a suppuration process from the very beginning. The earliest lesion is as pathognomonic as the primary lesion of syphilis, and all the subsequent stages of the disease within the organ are directly traceable to the spread and development of this lesion. There is no pathological evidence that an acute catarrhal inflammation of the appendix occurs. The changes associated under the name "chronic" appendicitis (stricture, obliteration, &c.) are pathogenetically the healed products of the acute lesion. According to this interpretation, chronic appendicitis is not a continuous progressive inflammation, but an end product. There is no pathological evidence of "involution" of the appendix, or of "chronic catarrhal" inflammation of the appendix. The only justifiable classification of inflammation of the appendix, therefore, is the following: (1) Acute appendicitis; (2) healing or subacute appendicitis; (3) healed or chronic appendicitis. Further, an acute localized peritonitis with the formation of fibrin and limited to the site of the lesion is always present in acute appendicitis as early as twelve hours after the onset (and perhaps earlier); so that the absence grossly of a localized peritonitis in suspected cases is *eo ipso* evidence of the absence of acute appendicitis. In addition to obliteration and stricture, attention is called to two new, easily recognizable, constant and pathognomonic signs of chronic appendicitis, namely: (1) absence of mucosal crypts, and (2) marked widening of the submucous connective tissue zone. The latter sign is especially easy to determine upon cross section of the organ, and is recommended as the simplest way to determine the presence or absence of a chronic appendicitis. Cross section of the appendix at various lines is far preferable to longitudinal section, to determine the pathologic change.

ERRATA.

Page 165. Description of Illustration: *For* "× 3,200" *read* "× 2,200."

Page 166, column 1, line 17 from bottom: *For* "YO Y" *read* "YO-Y, f."

Page 167, column 1, line 7 from bottom: *For* "anaërobically" *read* "aërobically."

Page 169, column 1, line 16 from top: *For* "1 to 200" *read* "1 in 200."

Page 172, Table III, right-hand column, under Milk: *For* "Slightly acidity" *read* "Slight acidity."

Page 173, column 1, line 17 from top: *For* "choleric" *read* "choleraic."

Page 173, column 1, line 7 from the bottom of the German extract: *For* "diece" *read* "diese."

Page 175. Description of Illustration: *For* "× 3,200" *read* "× 2,200."

Abstracts.

HÆMOGLOBINURIC FEVER TREATED BY INFUSIONS CONTAINING QUININE.[1]

By W. O. Ott.

A WHITE man, aged 35, telegraph operator, was admitted to hospital on December 13, 1915, with hæmoglobinuric fever. The patient had lived in a malarial district for the past six months. The patient had several attacks of malaria the preceding August, and had had chills with fever every ten or fifteen days since. For the past two months the patient had been somewhat jaundiced and very much run down. He had taken quinine irregularly since summer, and large amounts of it at times.

The present illness began Sunday, December 12, 1915. The patient was feeling bad when he returned from work Sunday morning (night operator), and he took several capsules of quinine at about 8 a.m. He was up most of that day, but felt feverish in the afternoon. At about 4 p.m. he had a severe chill with high fever. He began to vomit and pass bloody urine shortly after the chill. He was very restless that night, with frequent vomiting and a distressing hiccough. The fever remained high all that night, and he had another severe chill in the early part of the night. Monday morning it was noticed that he had become deeply jaundiced. The temperature was 104 at this time, and he continued to pass almost black urine in small amounts. The vomiting, hiccough and high temperature, with the extreme restlessness, continued all that day. At 7.30 p.m. he was admitted to hospital with a temperature of 103. He was evidently a very sick man. He was restless and vomited a yellowish fluid at short intervals. The urine was dark red, almost coffee coloured, and was passed in small amounts. He complained of tenderness and pain in the epigastric region from the prolonged vomiting. The patient was well developed and well nourished and deeply jaundiced, with the sclera lemon yellow. The mucous membranes were pale. The spleen was soft, tender to pressure, and reached 3 in. below the costal margin. The liver was not palpable. There was tenderness over the entire upper abdomen. Otherwise, the physical examination was negative.

At 9.30 and 11.30 p.m., 10 gr. of quinine sulphate were given by mouth. This was not retained and it was discontinued. An opiate was given at 12.30 a.m. for the extreme restlessness. The patient vomited several times during the remainder of the night, but slept at intervals. In the forenoon of December 14 the condition became much worse. Vomiting was almost continuous and the restlessness extreme. There was no absorption from proctoclysis. A small amount of almost black urine was

[1] Abstracted from *Journ. Amer. Med. Assoc.*, September 16, 1916.

passed during the forenoon. The prostration of the patient increased, and death seemed imminent. It was decided to give quinine, and at 11.30 10 gr. of quinine dihydrochloride in 300 c.c. of saline solution were given intravenously. The condition of the patient seemed better shortly after the infusion. In the afternoon the restlessness and vomiting decreased, and the patient was much more comfortable, and was voiding more freely. The saline infusion containing 10 gr. of quinine dihydrochloride was repeated at 4.30 and 10.30 p.m. By 6 p.m. the temperature had dropped to 99, and the appearance of the patient was greatly improved. The night of December 14 was passed fairly comfortably, although no liquids were retained and an opiate was required for restlessness. December 15, the quinine infusion was given at 11 a.m. and 4 p.m. The patient was much improved, and there was absorption from proctoclysis on this date. Liquids were not retained by mouth. The jaundice was not so intense. There was free secretion of urine, and it was of a light wine colour. At 2 p.m., December 16, one quinine infusion was given. The patient retained liquids. Urine secretion was free and lighter in colour. December 17, the urine was entirely clear, the jaundice had almost disappeared, and the spleen reached 1½ in. below the costal margin, and was firm. Quinine sulphate, 10 gr., three times a day, was taken by mouth on this date and retained. This was repeated daily until the patient was discharged.

The urine and blood findings are those characteristic of hæmoglobinuric fever. The first urine on admittance was dark red, almost black, and contained albumin, hyaline and granular casts, no red blood cells, but hæmoglobin, and a large amount of a dirty, brownish granular detritus. By December 18 the urine was clear of albumin, casts and hæmoglobin. No plasmodia were found in the blood on admittance, or subsequently. December 21, the blood examination showed: total whites, 6,050; total reds, 2,800,000; lymphocytes, 47 per cent; large mononuclears, 1 per cent.; trausitionals, 4 per cent.; neutrophilic leucocytes, 46 per cent.; myelocytes, 2 per cent.; and hæmoglobin, 55 per cent.

Two months after discharge the patient stated that his improvement was uninterrupted after his return home, and that he felt better now than at any time in the last five years. He had been free from attacks of malaria, and had gained weight rapidly.

Comment.

The question as to whether the marked improvement after the infusion was due simply to supplying fluids to the body, or to the quinine contained in it, presents itself. Recently, Bruce-Porter[2] observed marked improvement with repeated saline infusions containing no quiniue. Burkett[3] used Roger's hypertonic solution, and he believes that the improvement noted in a case so treated was due to overcoming acidosis. In our case, the rapid fall in temperature with only a slight subsequent rise, and the rapid amelioration of the vomiting, singultus and abdominal distress after the infusion, makes one feel that the improvement which followed was dependent, to some extent as least, on the quinine. Certainly no ill effects resulted from its administration. On the contrary, there was a rapid drop in temperature after the intravenous quinine, and a great improvement in the patient's condition. The improvement continued uninterruptedly until he was discharged from the hospital.

The treatment of hæmoglobinuric fever with large doses of quinine is not the generally accepted one at present. The physicians of the Isthmian Canal Commission advise against its use during an attack of hæmoglobinuria. The latter authors, however, recommend its cautious use if parasites are present. Stephens advises withholding quinine during the attacks of hæmoglobinuria, unless parasites are present in such numbers that the symptoms can in part be attributed to them.

The exact cause of hæmoglobinuric fever is unknown, and for this reason the rationality of any treatment of this condition must still remain in doubt in spite of the large advance that has recently been made in the study of this disease. The association of blackwater fever with malaria has long been kuown, and strong evidence is at hand pointing to its malarial origin. Stephens, in collecting reports of a series of cases, gives the percentage of positive blood examinations the day before onset, the day of the onset, and the day after the onset of blackwater, as 73, 47·5 and 23, respectively. This confirms the observation that the parasites disappear from the peripheral circulation with the outset of hæmoglobinuria. In blackwater fever the old worn-out red cells are hæmolysed, and new ones containing no plasmodia rapidly take their place. The asexual plasmodia, being unable to live free in the plasma, are destroyed. In this way a large percentage of the asexual parasites are destroyed. This explains why many patients are relieved of their malaria for months by an attack of hæmoglobinuric fever. It is believed by some that hæmoglobinuric fever is a self-limited disease, and that the hæmolysis, with its cousequent hæmoglobinuria, is an expression of nature to rid the body of the infection. The severe symptoms present are thought to be the result, in part at least, of setting free this large amount of hæmoglobin in the plasma.

Without entering into a discussion of the cause of the very remarkable hæmolysis that takes place in this condition, for the whole subject is still in obscurity, certain facts that bear on the treatment stand out. In the first place the sequence of the administration of quinine and the onset of hæmoglobinuria several hours afterward, is a well-established fact. On the other hand, there are many cases on record in which quinine as a causative factor in initiating the onset can be eliminated. Quinine is also thought to increase the hæmolysis,

[2] Bruce-Porter: "Intravenous Injections in Blackwater Fever," *Practitioner*, London, 1914, xcii, 261.

[3] Burkett, R. W. P.: "Blackwater Fever," *Lancet*, London, November 20, 1915, p. 1,138.

and consequently the severity of the symptoms in some cases, when given during an attack. The presence of malarial plasmodia is a fairly constant finding at the beginning of the attack, the blood being positive in 73 per cent. of the cases the day before the onset of the blackwater. If the fall in hæmoglobin content of the blood occurs forty-eight hours before the onset of symptoms, as it did in the case cited above, plasmodia are present in something over 73 per cent. of the cases at the onset of the hæmolysis. This is certainly presumptive evidence, at least, of the malarial plasmodia as a causative factor, and would seem to justify the use of quinine. The question of the possibility of doing harm to the patient with this drug must, of course, be borne in mind.

Quinine is best given in an infusion, since it is not retained by mouth. Beside this, the infusion is not an unimportant part of the treatment, for the demand for fluids is urgent. Anuria and death were less likely to supervene in rabbits injected with a hæmoglobin solution if the rabbit had been previously supplied with fluids, than if it had been deprived of fluids. Hæmoglobinuric fever patients usually vomit all fluids, and proctoclysis will often not be absorbed. From 300 to 500 c.c. of saline solution in which not more than from 5 to 10 gr. of quinine dihydrochloride have been dissolved may be given and repeated every six to eight hours, so that the patient gets from 15 to 30 gr. of quinine in twenty-four hours.

PERNICIOUS ANÆMIA TREATED BY SPLENECTOMY AND SYSTEMATIC, OFTEN-REPEATED TRANSFUSION OF BLOOD.[1]

Transfusion in Benzol Poisoning.[2]

By Roy D. McClure.

Blood from two individuals may not mix well because:—

(1) The red corpuscles of one or of each may be clumped by the serum of the other.

(2) Corpuscles clumped in this way may be hæmolysed as well.

(3) All human beings soon after birth may be grouped into four distinct classes, depending on the ability of their serum to agglutinate the red corpuscles of members of the other groups and on the susceptibility of their corpuscles to agglutination by the serum of members of the other groups.

In the selection of a donor little attention for a time was paid to the fact that the serum of an individual in one group hæmolysed and agglutinated the cells of a person in another group. Deaths have occurred as the result of transfusion when the tests were ignored or improperly performed. Even when the tests were properly performed and the bloods reported compatible, there was one case of severe hæmolysis. On repeating the laboratory tests agglutination was present at the end of one hour, but not at the end of a half hour. Therefore the report of compatibility cannot be safely made under an hour.

The selection of a proper donor is therefore a very important matter, and often rather difficult. It is also imperative that transmissible diseases be ruled out by history, blood examination, Wassermann, &c. Syphilis has been transmitted by transfusion in a case of pernicious anæmia. The donor was a close relative of the patient and before giving his blood denied having syphilis and also denied exposure to infection. Less than six weeks after this transfusion the patient returned with the most virulent syphilitic rash and mucous ulcers. At the same time the secondary eruption appeared in the donor. It then developed that the donor had a primary sore at the time he gave the blood. Malaria was transferred in one of the early cases by a transfusion of defibrinated blood. It was in the quiescent stage in the donor, but flared up in the recipient.

In 1909 there were admitted the first of a series of cases of benzol poisoning. The patients were girls employed in a canning factory in Baltimore. Benzol (benzene, C_6H_6) was used in dissolving rubber and the fumes resulted in the poisoning of the workers. The symptoms are a severe purpura hæmorrhagica with a severe anæmia of the aplastic type. Several transfusions were performed among these cases, but as there was only temporary improvement, if any, the procedure was regarded as of little value. Several patients died soon after admission.

The following case is reported, as the result of each transfusion was so striking, one of the operations so plainly saving her from immediate death. Previous results had been so discouraging, as the improvement of a single transfusion was so temporary, and we were ready to give up. The family of the patient, however, saw the enormous immediate benefit of each transfusion and insisted that we continue with this treatment. They produced the donors. Much to the surprise of all she soon ceased to require transfusion and made a complete recovery.

S. H., a woman, aged 31 years, worker in a canning factory, admitted to the hospital May 1, 1914, complained of bleeding from the nose and mouth. A diagnosis of benzol poisoning and secondary anæmia was made. Her present illness began with an onset seven weeks before entrance (early part of April, 1914), with a feeling of weakness and bleeding from the nose. The hæmorrhage usually lasted from one-half to two hours. Black and blue spots appeared over the body, followed by shortness of breath, bleeding from the gums and loss of appetite.

On examination the woman was found to be pale and obese. There was bleeding from the margins of the gums. There was no general glandular enlarge-

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[1] Abstracted from the *Journ. Amer. Med. Assoc.*, September 9, 1916.

[2] From the Surgical Clinic of Dr. W. S. Halsted, Johns Hopkins Hospital. Read before the joint meeting of the Section on Practice of Medicine and the Section on Surgery, General and Abdominal, at the Sixty-seventh Annual Session of the American Medical Association, Detroit, 1916.

ment. The lungs were clear, the heart slightly enlarged. A systolic blow was perceptible at the base. Numerous purpuric spots were distributed over the body, and there was slight œdema of the extremities.

On May 2, 1914, the red blood cell count was 1,460,000; white blood cells, 1,110; hæmoglobin, 25 per cent.; polymorphonuclears, 40 per cent.; mononuclears, 37 per cent.; transitionals, 15 per cent.; no nucleated red blood cells; no myelocytes. Platelets were almost absent. Bleeding time fourteen and one-half minutes; normal time is one-half to two minutes.

TABLE I.—RESULTS OF TRANSFUSIONS IN CASE OF SECONDARY ANÆMIA FROM BENZOL POISONING (SUTURE METHOD).

No.	Date, 1914	Hæmoglobin, per cent.			Red Blood Cells		
		Before	After	Incr.	Before	After	Increase
1	May 3	20	38	18	1,226,000	1,680,000	454,000
2*	,, 17	28	48	20	1,117,000	1,971,000	864,000
3	,, 23	20	40	20	910,000	1,856,000	946,000
4†	,, 31	11	42	31	0	0	
5	June 13	48	65	17	3,476,000	4,528,000	1,052,000

* Defibrinated blood.
† Patient bleeding, comatose.

After each of the first three transfusions she rapidly lost what she had gained, and, unfortunately another transfusion was not done until she had slipped back. The fourth transfusion was all but too late. A massive transfusion was done, probably 1,500 c.c. or more of blood being given, and there was a great rise in hæmoglobin. (We were still using the Carrel end-to-end suture method, so no measurement of the quantity of blood could be made.) Normoblasts and nucleated red cells made their appearance, and after the next transfusion (donor a negro man) the patient made an uneventful recovery, and was discharged from the hospital July 26, 1914.

January 17, 1916, the patient has remained well, the hæmoglobin being 95 per cent.; red blood cells, 4,272,000.

This led us to believe that perhaps steady use of carefully planned transfusions persistently used to prevent the anæmia and its results might be of benefit in pernicious anæmia. We advocate, too, splenectomy.

Since Eppinger, in May, 1913, first called attention to the very beneficial effect of splenectomy in pernicious anæmia, it has been widely performed. American surgeons have reported often great improvement, but probably no cure. It is unnecessary to discuss it further after the papers of this symposium. Eppinger regards splenectomy as the most important measure in the treatment of pernicious anæmia.

Table II shows a brief résumé of our transfusions in pernicious anæmia. As will be seen, splenectomy was carried out in only six of these cases.

TABLE II.—RESULT OF TRANSFUSIONS IN SEVENTEEN CASES OF PERNICIOUS ANÆMIA, SIXTY-FOUR TRANSFUSIONS BEING MADE WITH NO DEATHS.*

Result	Number	Per cent.
Beneficial	34	53
No benefit	23	35
Harmful	7	10
Severe reactions	7	10
Slight reactions	12	19
Chill	7	10
Dilated heart 24 hours after transfusion	1	1½
Jaundiced	1	1½
Hæmoglobinuria	3	4½
Temperature elevation over 101	12	19
Skin eruptions	7	10

* Splenectomy was performed in six cases.

The transfusions that resulted harmfully or were of no benefit we feel due to improper matching of the blood. This resulted in still greater care in the selection of donors. In the earlier cases, little benefit resulted from the fact that only a single transfusion was done. We will report only three cases here, as there is not space for all.

Case 1.—T. A., aged 38, was admitted to the hospital February 22, 1915, complaining of progressive weakness. A diagnosis of pernicious anæmia and pyorrhœa alveolaris was made. The present illness had its onset in June, 1914, with weakness, followed by loss of appetite, constipation, nausea and vomiting, and a loss of weight of 24 lb. There was dyspnœa, but no nervous system symptoms.

Blood examination made February 22, 1915, showed red blood cells, 1,584,000; white blood cells, 4,560; hæmoglobin, 32 per cent. The colour index was high; the differential count, 70 per cent.; polymorphonuclears, mononuclears, 25 per cent.; one nucleated red blood cell.

The patient was transfused thirteen times. Splenectomy was performed after the fifth transfusion.

On January 17, 1916, blood examination showed hæmoglobin 93 per cent.; red blood cells, 3,728,000; polymorphonuclears, 77 per cent.; small mononuclears, 10 per cent.

Case 2.—J. B., a woman, aged 43, was admitted to the hospital, September 10, 1915, complaining of weakness, shortness of breath, and pallor. A diagnosis of pernicious anæmia was made, and history was negative.

The patient had had cystitis for two years, appetite poor, with a burning sensation of tongue and mouth. The temperature was from 99 to 101° F. There had been some dizziness for six months. A roaring sensation in ears had been noticed for two months. There was slight œdema.

On examination of the patient the mucous membranes were found pale; the blood-pressure was 150 mm. of mercury systolic, 80 diastolic; the temperature was 100·4° F. There was an impaired percussion note at the apexes of the lungs, but no râles. The heart was slightly enlarged. A systolic murmur was heard at the apex. The liver was not enlarged and the spleen could not be felt. There was no general glandular enlargement. The reflexes were normal. The stools were negative.

Blood examination showed hæmoglobin, 27 per

cent.; red blood cells, 1,136,000; white blood cells, 3,560; polymorphonuclears, 66 per cent.; eosinophils, 0·5 per cent.; basophils, 0·5 per cent.; small mononuclears, 27·5 per cent.; large mononuclears, 3 per cent.; transitionals, 1 per cent.; myelocytes, 1 per cent.; myeloblasts, 0·5 per cent.

On September 12 the hæmoglobin was 29 per cent.; white blood cells, 2,000; red blood cells, 944,000. There were fresh hæmorrhages in both eye grounds. The Wassermann was negative. Gastric analysis showed hydrochloric acid deficit 8 per cent.: total hydrochloric acid 2 per cent. She was transfused fourteen times.

Case 3.—H. P., a widow, white, aged 62, was admitted to the hospital January 3, 1916, complaining of weakness and lack of blood. Her family and personal history were unimportant. Previous to her present illness she had always been healthy and strong. The onset occurred in January, 1914. There was increased frequency of urination. A few weeks later there was weakness of the knees, progressive shortness of breath, and for three weeks, pain over the heart. There had been no fainting or giddy spells; she had lost 37½ lb. in weight.

Examination showed a woman of large frame, with dyspnœa on slight exertion. There was a lemon colour to the skin, and evidence of recent loss of weight; no general glandular enlargement; teeth practically all gone; chest symmetrical; costal angle almost straight. No râles; region of cardiac dulness extended 4·5 cm. to the right, and 11 cm. to the left of the midline. There was a systolic murmur at the base of the heart, and a diastolic murmur over the vessels of the neck. The blood-pressure was 118 mm. of mercury systolic, 60 diastolic. The liver was not enlarged, and the spleen could not be felt. The reflexes were difficult to obtain. There were no sensory disturbances. Rectal examination was negative. Red blood cells were 936,000; white blood cells, 5,440; hæmoglobin, 26 per cent.; polymorphonuclears, 50 per cent.; eosinophils, 0·4 per cent.; basophils, 0·4 per cent.; small mononuclears, 28·8 per cent; large mononuclears, 2·8 per cent.; transitionals, 0·8 per cent.; myelocytes, 13·6 per cent.; unclassified, 3·2 per cent.; red blood cells, January 7, 1,088,000; hæmoglobin, 25 per cent. Gastric analysis showed no free hydrochlorates; stool examination was negative; eye grounds normal except for pallor of the discs. January 10, red blood cells, 1,288,000; hæmoglobin, 23 per cent. Splenectomy was performed after the seventh transfusion. She was transfused ten times.

The repeated systematic transfusion has been carried out only during the past year. The results, however, have been so encouraging that we feel that the life of a patient with pernicious anæmia may be indefinitely prolonged if the spleen is removed as soon as the patient is in condition to stand the operation, and sometimes we have to transfuse several times before splenectomy.

After the spleen is removed if there is not a rapid improvement in the blood picture, we would advocate transfusion until the hæmoglobin is as high as 90 per cent. or more, never allowing it to fall below 75 per cent. As remissions often last several months or a year, not many transfusions may be required. It is well known that anæmia so reduces the resistance of the body to infections that it is often an easy prey. Thus can the usual secondary causes of death in pernicious anæmia be avoided, and who can tell but that within a few years of persistent transfusions the primary cause, whatever it may be, of pernicious anæmia may lose its force and perhaps the disease be cured?

Discussion.

F. Smithies: During the past two and a half years we have treated twenty-seven cases of pernicious anæmia by multiple transfusion of whole blood and splenectomy. Just what effect on the hæmatopoietic tissues may be produced by a periodically recurring low grade infection it is not at present possible to fully state. Of peculiar significance is the fact that in practically all of our cases infective foci were demonstrable. The removed spleen showed evidences of chronic splenitis and perisplenitis, indicating that a toxic or infective process had been chronically going on. It has not been possible to culture organisms from the blood or the tissues. It would seem that work similar to that carried out in tissue culture will at some time demonstrate organisms which at present escape detection. The term "treatment by splenectomy" is misleading and incomplete. The splenectomy is merely one part of the treatment and frequently a part of the treatment which may perhaps later on be proved to be the least essential. The routine of treatment which we have emphasized is: multiple, massive transfusions of whole blood, eradication of local foci of infection wherever such may exist, and lastly, laparotomy for removal of the spleen and other tissues evidencing chronic subinfection.

Multiple blood transfusions supply protective antibodies and enable the patient to get rid of the secondary changes which have been going on in the various organs. They improve the blood in quantity and quality. They thus bring the patient to his splenectomy as a fair to good operative risk. During the multiple blood transfusion the patient can be treated with regard to self-evident infection. The operative procedure then becomes relatively safe. Of the twenty-seven cases operated on there were but two operative deaths, and one other death within three months following splenectomy. This rather remarkable experience is due to the fact that the patients were carefully prepared for the major operation. Many of the poor results following splenectomy in pernicious anæmia are due to the patient's being rushed into splenectomy before he has been properly prepared as a surgical risk. Ninety per cent. of the cases observed showed subinfections in the gall-bladder or appendix, and all showed evidences of chronic infection in the spleen.

The effects on the blood in the cases are: In cases that have run from four to twenty-seven months following our treatment there has been an average hæmoglobin gain of 43 per cent.; an average

gain of red cells of 3,322,000, and this gain has in general been well maintained. Study of blood smears shows an absence or diminution of nucleated red blood cells of 94 per cent. There was a decrease in the colour index in 68 per cent. There was a permanent increase in the leucocytes in 88 per cent.; a decrease in coagulation time in 66 per cent.; a decrease in polychromatophilia in 56 per cent.; and the establishment of a relative polymorphonuclear leucocytes in 61 per cent.; a reduction, relatively, in lymphocytosis in 55 per cent.; and a definitely demonstrable gain in blood platelets in 61 per cent. Patients frequently improved, clinically, out of all proportion to the apparent improvement in the blood picture. The permanence of these results no one can at present state. One patient treated twenty-seven months ago is in most excellent shape after having been a useless invalid for more than two years previously.

B. VINCENT: Transfusion is so often combined with splenectomy in the treatment of pernicious anæmia that they may be considered together in discussing the effects of splenectomy. We transfuse on an average of 600 c.c. of blood in these cases, and believe that a relapse which does not show a tendency to spontaneous remission is an indication for transfusion. Some of our patients were transfused before splenectomy and others received transfusions afterward in the relapses which eventually occur in these cases. Dr. Minot has called attention to the increased activity of the bone marrow which follows splenectomy and is shown by the appearance of Howell-Jolly bodies, a rise in the leucocyte count and an increase in the blood platelets and reticulated reds. A similar change may be observed after transfusion and appears on the fourth to tenth day. This furnishes the most favourable time to do a splenectomy in these cases which have been transfused in preparation for the operation. The mortality of splenectomy in pernicious anæmia should be very low, provided the right stage of the disease is taken to do the operation. It is a mistake to remove the spleen in a relapse. Such a case should be transfused and not operated on until it has reached the stage of improvement. There is a type of pernicious anæmia, one whose course is steadily downward without remissions, which does not improve with transfusion and, in our experience, this type of case shows very little change after splenectomy. The immediate effects of splenectomy are often strikingly favourable, but the longer the cases are followed the less encouraging they become.

Splenectomy is capable of bringing about a satisfactory remission of considerable duration. It may last six months and rarely lasts a year. After this period the disease resumes its normal course. Removal of the spleen does not prevent the recurrence of relapses or alter their severity. I doubt whether it prolongs the patient's life unless the case is followed to the end and transfused in the relapses. Transfusion is undoubtedly the best treatment for a relapse. It does not give such a permanent result as splenectomy, but makes the patient more comfortable and probably prolongs his life. Therefore splenectomy and transfusion are palliative, not curative. Splenectomy diminishes blood destruction, and both splenectomy and transfusion are followed by bone marrow activity which brings about a temporary symptomatic improvement. This benefit is temporary and not always certain, but nevertheless transfusion and splenectomy are the most effective means we have at the present time for the treatment of pernicious anæmia.

H. Z. GIFFIN: Thirty-nine cases have been operated on with an operative mortality of 3 (7·7 per cent.). There is apparently no reason why the operative mortality for pernicious anæmia should be high. There have been four post-operative deaths, leaving thirty-two living patients. Five patients are at present in relapses, so of thirty-nine cases there are twenty-seven patients in good or fairly good condition. One patient lived as long as three years. The longest period during which patients have maintained a good condition is one year, which occurred in two instances. Pre-operative transfusions have been given preparatory to operation to improve the general condition of the patient, to initiate if possible an upward wave and to improve the characteristics of the blood count. One can predict that four patients out of five will show a very marked gain after splenectomy, and it would seem that they should be given the opportunity to have this gain without very strenuous post-operative treatment. We have given post-operative transfusions only in relapses. I wish to speak here especially of the examination of the duodenal contents of pernicious anæmia patients for the blood-derived pigments. We have followed up the work of Schneider, reported in January in the *Archives of Internal Medicine*, in thirty-three cases of pernicious anæmia and have obtained high values for urobilin and urobilinogen in the duodenal contents by the Wilbur and Addis spectroscopic test in all but three. In twelve cases examined a short time after splenectomy ten gave very low value. We have examined the duodenal contents for blood-derived pigments in nineteen cases of a miscellaneous group with secondary anæmia and have obtained low values. In four cases of hæmolytic jaundice three have shown high values. This test may prove to be important in the study of patients with pernicious anæmia. For instance, if a patient shows high hæmolytic values in the duodenal contents and is able, in spite of active hæmolysis, to maintain a good blood picture, he should be a favourable case for splenectomy, for splenectomy is followed by a reduction of the hæmolytic values. With splenic anæmia our experience is of thirty-three cases. The results are uniformly good. With hæmolytic jaundice our experience is of ten cases with one death. In hæmolytic jaundice there has been a very great improvement in the general condition of the patient, the jaundice and the anæmia. One patient is in excellent condition who was operated on eight years ago. One case of acquired hæmolytic jaundice presented a pernicious anæmia blood count. Cases of hæmolytic jaundice in adults which show a pernicious anæmia type of blood count are particularly interest-

ing because of a possible close relationship between the two diseases.

W. S. Thayer: My first experience of a splenectomy done in pernicious anæmia dates from three years ago next November. That patient had already had distinct signs of spastic paraplegia. She made what appeared to be a complete recovery from the standpoint of her anæmia and remained well for a year and a half. Her cord changes failed to progress. Then, in about two or three months, she rapidly went downhill with a relapse, and died from a characteristic pernicious anæmia. We have only succeeded in producing a remission of the anæmia; we had for the first time in my experience done something which arrested the progress of the cord changes; as a rule the cord changes have progressed without respect to the operation. The anæmia improved in one case, but the cord changes grew rapidly worse. With splenectomy there is a temporary improvement in the majority of instances. The best figures show a considerable mortality from the operation. One is tempted to regard pernicious anæmia as inevitably fatal, and one is justified in seeking any remedy which may bring improvement. There are cases of long remissions—of sixteen years; others of shorter time; one of five years, and the patient died of another malady. We never need be utterly hopeless with regard to pernicious anæmia, and one must consider very carefully before advising splenectomy. We do in most cases accomplish a little something which we may not be able to accomplish under other circumstances, but it ought to be put very directly to the patient, and we should go very slowly in advising so serious a procedure. In regard to splenic anæmia, particularly those with violent gastric hæmorrhages, the results did not seem to be uniformly beneficial. In hæmorrhagic jaundice the results appear to be almost uniformly beneficial, but there again one ought to consider very seriously the question of operation before advising definitely to have it done. If we are dealing with a case of congenital hæmolytic jaundice, as a rule, the symptoms are not grave. In three cases now under observation, in all of which the patient does not suffer much, there is a large spleen and a continued jaundice of greater or less degree quite endurable, so endurable that in none have I felt like advising splenectomy. One of these patients who underwent appendicitis associated with the removal of stone from the gall-bladder withstood the operation as well as a healthy person and, indeed, three weeks after the operation the fragility of the blood was less than it was before. One should not urge an operation. The jaundice may be so serious and the anæmia grave enough to justify it. In instances of acquired hæmolytic jaundice it may be that the anæmia is serious enough to make the operation almost imperative. These methods of transfusion have rendered the possibility of doing splenectomy in grave anæmia a relatively simple matter where previously it would have been absolutely impossible. A small boy with splenic anæmia was watched for six months that he might develop a good colour. Finally, the boy's condition became so serious that he was transfused and taken to the operating room practically moribund, and transfusion was done while operation was being carried out. By the end of the operation the arteries were spurting and the boy made a perfect recovery following the operation.

G. A. Friedman: A patient with hæmolytic jaundice stated that he was sick for eight months, and on close questioning no other illness could be elicited, except that when he was very young he had a fever which lasted for several days. There was undoubtedly no hereditary tendency in this case. When first seen he was more icteric than sick, and, practically, he came to the clinic, not so much for his symptoms, as for his jaundice. One of my co-workers on first examination suggested catarrhal jaundice. It is very important, and especially so in cases of young people, that the first thought that should come to the mind should be catarrhal jaundice. But an icterus which begins acutely with enlargement of the spleen should suggest hæmolytic jaundice. In a proportion of cases of catarrhal jaundice the spleen is enlarged and not the liver. But on considering more carefully the history in the case at hand, one must see that we are dealing with an entirely different condition. There was an absence of pruritus during the entire period of the illness—eight months. The absence of bile in the urine, and the presence of urobilin and urobilinogen, the presence of bilirubin in the blood, and the presence of bile in the stools, are aids in the diagnosis. The anæmia here, however, was not marked. The resistance of the red blood cells to hypertonic salt solutions was only slightly diminished. It was between 0·35 to 0·45, but the percentage of the reticulated red cells was increased. The result of the operation was marked. Patient was practically free from jaundice on the fourth day after the splenectomy, and on the eighth day there was no trace of it. At the end of last March there was no jaundice and the patient was well. The medical treatment is absolutely without any benefit.

S. J. Meltzer: A possible factor which has not been referred to either in the experimental or in the clinical work on the subject, is that the red corpuscles run in the middle of the blood-stream and are, therefore, as a rule, not exposed to any kind of shocks. The blood, after leaving the renal artery, passes through a considerable amount of alveolar tissue before it enters into the renal veins. The blood cells in their rapid run through these tissues must continually come in conflict with some jarring ridges. Perhaps fragile red blood corpuscles may readily break down in the spleen or may be prepared to give up some of the hæmoglobin, and some of the nucleated cells may lose their nucleus there. The mechanical effect of the alveolar construction of the spleen may have a certain influence on the red blood corpuscles, at least, in pathologic conditions of the blood, and may be, therefore, a potent factor in certain forms of anæmias.

R. I. Lee: The ordinary course of pernicious anæmia is very bizarre, although it is next to impossible to tell from a few cases whether the

effect of a particular therapeutic agent is favourable or not. The blood picture in pernicious anæmia may be said to correspond roughly to blood destruction and blood formation. The same thing holds true of hæmolytic jaundice and splenic anæmia. We have studied splenectomy and transfusion from the point of view of the effect of stimulating the bone marrow activity by the method that Dr. Minot outlined. We have used no particular method, but we have used those general comprehensive estimates of all these methods. We do not think, for example, that the reticulate cells alone are of very great value, but the qualitative changes in the reticulate cells, especially with the blood platelets and white corpuscles, give us good information in regard to the bone marrow. After splenectomy and after transfusion we always get a slight tendency toward stimulation of the bone marrow. That stimulation of the bone marrow varies a great deal. It is much more constant. It is much more constant and energetic after splenectomy than after any other therapeutic procedure. The benefit of transfusion is to furnish bulk of blood which may then be destroyed very rapidly, but the main benefit of transfusion is to inaugurate a remission which means merely to stimulate the bone marrow, and it is only by following the patients that we can tell whether they are benefited or not. We merely say that after splenectomy rather constantly and after transfusion occasionally one does see the signs of a stimulated bone marrow.

E. B. Krumbhaar: It has been generally accepted not only that blood transfusions are a valuable prelude to splenectomy, but that in themselves they constitute an efficient method of combating pernicious anæmia. In fact, it remains to be proved whether or not equally good results would not be obtained by repeated transfusions in the absence of splenectomy, although the impression is prevalent that the improvement following splenectomy is more lasting. This is to be expected if it is borne in mind that whereas transfusion merely improves the condition of the blood, splenectomy removes the most apparent noxa. About the long periods of spontaneous remissions, in Cabot's series of 1,200 cases, only three patients were considered as "cured," in other words, did not develop symptoms during five years. May it not be that among the small number of splenectomized patients that we have thus far had opportunity to see, there is a group which will eventually give us a larger proportion of long surviving cases? I hesitate to use the word "cure," because we do not think of any of them as really cured. In regard to the use of the term "splenic anæmia," most physicians would agree that it probably includes one or more clinical conditions of uncertain or varying etiology. But just as the hæmolytic jaundices, and probably also von Taksch's disease have been separated from this group with profit, so also Gaucher's splenomegaly, with its unique pathology and well-defined symptom complex, should to my mind be considered an independent condition. Thus "splenic anæmia" in the present state of our knowledge might profitably and feasibly either be discarded entirely, or considered as synonymous with Banti's disease, or with the two early stages of that disease.

J. L. Miller: Not every patient with hæmolytic icterus is inconvenienced by it. In fact, the majority of these patients suffer little or no inconvenience aside from discoloration of the skin. For this reason, Türck has referred to it as a cosmetic disturbance rather than a disease. It would seem, therefore, a question whether an operation with a mortality of at least 10 per cent. should be undertaken in these cases of hæmolytic icterus, unless the person shows a definite disturbance or unless he should be willing to undertake the risk associated with the operation in order to be relieved of the icterus. There has recently been a report of three cases of hæmolytic icterus cured, the result of Röntgen-ray treatment. In those cases in which splenectomy is not undertaken it might be well to try the effect of the Röntgen-ray to see whether a cure might be effected.

New Preparation.

ROBOLEINE.

A close consideration of the constituents of Roboleine from a therapeutic point of view indicates a wide field of utility in all conditions of impaired functional metabolism. It is, moreover, the only ethical preparation of its kind on the market, and consequently it is not surprising that it is in demand in all civilized countries. We have received from Messrs. Oppenheimer, Son and Co., Ltd., a copy of a recent testimonial which has lately been addressed to them by a Canadian "Tommy" from a Nottingham hospital. It runs as follows:—

"I am writing to say how much I am indebted to your preparation, 'Roboleine,' for my endurance of to-day. When I arrived in England, towards the end of June, I was only supposed to be dressed for six hours a day and walk 800 yards. Directly after starting 'Roboleine' I commenced staying up all day, from 10 a.m. to 10 p.m., and gradually increased my exercise to two miles a day. Now I can stay up from 8 a.m. till late at night without resting during that period. Considering that I am gaining gradually in weight slowly but surely, I consider that great merit is due to 'Roboleine.' I shall continue to take it, and also 'Collosols,' the second bottle of which I am now taking, and hope to report a complete cure of tuberculosis very soon. I was in the Mountain Sanatorium, Hamilton, Canada, prior to sailing for England, and should have stayed for six months' further treatment.

Sincerely yours,

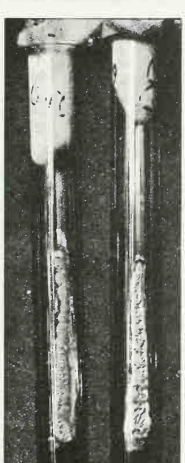
(Signed) William C. J. Huntbach."

Original Communications.

PRELIMINARY NOTE ON A CASE OF THRUSH-LIKE DISEASE DUE TO *MONILIA RUGOSA CASTELLANI*, 1910.

By A. Pijper, M.D.Leyden, Holland.
Bethal, South Africa.

In February last I was called to see a child (white) who presented numerous whitish thrush-like patches on the oral mucosa. On removing one of these patches a slight bleeding spot was left. The material was inoculated in Sabouraud's agar. After two or three days a growth developed which had the macroscopical aspect of *Monilia rugosa Castellani*, presenting very typically its characteristic crinkled



Monilia rugosa Castellani (Sabouraud's agar cultures).

surface and general appearance. Microscopical examination of the cultures showed numerous mycelial threads and yeast-like cells, and also peculiar formations which I am inclined to consider to be *asci*. This is interesting, in view of the opinion expressed by Castellani when he first found and described rugosa, that the fungus might not be a monilia, and placed it in such genus only temporarily. The presence of asci would make the fungus to be transferred to the sub-order Carpoascess, family *Perisporiascæ*, but further investigations are necessary on the point.

Cultural Characters and Biochemical Reactions.

I have grown the fungus in Sabourand's agar, serum, gelatine, litmus milk, and in the following sugar broths—glucose, maltose, saccharose, lactose, dextrin—the only sugars I could obtain here. The cultural characters and biochemical reactions are identical to those given by Castellani. The characteristic crinkled appearance of the fungus is well seen in Sabouraud's maltose agar; serum and gelatine are not liquefied. Litmus milk generally becomes acid, and portions of it may become slightly peptonized, while others may become clotted. Glucose broth turns generally slightly acid; maltose broth also generally becomes slightly acid; and the same may be said of saccharose; there is generally no change in lactose and dextrin broths. In none of the sugar broths is there production of gas.

TREATMENT OF FILARIASIS AND ELEPHANTOID CONDITIONS BY INTRAMUSCULAR INJECTIONS OF SALVARSAN.

By James Garvie McNaughton, M.B., C.M.Edin., M.R.C.P.Edin.

Government Medical Officer, Gilbert and Ellice Islands Protectorate, Funafuti, Ellice Islands, N. Pacific.

The following communication, dated May 24, 1916, was addressed to Sir Patrick Manson, G.C.M.G., LL.D., and forwarded by him for publication in the Journal:—

I hesitate to write to you, but the fact that I have had no tropical medicine literature for two years, and no mail at all in 1916, must be my excuse for not knowing whether any results of the treatment of elephantiasis by salvarsan have been already published. I give an epitome of my notes on a few cases treated with good results:—

(1) T., aged 30, an Ellice Islander. Elephantiasis ten years. Enlarged scrotum and right leg. Attacks of "fever" at least once a month. In May, 1914, he was given ·3 grm. salvarsan intramuscularly during an attack of fever. No fever since that date. No filariæ now found in blood. Scrotum removed by me in April, 1916. Right leg smaller than it was in 1914, but no measurements were taken at that time.

(2) L., aged 36, Ellice Islander. First attack of "elephantoid fever" in 1896. Recurred at least every two months, and once a week if he went fishing or was in salt water. In 1914 both legs had become elephantoid. In May, 1914, during an attack of fever, he was given ·3 grm. salvarsan intramuscularly. No attack of fever since that time, and both legs are now normal.

(3) F., aged 33, Ellice Islander. Elephantoid fever first in 1883. Right leg began to swell at that time; attacks of fever ever since at least every three weeks, and often twice weekly if he went fishing or got wet. In March, 1916, during an attack of fever, I gave ·3 grm. salvarsan intramuscularly. No attack of fever since, leg is slightly smaller, and

general health improved. Before the injection the right foot was very easily bruised by knocking against coral and sores formed. Now that no longer happens.

All the above cases are medical students, fairly intelligent, and able to give a fairly accurate history.

(4) S., aged 35, Ellice Islander. Has had elephantoid fever for "many" years. (It is very difficult to obtain an exact statement of time from a native.) There was no visible thickening of legs or scrotum. Admitted to hospital May 18, 1916, at 10 a.m., complaining of pain in groin, which showed enlarged glands. Temperature 100·4° F. One filaria found in slide prepared on admission.

At 12 noon I injected ·3 grm. salvarsan intramuscularly. At 6 p.m., temperature 103·4° F. Blood-slide showed three filariæ. At 8 p.m. filariæ more numerous, but appeared to be degenerating. Several seemed to show part eaten away.

At 6 a.m., May 19.—Temperature normal and patient feeling quite well. It has been normal ever since, and I have failed to find more filariæ.

(5) J., aged 40, Ellice Islander. History of elephantiasis for twenty years. Scrotum, both legs and arms affected. Fever every ten days, sometimes twice a week.

Scrotum removed by me in April, 1916. After the operation he had an attack of elephantoid fever at least once in ten days. This was not brought to my notice till May 20. On that day his temperature was normal in the morning, but at 9 p.m. it was 101·4° F. Filariæ found at 9 p.m., and ·3 grm. salvarsan given intramuscularly.

At 2 a.m., May 21.—Temperature normal, and has kept so since. All symptoms of fever disappeared by 2 a.m.

The beneficial effect was so sudden that "J." told me in the morning that I had put a devil in with the needle, and the devil cured him.

Now, I know that five swallows do not make a summer, but I feel that all of us in the Pacific will do no harm in working on such lines. I gave only ·3 grm. for a dose, as I wished to repeat the dose if the fever recurred.

There is much elephantiasis in the Ellice Islands, which are in touch with Samoa. Probably 20 to 30 per cent. of the population is affected. There are many scrotal cases. I lately removed a scrotum weighing 58 lb. and measuring 48 in. by 54 in. in circumference. I have invariably had good results, and largely attribute my success to the injection of one or two pints of normal saline into the rectum during the operation.

My predecessor, Dr. B. C. N. O'Reilly, injected salvarsan in cases 1 and 2, but he had no opportunity of following the later history. My difficulty now is scarcity of the drug.

Elephantoid lesions in limbs of at least ten years' standing apparently diminish in size after treatment with salvarsan. It is too early to be dogmatic, further observations are necessary; but if other cases react to salvarsan as those I have observed, I see no reason why elephantiasis should not be completely wiped out.

I have used salvarsan and neosalvarsan in over 500 cases of yaws, with invariably a splendid result, and the fact that in ninety cases in the Ellice Group, where elephantiasis is so prevalent, I had no elephantoid fever in any case after the injection, helped to strengthen my feeling that salvarsan would benefit elephantiasis.

If it will be acceptable I hope to send you further notes on these cases.

THE CUBAN PIG.

Attention has recently been drawn to the raising of pigs in Cuba. A study of the diseases of the pig in the island has been undertaken, and also an investigation of the food supply possible for pigs.

The most prevalent disease is termed "pintadillo," which is considered to be a mild form of cholera.

Many trees and plants yield an abundance of food for pigs, and as most of these grow wild the cost is little. A plentiful food is available from the seeds of the royal palm tree, termed "palmiche" locally. As these seeds fall in quantities all the year round a continuous supply is available. The palmiche conveys a "nutty" flavour to the flesh, which is much appreciated.

Amongst other foods obtainable for pigs from plants growing wild in Cuba are: The guava, yuca roots, mango, sugar-cane, and many other tubers and roots. Amongst cultivated foods are cow-peas, pea-nuts, sweet potatoes; and soya beans are available for pig-rearing and feeding.

No great attempt, however, has been made to deal with the rearing of pigs in the island; yet, seeing that Nature had supplied the food, it only wants a little attention to produce a good breed of pigs to enhance a considerable amount of pig flesh for the world's markets. The native pig in Cuba is of the "razorback" type. Seeing that its food has to be sought for in the woods, where it runs in a semi-wild state, grouped into herds by a herdsman and his dogs, it is no wonder that it is narrow of beam and gaunt in frame. A cross between these wild hogs and the standard breeds of well-known types yields a cross of better value, and so long as the "nutty" flavour of the flesh is maintained, so will the market demand continue. A clean-fed pork is a desirable commodity of to-day, and so long as the cross-bred pigs are allowed to roam where the seeds of the royal palm tree are to be found, several of the diseases associated with the flesh of the pig would be conspicuous by their absence.

New Fibre Plant in Cuba.—A plant, the *Urena lobata*, locally known in Cuba as the "Malva blanca," is being exploited for its fibre, which is of a quality between jute and flax. Occurring wild as a weed in tobacco plantations, its fibre is found on cultivation to improve in texture. The fibre is being used at present in the manufacture of sugar bags.

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THE JOURNAL OF

Tropical Medicine and Hygiene

NOVEMBER 1, 1916.

THE QUESTION OF PASSING ARMY UNFITS FOR THE TROPICS.

AT the present time several old tropical practitioners in England are much exercised in their judgment concerning candidates for positions in the Tropics in banks, merchants' offices, rubber plantations, &c.; and yet again another class have to be dealt with—namely, men returning from the Tropics on leave who want to know if they are physically fit to join the Army and go to the Front. It is a fact that from well-nigh ever since the War began practically all the men coming forward for commercial appointments in the Tropics have some physical defect which prevents their joining the Army. With a law prevailing that no man of "military" age can leave the country without a permit, and then only when rejected as unfit for the Army, or placed in so late a class that he has little or no chance of ever being called at all owing to a physical defect, it comes about that no such being as an absolutely healthy man is obtainable, except he comes from a British Dominion where conscription is not in vogue. Irishmen are getting many of the good posts to-day owing to absence of the enforcement of any laws preventing them leaving their country, but they are the only important exception, for even in the most remote Crown colonies and protectorates the same law obtains as holds good in Britain.

With this influx of physically defective men to be examined and pronounced upon the medical man's difficulties are increased, and he is perplexed to a degree to arrive at a logical decision. Moreover, he is reminded by the authorities, for whom he is acting, that "in these times, when men are so difficult to get, one must not be too particular." This does not relieve responsibility; one has a duty to the candidate as well as to the employer.

Of all organs the heart is the one seized upon by the public, and eagerly also by the medical profession, as the test of fitness for work in any country and for any occupation.

In days when candidates were plentiful and we could pick and choose, the least evidence of cardiac disturbance was seized upon as constituting a bar to fitness for tropical life. We have learned much lately through the clinical evidence brought forward by Mackenzie and others as to disturbances of the heart, whether of a functional or organic nature. We are not so terrified of heart lesions as we were. When we come to think of it, no organ can stand so severe lessons as the heart and still perform its functions to a satisfactory degree. The youth who has had a succession of attacks of rheumatic fever, and whose heart at 20 years of age seems in a bad way, and to whose parents or relatives a grave prognosis is given, astonishes one by continuing to live and to earn his livelihood for many years—aye, into advanced middle age and even old age. Mitral or aortic inefficiency, separately or combined, which would to the inexperienced predict early disaster, may—and oftener does than does not—falsify anticipations. Such a heart may render a man unfit for the trenches or military work of any active kind, but it may continue to withstand work in a tropical climate, whether in the office or on a plantation. Examples of hearts with marked bruits due to a lesion of sorts tested by some ten to fifteen years of tropical life are difficult to find nowadays, when almost every *employé* is examined before proceeding abroad. But in days gone by medical examination before proceeding to the Tropics was

not the custom as it is to-day, and it is from amongst such men only that evidence is obtainable. The writer examined a man lately from Calcutta of all places who presented a mitral bruit of marked intensity. He had gone there fifteen years previously; he had not been medically inspected before going out; he had been home once only in the fifteen years, yet he presented no signs of ill-health nor any detrimental consequence to his circulation by his long residence in a moist, low-lying tropical climate. He knew he had "heart trouble" before he left home, being told so by his own doctor, but as he had not been medically inspected by a doctor on behalf of his firm he said nothing about his condition. In Calcutta, when he consulted a doctor about some illness, he was told, "Well, you can remain here now you are here, but I should never have allowed you to come out had I seen you before leaving England." However, the man, in spite of all prognostications, is in sound health on his second arrival in England after fifteen years' absence, although his mitral bruit persists. A few of such non-inspected cases may crop up occasionally, but they are getting very rare, as practically all must be reported upon nowadays before starting for the Tropics.

Another heart case, this time from the Army. The man enlisted as a private, and after a few months was given rank as an officer. His heart was not examined on enlisting. He went through two or three battles at the Front in France, and had some nine months in the trenches. During examination, whilst suffering from cold, his heart was found to be "diseased," and after being put on Home Service for a time he was pronounced unfit for service. This man the writer had declared to be unfit for tropical service two years before the War on account of his heart, yet he did most strenuous work at the Front and was quite fit. Seeing, however, many men "sent down" were wanted for plantation work abroad, and this time the writer after consultation passed him for tropical work. His disease was congenital—a patent ductus arteriosus.

Many other examples of a somewhat similar nature are recorded where men with even valvular affection after rheumatic fever have maintained their health and strength in a tropical country. Few of us, however, would have the courage to send a man with valvular disease to the Tropics, but the firm directors sometimes say they will risk it, and one must confess nothing untoward has occurred.

Lung troubles next to heart affections come into the clinical field. Leaving aside gross tubercular lung lesions, we have asthma, hay fever, old pleurisy, &c., to consider.

Asthma is no bar to tropical life; and, provided the directors of any company are warned that the candidate has asthma, that it may or may not continue, and that if it does continue in the Tropics it is not likely to be worse there than at home; there is no real barrier to the acceptance of an asthmatic. The well-known peculiarity of asthma as regards climate, elevation, &c., makes a positive prognosis as to the future of the asthmatic in the Tropics hazardous.

Hay fever, unless of the most aggravated description, should not condemn a candidate for work in the Tropics. When an examination of the nostrils in either asthma or hay fever proves negative there is no true reason for rejecting a candidate. Emphysema of the lungs from whatever cause is a deterrent; it is wise to reject such candidates straight away.

Pleurisy that has cleared up and not recurred for, say, two or three years should not debar a man from going to the Tropics.

J. C.

(To be continued.)

Annotations.

Dangers of Lumbar Puncture (V. Boivie, *Hygiea*, lxxviii, No. 14).—Exceptional care is necessary with high blood-pressure and rigid blood-vessels. Psychic irritation and alcoholism contra-indicate it entirely. Patients should be kept reclining for twenty-four hours before lumbar puncture, and for from twenty-four to forty-eight hours afterward, with the head low during the first twelve hours. Any change from the reclining position should be made extremely gradually. The fluid should never be aspirated under any circumstances, and no attempt should be made at lumbar puncture on out-patients. The mishaps that have been published can be traced as a rule to the bursting of an aneurysm or arterio-sclerotic vessel under too rapid fluctuations of pressure in the spinal canal.

Local Anæsthesia for Reduction of Luxations.—Kalima (*Finska Läkaresällskapets Harlingar*) tried reduction of the humerus in eleven cases and of four other bones in one case each. In three cases it became necessary to use general anæsthesia, but in all others reduction was simple and easy. In fifteen minutes after injecting the novocain the dislocated extremity could be manipulated without causing the patient the slightest pain. This is particularly an advantage when there is doubt whether the bone is fractured or merely dislocated. The muscles relax under the local anæsthesia so that sometimes the bone can be slipped into place without reduction manœuvres. In two cases cited the femur was dislocated through the sciatic foramen, in two through the obturator, including his personal case. In all the luxation was reduced with ease. The anæsthetic must be injected at a point where the skin is intact, using from 10 to 40 c.c. of a 1 per cent. solution of novocain, or, in case of the femur, up to 50 or 70 c.c.

Stab Wounds of the Heart.—Runeberg reports five cases with recovery under operative treatment. The symptoms indicating pressure on the heart may include apathy and somnolence approaching absolute unconsciousness. In other cases symptoms of internal hæmorrhage dominate the clinical picture. In operating, the extrapleural route is best, cutting an osteoplastic flap to ensure better access. The pericardium cavity is irrigated with warm saline to remove all blood, flushing the deeper recesses through a rubber tube. This reduces to the minimum the danger of pericarditis. The opening in the heart and in the pleura is carefully sutured. Examination later in a number of cases of stab wounds has shown a surprising tolerance on the part of the heart.

Heat Strokes in Mesopotamia.—The British Mesopotamian Expeditionary Forces have had to contend with intense heat in their work at the head of the Persian Gulf. At Basra the temperature has ranged from 104 to 109. The treatment of sunstroke and heat apoplexy practised in Arabia is the intramuscular injection of 20 gr. of quinine, as it is believed that the malarial parasite is a potent factor in the causation of heat apoplexy. The quinine injection kills the parasite and reduces the fever. Three or four pints of cool water, as near freezing point as possible, are then given as an enema, and the patient is packed in crushed ice.

Subphrenic Abscess.—A. Franchini (*Gazetta degli ospedali*, August 27) reports six operations for subphrenic abscess. The success in all was due to the avoidance of general anæsthesia and scrupulous aftercare, but above all to the convenient mode of access. He resected the tenth rib from the back and incised the parietal pleura for 8 or 9 cm. The lips of the incision were then sutured in a circle to the bulging portion of the diaphragm pushed up by the abscess. An incision in the diaphragm released the pus and gas of a fæcal odour. The cavity was cleared out and dried with gauze and two large drains introduced. One case for some time before the abscess had had symptoms of acid gastritis. In some cases he sutured to the skin the lips of the incision in the diaphragm. In a few of his cases the abscess was accompanied by pleural effusion, percussion showing the normal resonance of the lung, then the dulness over the pleural effusion, below this an area of tympanitic resonance, and below this the liver dulness.

Progressive Oxidation of Cold Storage Butter.—D. C. Dyer (*Journ. Agri. Research*, 1916, vi, 927) shows that (*a*) the development of undesirable flavours in storage butter is not dependent on an oxidation of the fat itself, but that (*b*) it is attributable to a slow process of oxidation progressing in the non-fatty constituents of the buttermilk, and that (*c*) the extent of this change is directly proportional to the amount of acid present in the cream from which the butter had been prepared. In other words, the buttermilk supplied the substances which decomposce during cold storage, and this decomposition is proportional to the amount of acid present in the cream before churning. The experiments showed that butter made from sweet cream had a very mild flavour and kept in good condition almost indefinitely in storage, while the butter from high acidity cream had a high flavour but would not keep well. The remedy consists in preventing the cream from ripening too much, i.e., producing too much acid before churning or, if that has occurred, in washing out the buttermilk from the freshly churned butter with fresh water.

Relation of Helminthiasis to Epileptiform Attacks (A. E. Shtsherbak, *Russkiy Vrach*, No. 29).—A girl aged 8 presented what was assumed to be chronic true epilepsy by several neurologists and pediatrists. They made apparently thorough examinations, searching the stools for helminths' eggs on several occasions, but never finding any. This diagnosis proved to be erroneous, as the trouble was finally traced to the presence of *Tænia nana*. He knows of only thirty-six clinical cases on record of the *Tænia nana* as parasite in man, and eleven were published in Russia. Analysing the nervous manifestations in his case, throughout the entire long history of the disturbances there was evident a combination of epilepsy, hysteria, and migraine. Some of the attacks seemed to be exclusively an epileptic seizure or a hysteria fit or an attack of migraine or various combinations. This suggested helminthiasis, and the stools were examined anew, but nothing abnormal was found on repeated examination, but the third examination showed the eggs of the *Tænia nana*, and after the child had been finally freed from the parasites her nervous system recovered its tone, and there has been no further "epilepsy" during the nearly six years to date. Thymol proved the most effectual of the drugs used in expelling the parasites, but male fern was used freely also, as is described in detail.

Diagnosis and Treatment of Glaucoma (A. Barraquer, *Siglo Medico*, August 19).—There are hundreds of victims every year in Spain because the general practitioners fail to recognize glaucoma. When it develops in an acute form with vomiting and headache, they ascribe it to deranged digestion with casual neuralgia. When it develops insidiously, in a chronic form, it is mistaken for senile cataract. Practitioners should be especially careful to diagnose acute glaucoma, iritis, and cataract, and to advise patients with squint and myopia to ward off aggravation. They should also recognize asthenopia and the ocular origin of dizziness and headache in some cases, and the relations between disturbances in vision and disease of the various organs outside of the eye. The practitioner is often misled when a patient in bed for any trouble or one complaining of intense headache and states that he has just had

an attack, cannot sleep, has no appetite, and cannot see well. The pulse is accelerated, the tongue coated and the eyelids are swollen, the eyes blood-shot and lacrimating, with mydriasis and diminished depth of the anterior chamber and increased tension —all coming on within a few days. The hyperæmia, pushing forward of the lens and iris and the fogginess of the general vision are the revealing symptoms of glaucoma, and should exclude simple neuralgia. Equally important is it to detect glaucoma in its prodromal stage, from the coloured halo around the flame of lamps or candles, with transient feeling of oppression over the eyebrows. This condition may be mistaken for ophthalmic migraine, but there is no headache with this insidious type of glaucoma, and the symptoms persist longer than with migraine.

Plague in Senegal and Dakar (Kermorgant, *Bulletin de l'Académie de Médecine*, August 22). —Bubonic plague was epidemic from April, 1914, to February, 1915. As the natives concealed their sick at first the epidemic got a foothold. During the nine months there were 8,686 cases of plague, with a known mortality of 1,425 cases; the population totals 20,000. Among the Europeans there were only seven cases with three deaths. The entire civilian population of the towns affected were vaccinated three times. At Dakar 8,000 natives were given a total of 13,596 vaccinations, and throughout the Senegal 129,752 vaccinations were made. The children had the disease in the mild ambulant, bubonic form. A campaign against rats was undertaken with periodical "sulphuration" of the sewers, besides the use of traps, poisons, bounties, and rat virus. There was an abnormally high mortality during the period of the epidemic in dogs, cats, rabbits, poultry, and monkeys in captivity. The cattle and horses also died off in large numbers. No explanation for this high mortality could be found, except that it was traced to plague bacilli in two cats, one monkey, and a tame civet cat. The epidemic at Dakar was apparently stamped out twice and flared up again, so there were really three epidemics.

The natives like to bury the dead in the midst of their villages, and consequently a systematic transference of the natives to new villages was an important part of the campaign. The site of the old villages was burned over with huge bonfires and walled off with logs, stumps, and brush. No one was allowed to return to them or cultivate the ground. The plague in this epidemic seemed to have been communicated by man to the rats of the region, as no infected rats were found until late in the epidemic. As soon as the suspects were isolated and the contaminated huts burnt down scarcely any new cases developed. The first cases were of the pneumonic type, fatal in less than three days. Under serotherapy and camphorated oil the less severe bubonic type was successfully combated, when the case was seen in time or the patient had been vaccinated against plague.

Abstracts.

HEALTH OF THE NATIVE ARMY OF INDIA.

The Report of the Sanitary Commissioner, with the Government of India, gives a table showing the remarkable improvement in the health of the native army since 1880. We will here summarize the table:—

Year	Death rate (including deaths of absentees on enrolled strength)
1880	41·12 per mille
1885	16·09 ,,
1890	18·60 ,,
1905	15·71 ,,
1910	18·57 ,,
1505	9·50 ,,
1910	7·12 ,,
1911	6·78 ,,
1912	5·66 ,,
1913	4·55 ,,
1914	3·73 ,,

During the same period the death-rate for British troops dropped from 24·8 to 4·3.—*Indian Medical Gazette*, July, 1916.

DIETARY TOXICITY *VERSUS* DEFICIENCY.[1]

Researches from the Departments of Agricultural Chemistry and Anatomy at the University of Wisconsin show that a ration from the wheat plant —wheat grain plus wheat straw—was wholly inadequate with heifers for reproduction and in some instances for continued growth. With swine, confined to the wheat grain and a suitable salt mixture, growth soon ceased and the animals passed into a poor condition, while a corn and salt mixture ration was at least sufficient for slow growth and continued well-being. Our ideas of what constitutes an adequate ration have been considerably expanded. The nature of the so-called deficiency diseases or avitaminoses has been widely discussed in relation, among others, to beriberi, scurvy, rickets, and pellagra. It may be stated, in a general way, from the extensive data now available that certain at present unidentified substances, aside from protein, carbohydrates, fats and salts, are indispensable for growth or prolonged maintenauce; and, furthermore, that there is a class of such accessories soluble in fats and another soluble in water and alcohol. Furthermore, it seems highly probable that, while the amount of accessory substances of either of these classes which is required to induce growth is small, the evidence points to the belief that a certain quantity must be present before any growth can take place, and that above this amount, growth seems to be in some measure proportional to the amount of accessories present.

Evidence seems to be at hand that in certain defects of nutrition, presumably of dietary origin because they can be corrected by alterations in the

[1] Abstracted from the *Journ. Amer. Med. Assoc.*, October 7, 1916.

food, we have to deal, not with a true deficiency in the diet, but with some inherent substance in the ration that is either interfering with the use of certain constituents necessary for perfect nutrition, or is directly causing nutritional disturbances. Apparently certain wheat rations produce pathologic conditions with histologic pictures analogous to those seen in the polyneuritis of fowls, as the result of an inherent toxicity, as well as by a deficiency in the food supplied. Malnutrition, histologically characterized by nerve degeneration, may result from the absence of certain factors in the diet, as in the case of beriberi. A similar condition may likewise arise from the presence of toxic materials in apparently normal food products, and in the presence of all known factors essential for continued growth and well-being. The newer investigations indicate that with a large mass of wheat in the ration of swine, toxicity will follow even in the presence of all the recognized factors for growth. Only in the presence of very liberal quantities of all these factors can the effect of the toxicity be overcome. One almost inevitably thinks of the cotton-seed feeding problem in this connexion. The lesson of these significant observations may be summarized in the words of the investigators: For normal nutrition with natural foodstuffs not only must there be a plentiful supply and proper constitution of the foregoing essential factors, but also a supply sufficient to overcome any inherent toxicity or else an absence of the toxicity itself. Of course, it is assumed that some kinds of toxicity of natural foodstuffs can be overcome by a plentiful supply of the normal factors of nutrition. They may not always be possible.

TRICHINOSIS: IMMEDIATE RESULT FOLLOWING INTRAVENOUS INJECTION OF NEOSALVARSAN.[1]

By J. B. McNERTHNEY and W. B. McNERTHNEY.

H. R., German, aged 33, entered hospital July 30, 1915. While watchman for a cold storage plant he had eaten for some days undercooked ham. He had been in another hospital in a different part of the State since the date of his infection. The nature of the treatment we were unable to ascertain. He was rapidly getting worse and was brought to the hospital on a stretcher.

The patient, in his fifteenth week of disease, was greatly emaciated and severely prostrated, having lost 60 lb. The temperature was 100. The forearms were flexed on the arms, and there was restriction of the wrist joints so marked that he was unable to lift a cup or feed himself. There was rigidity of the muscles of the neck, and deglutition was difficult. The chest muscles appeared free. The abdomen was tender to touch, with rigidity of the rectus muscle. The Kernig sign was present. The patellar reflex was absent. The hip-joints were extremely painful, and the lower limbs showed a cyanosis and œdema. Owing to the long confinement, the patient had sores. It was apparent that he was suffering from a severe type of anæmia, and a blood examination at this time showed: Erythrocytes, 3,000,000; hæmoglobin, 55 per cent.; leucocytes; 30,000; differential count: neutrophiles, 58 per cent.; lymphocytes, small and large, 7 per cent.; eosinophiles, 35 per cent.

A section of muscle fibres was removed from the lower third of a biceps muscle, and numerous living trichinæ showed in every field. The cerebrospinal fluid or blood was not examined for trichinæ.

During the administration of 0·06 grm. of neosalvarsan, intravenously, he became slightly cyanosed and it was followed by a marked chill. Within forty-eight hours the patient felt less pain than he had for months, and was soon able partially to extend his forearms. Within one week he was in a chair and able to sit in an automobile, and left the hospital August 9, 1915. Fourteen days after intravenous injection he was able to walk with crutches, and three weeks later he discarded his crutches and went on to an uninterrupted recovery.

[1] Abstracted from the *Journ. Amer. Med. Assoc.*, October 7, 1916.

DIARSENOL[1] FOR MALARIA.[2]

By F. C. NEFF.

Case 1.—Mrs. T. and her three children were admitted to the hospital on March 15, 1916. The eldest child, Gertie T., aged 11, had been ill since June, 1915, infected during residence in Oklahoma. Had chills on every third day, and had had quinine treatment without permanent results. On admission to the hospital on March 15 spleen was found greatly enlarged, reaching half-way to the pelvis. A thin smear of the blood showed tertian plasmodia, about one to every eight or ten fields, most half-grown parasites. On March 22 0·2 grm. of diarsenol was given intravenously. No further chills or fever occurred thereafter for twenty-three days. By palpation and radiographs the spleen showed definite reduction in size, and no organisms were found in thick smears of the peripheral blood. On March 29 0·25 grm. diarsenol was given because of the previous small dose administered. Neither injection caused reaction. On April 15 organisms were found in the smear, and on April 18 0·4 grm. diarsenol was given. Since that time the child has gained in weight and been symptom free, the blood sterile, though spleen is still palpable below the costal border.

Case 2.—Jessie T., aged 9, sister of preceding patient, received her infection at the same time, June, 1915; at first had attacks about every fifteen days, later chills appeared every other day. Coming under observation March 15, child appeared well nourished; hæmoglobin 80, spleen two fingers below

[1] Diarsenol is the Canadian preparation of salvarsan.

[2] Abstracted from *Journ. Amer. Med. Assoc.*, October 7, 1916.

ribs, recently had had quinine treatment. No organisms were found in thin smears, temperature was normal for five days preceding administration of diarsenol, 0·15 grm. on March 22, and a second dose of 0·2 grm. on March 29. Child has remained afebrile and the blood sterile until the present date, June 3, 1916. This patient had been actively malarial until entering the hospital, but has showed no symptoms except the enlarged spleen since then. The spleen has receded, but not entirely disappeared.

Case 3.—Josie T., aged 5, sister of preceding patients, had had attacks every week since infection in the summer of 1915, with chills every other day. No results from quinine treatment. On examination, spleen tender and reaching to brim of the pelvis. Chills occurred every other day until March 22, when diarsenol, 0·1 grm., was administered, when no more chills occurred; a second dose of 0·15 grm. was given on March 29. Spleen became diminished in size. Symptoms absent thereafter until April 14, when fever and headache and organisms appeared. April 18 0·2 grm. diarsenol was given with immediate subsidence of all symptoms. The peripheral blood was sterile six weeks later, the spleen reduced in size, but still markedly large.

Case 4.—Maggie W., aged 10, one of five actively malarial sisters, entered the hospital April 15, 1916, suffering since June, 1915, with fever and chills on alternate days, with relapses in spite of quinine treatment. Spleen markedly enlarged, blood contained numerous adult tertian parasites, temperature every third day slightly above normal, diarsenol 0·3 grm., was given on April 18, with subsidence of temperature; peripheral blood sterile until May 6, when organisms were again found in the blood. No further opportunity was given for treatment, as family left the city.

Case 5.—Beatrice W., aged 7, sister of the preceding patient, also has been infected since summer of 1915; has had chills, fever, and enlarged spleen ever since. This child had tertian parasites on admission to hospital April 15, 1916, spleen about twice the normal size. April 16 and 18 temperature rose to 104·5° F., accompanied by chills. Diarsenol, 0·2 grm., was given on April 18, with no further symptoms. The peripheral blood became sterile and patient left hospital. May 6 spleen could be felt two fingers below ribs, malarial organisms abundant, temperature 101° F. As all members of the family were infected and had become indifferent to the disease, they would not give consent to remove the children to the hospital for further treatment.

That there is room for improvement in the treatment of malaria is evident when one observes how resistant the disease often is to permanent cure by the universally administered quinine. Disappearance of chills and fever is frequently taken as evidence of a cure. If the patient feels well he will probably not return for treatment or observation.

A remedy that will cause not only an immediate disappearance of symptoms, but will sterilize the entire blood-stream, reduce permanently the size of the spleen to the normal and reach what has been described as the blocked capillaries of the spleen and other internal organs and the bone marrow, will be of the greatest benefit. From the efforts of great numbers of clinicians to find such a drug, it is doubtful if many men experienced in the treatment of long-standing malarial infection believe that quinine alone can do this.

Soon after the discovery of salvarsan and neosalvarsan experiments were begun with their employment in malaria, based on the fact of the common protozoal nature of the malarial and syphilitic organisms, the arsenobenzol preparations being germicidal for both.

Among the cases reported in the literature in which observation has been extended over a sufficient length of time to be conclusive is one by Captain Reasoner[1] of the Army, who reported a subtertian malarial infection lasting twelve years, during which symptoms were present every month and quinine had been routinely administered. Following the administration of 0·4 grm. salvarsan, the patient gained 8 lb. in weight within thirty days, and there was no return of the malarial symptoms during subsequent observations. Goldthwaite[2] reported one case which did not yield to intramuscular injections of quinine which promptly recovered following one injection of salvarsan. Reed[3] had one patient who had had three relapses under quinine treatment, but remained cured at the end of a year following a single dose of salvarsan. Baermann reports four patients with tertian malaria treated with salvarsan who were free of the organisms at the end of two months. Werner and Iversen and Tuschinsky observed similar results from neosalvarsan to those observed with the older preparation of arsenic when used in corresponding doses.

Comment.

Two of the author's patients received only one injection of the drug. This was insufficient, as organisms again appeared at the end of three weeks. In the ten-year-old child one dose of 0·3 grm. was given, and in the seven-year-old 0·2 grm. was given. No opportunity was permitted for further treatment, as the parents refused to bring the children back to the hospital.

Three of the patients received from two to four injections, and at one interval of three weeks organisms were again found in two children, following which the only large dose was given. These three children have since gained markedly in weight and have been continuously well. On June 3, 1916 at the last observation, the children were still free of organisms six weeks following the last dose of the drug. All these patients had had quinine for eight months before entering the hospital. No quinine was given thereafter. The spleens have never reached normal size, but have become from

[1] Reasoner: *Military Surgeon*, 1912, xxix, p. 294.
[2] Goldthwaite, Lieut. R. H.: "Salvarsan and Malaria, *Military Surgeon*, 1912, xxxi, p. 455.
[3] Reed, E. U.: *U.S. Nav. Bull.*, 1913, vii, p. 255.

one-half to two-thirds smaller. Because of the still definitely enlarged spleens, we do not feel that the patients can be said to be permanently cured.

Only one preparation of arsenic, diarsenol, was used, as at the time we were unable to obtain salvarsan. The dosage was probably too small, but we hesitated to employ larger doses because of the possibility of toxicity from their use. However, no reactions occurred, nor any manifestation which would contraindicate the employment of such a remedy. Whether our patients would have done better on salvarsan or neosalvarsan is impossible to say.

From such a limited number of cases and a short period of observation, one cannot draw any conclusions as to the permanent curability of chronic malaria with diarsenol. Against its use in children with malaria is the somewhat greater immediate cost, the technical difficulties of administration, the fear of untoward effects, the apparent necessity for repeated doses, and in our cases the persistence of an enlarged spleen in spite of such doses as we used. In its favour are the rapid cessation of general symptoms, the sterilization of the peripheral blood, the marked gain in weight and in health. There is a necessity for a remedy which is a parasiticide for strains of malarial organisms that are quinine fast or are not accessible to quinine. What might be accomplished with larger doses over a longer period of time, using quinine as an adjuvant, would be of interest in these cases.

A NEW ULCERATIVE DERMATO-MYCOSIS.[1]

By Aldo Castellani.

Anglo-Serbian Military Hospital, Soloriotissa.

In Ceylon a peculiar ulcerative condition is clinically very characteristic. The disease would appear to be present also in the Federated Malay States. A case of the same disease occurred in the Balkans.

Etiology.

As a rule no hyphomycetic elements are seen microscopically in scrapings from the ulcers and contents of the nodules. If the material, however, is inoculated in glucose-agar tubes, small, yellowish, amber-coloured colonies appear four to eight days after inoculation; they enlarge fairly rapidly, become hemispheric, and often coalesce in a knotty mass. At times the colonies may not fuse together; each colony then remains separate, reaches a large size, and occasionally presents peculiar radiating furrows as seen in certain species of trichophytons. In many cases, when the material has been collected from ulcerated lesions, the fungus grows in symbiosis with a coccus, and it may be somewhat difficult to separate the two organisms. When the inoculations have been made from lesions not yet ulcerated, the fungus only is present. The disease has been easily reproduced in two coolies (who volunteered) by injecting cultures of the isolated fungus. Cultures used for such experiments must be recent, as old cultures apparently lose their pathogenicity. The experiments on this subject will be reported in detail later.

The Fungus.

Professor Pinoy reports:—

"The fungus belongs to the hyphomycetes or *Fungi imperfecti*, and is of somewhat difficult classification. I propose to include it in the genus *Accladium*, at least temporarily, and call it *Accladium castellanii*. The microscopic appearance on culture media (Sabouraud's agar, carrot) recalls somewhat the appearance of *Cladosporium herbarium*, with the difference that the colonies are whitish and amber yellow instead of being greenish-black. The growth consists of many small roundish masses which later on often coalesce, covered by spiculated formations consisting of erect, straight filaments parallel to each other or at times interlacing. These filaments are approximately 2 microns in diameter, and carry laterally pseudoconidia of variable shape, cylindriform, piriform, or spherical, attenuated in size at their points of insertion. Most of these pseudoconidia are 4 microns long, with a breadth of 3 microns. This type of fructification recalls the type *Accladium* described by Bodin in some species of the genus *Trichophyton*. These pseudoconidia become detached and then develop by sprouting, and mycelial filaments are formed. Certain filaments produce spherical chlamydospores arranged in small strings as found in certain fungi of the genus *Fusarium*. These small chains of chlamydospores are very frequently terminal, the dimensions being variable—8 to 10 microns."

Symptoms.

In a well-marked case ulcers are seen practically all over the body, though on the face, scalp, palms, and soles they are in small numbers or altogether absent. The ulcers are generally sharply defined, roundish or oval, with red granulating fundus. In certain cases there may be abundant purulent secretion, and the ulcers are often covered by thick yellow crusts. Gummata-like nodules and furuncle-like lesions may also be observed. Some of the superficial lymphatic glands are often enlarged. The lesions are not as a rule very painful, and there is little or no itching. The general condition of the patient is not seriously affected for a long time, but he often complains of weakness, general discomfort, and is unfit to attend to his work.

The course of the disease is long, and if left untreated there is apparently not much tendency to spontaneous cure.

Diagnosis.

Most of the patients came with the diagnosis of syphilis, but in none of them except one was there a history pointing to that infection, and in two of the cases in which a Wassermann test was carried

[1] Abstracted from the *British Medical Journal*, October 7, 1916.

out the result was negative. Moreover, scrapings from the ulcers never showed spirochætes, and salvarsan and mercury have no beneficial effect on the condition.

Treatment.

Potassium iodide acts fairly well. It should be given in full doses, gr. xx, three or four times daily. The drug appears to act better if the patient is given a salt-free diet, as in other dermato-mycoses. Mercury and arsenic have no beneficial effect on the course of the malady. As regards local treatment, it is sufficient to keep the ulcers clean by dressing them with weak mercury perchloride lotion. Ointments are badly borne in most cases.

A NOTE ON WEIL'S DISEASE (*SPIROCHÆTOSIS ICTERO-HÆMORRHAGICA*) AS IT HAS OCCURRED IN THE ARMY IN FLANDERS.[1]

By A. Stokes and J. A. Ryle.

Weil, in 1886, first described the disease, characterized by jaundice, pyrexia, hæmorrhages, and the fact that it was apparently infectious, as the cases occurred either in widespread epidemics or localized groups of cases, or sometimes all the members of a single family would be affected at the same time. In the British Isles the epidemic form is rare, but the family type of infectious jaundice is well known. In the western part of Japan there prevails an epidemic and endemic disease characterized by conjunctival congestion, muscular pains, fever, jaundice, hæmorrhagic diathesis, and albuminuria, which is known as Weil's disease, or febrile jaundice.

Etiology.

In 1914 Inada and Ito reported the discovery of a spirochæte in the liver of a guinea-pig which had been injected with the blood of a patient who was suffering from Weil's disease. In 1915 these authors came to the conclusion that this spirochæte was the cause of Weil's disease, and later they found that the blood of patients recovering from Weil's disease contained protective substances against the spirochæte they had found. Further, they showed that when they injected the blood of patients with Weil's disease during the first five days of the disease into the peritoneum of a guinea-pig, the animal developed albuminuria, pyrexia, and jaundice, and they were able to show the spirochætes in the liver and blood of the animal in large numbers. They were able to pass the infection from animal to animal, and in one strain they had reached fifty generations.

At some period after the tenth day the spirochætes appear in the urine, and they have been able to demonstrate them both by dark-ground illumination and by animal inoculation. The appearance of the spirochætes in the urine is a consequence of the appearance of the immune substance in the blood. They have been able to find the spirochætes in the urine as late as the thirtieth day.

Mode of Infection.—Weil believed that the infection was through the alimentary canal. In Japan the disease sometimes begins with a local swelling of the lymph glands, and the disease can be communicated to animals by applying infective material to the uninjured skin; there is a possibility of the infection occurring through the skin exposed to infective material. The disease was frequent in men working in a certain part of a coal mine, and when the accumulated water was pumped out there were no further cases in that part of the mine. There are more cases in wet mines than in dry mines, and men working on the surface did not contract the disease. Though this does not show that the infection is necessarily through the skin, it makes it worth considering and is important from the point of view of soldiers working in the trenches.

General Clinical Picture of the Disease in the Cases Reported.

Our attention was first called to the disease by a fatal case of jaundice which was under Captain Flood, R.A.M.C. He has given us permission to mention the case.

The man was admitted with a temperature of 105° and very deep jaundice. On the evening of admission there was severe epistaxis which necessitated the plugging of the nares. Hæmorrhagic diarrhœa set in, and on the third day after admission the trunk and limbs were covered with hæmorrhagic petechiæ; death followed on the next day. At the *post-mortem* examination, by Captain Marshall, R.A.M.C., multiple hæmorrhages in the pleuræ, pericardium, and peritoneum were the most striking thing. The bile passages were free and the duodenum was normal.

About fifteen cases of Weil's disease have now come to notice, and Inada and Ito confirm the findings of the discoverers. In two cases infected animals have shown the characteristic pathological changes and we have been able to demonstrate the spirochætes.

The earliest cases that have come under our notice have been one on the fifth day of illness and four on the sixth day; the latest case was admitted on the tenth day. With the exception of one case all the men at the time of the onset of the disease were, or had recently been, employed in the trenches. In four instances more than one case occurred in the same unit. They gave a uniform history of onset, and all the men knew accurately the day on which they first felt ill; this indicates the acuteness of the inception of the symptoms.

The characteristic symptoms have been generalized pains in the head and lower limbs. The patients complain of weakness, and of feeling as if they had been beaten all over, and they are reluctant to move

[1] Abstracted from the *British Medical Journal*, September 23, 1916.

their arms or legs. They frequently complain of severe pain in the eyes; some have complained of vague, unlocalized abdominal pain. In the majority the pains appear to be muscular; the patient is unwilling to have his arm extended for the purpose of taking blood. In one case the pain was apparently most felt in the tibiæ. All the patients on admission were very weak, and complained of the early feeling of unsteadiness and inability to stand. One man was found in a fainting condition in the latrine, and another fainted in the trenches and was unable to walk.

Most of the men say that they have been vomiting repeatedly, and in a few cases that they have thrown up blood. Some of the patients say that they have had nose bleeding, but this is not very common.

Alimentary System.—The tongue is very dry, brown, and fissured. Hæmorrhagic herpes labialis was seen in five cases. Abdominal examination revealed enlargement of the liver in only one case, and in no instance was there enlargement of the spleen. All the patients were constipated. The stools were of normal colour and bulk. In some of the cases there was blood in the dejecta. Vomiting in the early stages occurred in every case. Diarrhœa was not noted in any case.

Respiratory System.—There was no evidence of respiratory complications, but in the acute stages a little blood-stained sputum was noted.

Excretory System.—Two cases had difficulty in micturition for which there was no obvious cause. The urine contained bile, and there was a slight albuminuria during the pyrexial period in all cases.

Nervous System.—Sleeplessness due to the severe pains was common in the early stages; in the more grave cases torpor was noted, and in one fatal case this progressed to the "typhoid state," with rambling delirium and muscular tremors. Pruritus due to the jaundice occurred in three cases.

Lymphatic System.—All cases showed enlarged glands. The pectoral group of the axillary glands were most often felt as discrete shoddy nodes on the thoracic wall of the axilla. Glands in the neck and groin were also felt. These were sometimes tender on pressure. The spleen was never palpable, and percussion did not show an enlarged area of dulness.

The Skin.—Varying degrees of jaundice were seen. It was usually of a lemon or orange tint, and never approached the greenish colour of obstructive jaundice. The colour rapidly increased and as rapidly decreased as convalescence began. The degree of jaundice was not constant for two consecutive days, and was always most striking in the severe cases. The date of appearance of the jaundice as far as we know is on the fourth day. Petechial hæmorrhages only occurred in one fatal case.

The Fever.—All cases showed an irregular pyrexia descending by lysis. Subnormal temperature was common in early convalescence, and also preceded death in one case. A few cases presenting all these symptoms with the exception of jaundice were seen, but in the absence of the jaundice they were not investigated.

Prognosis.

From the cases that have b en observed it would appear that there are both mild and very severe types of Weil's disease. The jaundice, weakness, and pain in some of the cases have been slight and not of long duration. On the other hand, there have been three deaths, and at least two other cases have been very ill.

Experimental.

Inada and Ido injected the blood of patients with Weil's disease into guinea-pigs, and of seventeen inoculations had thirteen positive results. We have had only two positive results in animals from the blood of patients. In each case the guinea-pig was found to have the spirochætes in large numbers in the liver and blood.

The infected animals were killed and a *post-mortem* examination done immediately. Both showed the typical pathological changes. To quote from the Japanese workers:—

"The lungs present small and large hæmorrhagic spots, like the wings of a mottled butterfly. This change is one of the most important in the diagnosis of the disease."

This description of the lungs is very good and they resemble nothing more than a very gaudy butterfly. The intestines of the two animals both showed the hæmorrhages in the intestines. One of the animals had very deep jaundice, in the other there was no evidence of jaundice. Emulsions of the liver were made and examined with dark-ground illumination and very numerous spirochætes were found.

We have not yet attempted to cultivate the spirochætes, but hope shortly to do so. We have examined the urine of all the cases up to date, but have not so far been able to find the spirochætes in them. This may be on account of the comparatively early date on which the patients are evacuated to the base. The experiments of infecting guinea-pigs with the urine of the patients are not yet complete. The Japanese authors state that after the fourteenth day the spirochætes appear in the urine of the patient, and they have succeeded in five out of fifteen experiments in infecting animals with the urine. The examination of the blood of the patient for spirochætes was done in six cases, and in only one were they easily found. In this case the blood was citrated and allowed to stand, and then the plasma centrifugalized and examined with the dark-ground stage and also by staining; the spirochætes were seen moving and also stained, and the guinea-pig infected with this blood gave a positive result. In another case a single spirochæte was found with the dark-ground illumination, but, as only one was found, we are not very confident that it was a real organism. Reinoculation was successful from animal to animal.

Conclusion.

In conclusion, we think that the experimental facts which we have to offer are meagre, but are sufficient to show that the cause of epidemic jaundice (*Spirochætosis icterohæmorrhagica*) in Japan and in Flanders is identical.

Notes and News.

MADAGASCAR.

Blackwater fever cases occur in Madagascar. A native taken ill on May 2 died on May 8, 1916.

New Year's Festival in Madagascar.

Mrs. Kestell-Cornish, writing in the *Madagascar Church Mission Association Magazine* for October, 1916, describes the New Year Festival of twenty-four years ago—that is, three years before the French annexed the island:—

"The Malagasy New Year's Day, called *Fandroana*, or Bathing, was one of, if not *the* greatest day in the year. As the Festival drew near everyone of rank prepared a present to give the Queen. I remember a man coming to us and begging us to let him buy something of ours to give to the Queen, so I let him have a zouave jacket of mine worked in silver, and he went away delighted. Several years later I saw my jacket in the museum with other articles of dress belonging to the exiled Queen. On New Year's Eve a number of cattle were brought into the town in the morning and driven up to the Palace to be blessed by the Queen, and they were then distributed among the chief people in the towns and various villages. A crowd waited in the streets for the return of the bullocks, and if one could catch one he could keep it. Some seized and held on to the tails of the poor frightened animals, others threw their lamba in front of them, and they would even throw themselves in front of a bullock going at full speed and trip it up by catching it by the leg! It was not pleasant to walk in the town on that day with all the frightened bullocks rushing about in the narrow roads, where there was hardly room to pass. Towards evening the Festival begins with the lighting of fires on all the hills, and it was quite a pretty sight to watch these beacon lights appearing in the gathering darkness.

"Now I am going to take you with me to the Palace. Our invitation is for 7 p.m., so a little before the time we pick our way along the dark and roughly paved road which leads to the Palace gate. The courtyard is full of people, and unfortunate cattle tied up ready to be slaughtered on the morrow. We enter a large room, which is quite bare, except for the Queen's throne, which stands at one end, for no one is allowed a chair or seat of any sort; the Prime Minister even has to sit on one of the steps of the throne. The Queen and Prime Minister and the whole Court are there, and the chiefs and big people of tribes and villages from all parts of the country. A long extemporary prayer is said by the Court Chaplain, and a hymn is sung, and then the Queen mounts her throne and receives gifts of money from the heads of all the various tribes, and many speeches are made. The Prime Minister, a little man in a uniform of white silk with gold facings, makes a long and animated speech, marching backwards and forwards, and waving his sword, and every now and then appealing to the people, 'Is not that so?' They agree with shouts of 'Izay'—'that is so,' and the crowd outside take up the cry, and you hear it echoed by other voices in the far distance. Meanwhile several men have been heating water over a fire of smokeless wood in the middle of the room. This is the water for the Queen's bath, and presently it is taken behind a screen of curtains, which are held up by women, and the Queen is then escorted to this curious bath-room! A large box containing the Queen's clothes is then opened, and the Prime Minister hands out the garments to the women. The Queen presently appears dressed in red velvet with a long train beautifully embroidered in gold. The Prime Minister leads her to the throne. Now comes a very interesting and pretty part of the ceremony. The Queen rises from her throne holding a sort of long-handled spoon with a perforated cover, containing water from the bath. She walks slowly to the door sprinkling the people with the water as she passes, and at the large open door she stands and sprinkles the crowd outside. This is the sign that the New Year has begun, and bang goes a cannon in the Palace courtyard, and then another, and another, in all parts of the city, proclaiming that the New Year has begun. Meanwhile the cooks have been busy preparing rice. We, with the other Europeans, and a crowd of Malagasy, who are all seated on the floor, have a plate with beef, honey, and last year's rice put before us. We manage to eat a few spoonfuls of rice and honey, but the dried-up shreds of beef are impossible! The ceremony of the 'Fandroana' is over, and we are glad to get up from our cramped position and make our way home. The next day there was a great slaughter of oxen, and for days no work was done, as the people gave themselves over to feasting, and we had such a number of pieces of beef sent us that we did not know what to do with it all. The Festival of the 'Fandroana' has passed away, together with the Queen and her Court and clever old Prime Minister, and we now keep the *Bonne Année* and July 14, and cry *Vive la France!*" This is an interesting bit of history which deserves to be told and recorded.

Oil-bearing Nuts in the Philippines.—An oil expressed from the Calumpang nut met with in the Philippines is found to approximate olive oil in its properties; it is non-irritating and non-toxic, and for culinary purposes seems to suit admirably.

Another oil-bearing nut, known locally as the "Balucanag"—*Chisochiton cumingianus* (Harms)—has properties resembling castor oil. It is much milder than castor oil, however; five parts of the nut oil (locally known as "cato") correspond in purgative properties to one of castor oil. Cato is being used in soap production at present.

Original Communication.

SUGGESTIONS FOR THE INSTITUTION OF RURAL ANTI-MOSQUITO MEASURES IN ANTIGUA.

By W. M. McDonald, M.R.C.S.
Medical Officer of Health, St. John's, Antigua.

The question of prevention of malarial and filarial disease in Antigua and the other Leeward Islands has not hitherto received the attention which it deserves. This is very largely due to the apathy of the public in this matter, the prevailing idea among the general public being that malarial and filarial diseases have always existed in these islands, and that we have got on very well in spite of them, and, further, that if the prevention of these diseases is dependent on destruction of mosquitoes that the task of preventing them is an impossible one, and therefore should not be attempted.

It has not hitherto been generally recognized that the prevention of disease pays and is to the economic advantage of the individual, the employer of labour, and of the Government. Modern life is in a large measure competitive, and those weakened by sickness cannot hope to compete successfully against the well.

The prosperity of the managers and estate owners is to a great degree dependent on the health and vitality of the labouring population. In this connection, I believe that if it were possible to take a given area, to carry out in it efficient anti-mosquito measures, and to record the results of increased efficiency among the labouring population, together with the cost of the measures adopted, that such an experiment, provided that the results were encouraging, as I am sure that would be, would induce the co-operation of employers of labour throughout the island in a comprehensive scheme of mosquito destruction.

I beg to recommend, therefore, that an experimental area be established, in which experiments may be carried out in the practical application of various anti-mosquito measures, with a view to ascertaining the relative cost and efficiency of those measures. Such an area being established under Government control should be regarded as bearing the same relation to prevention of disease among labourers, as the Agricultural Experimental Station does to the prevention of disease among canes.

A careful record would be kept of (*a*) the relative cost and efficiency of the various anti-mosquito measures; (*b*) the return of malarial fever in this area.

The principal objects, however, of such an experiment would be to (*a*) provide practical knowledge of the working of various anti-mosquito measures; (*b*) to determine which of these measures in practice combine a maximum of efficiency with a minimum of cost; (*c*) to determine whether the cost of the more expensive measures is, in regard to financial limitations, warranted by the results of these measures; (*d*) to determine whether adoption of the least expensive measures is likely to prove of any avail even if we are deterred by financial limitations from carrying out the more expensive measures.

Rural anti-malarial measures vary greatly in their nature and their cost. Beginning at the bottom of the ladder, they may be grouped as follows:—

(*a*) Utilization of the natural enemies of the mosquito, such as ducks, millions, and heavy winds.

(*b*) Oiling of pools, ditches, and streams.

(*c*) Drainage.

(*d*) Grading and paving of such drains as cannot otherwise be effectually treated.

In regard to (*a*), this measure has to be applied with a due regard to the many methods by which mosquitoes escape from their natural enemies. The wholesale stocking of ponds, &c., with millions is a good measure, but it is totally inadequate because it is a half measure. If we take a large open pond without millions, we should find comparatively few mosquito larvæ in the open wind-swept part of the pond. The mosquitoes naturally gravitate to the margin of the pond, and lay their eggs in the parts which provide shelter from sun and wind. When the eggs develop into larvæ these follow the same conditions.

It follows, therefore, that the more grass, vegetation, and protection that exists round the margin of the pond the greater will be the number of mosquitoes breeding in it. When we stock the pond with millions, these fish devour all the larvæ that they can reach, but the fact remains that the millions do not or cannot reach the larvæ which shelter among grass and aquatic plants round the margin of the pond.

I have personally investigated many ponds in which I found anopheles larvæ, although I knew that these ponds had been stocked with millions. At first I thought it possible that the millions had died or been destroyed. I therefore personally restocked these ponds with millions which I had obtained from the Botanic Station.

Subsequent investigation revealed no diminution in the number of larvæ, and on close observation I was able to discern the millions in great numbers in the open water of the pond, but it was apparent that the fish were not able to reach the larvæ, which were sheltering also in great numbers among the grass and vegetation round the edges of the pond. It follows, therefore, that the only effective method of destroying the larvæ in the ponds throughout the island is to keep the margin of these ponds clear of grass and aquatic plants and to cut down all trees and superfluous vegetation on the banks surrounding the pond, as well as stocking the pond with fish. This should not prove a very expensive measure. By experimenting we should be able to determine the cost of clearing a pond and the approximate cost of keeping it clear.

Ducks are stated to be just as effective as fish in destroying larvæ. The keeping of ducks, therefore, should be encouraged on estates, and wild ducks should be protected in swampy regions. Experiments have recently been carried out and

the results reported in the JOURNAL OF TROPICAL MEDICINE AND HYGIENE, proving that the part played by ducks in the destruction of mosquitoes rests on the established facts and not merely on hearsay.

(*b*) Oiling is likely to prove the most practical method of dealing with the majority of breeding places throughout the country.

Oil may be applied in several ways.

(1) To small pools in the neighbourhood of residences with an ordinary watering-can. For this purpose a light oil, such as kerosene, is best.

(2) By a knapsack sprayer with adjustable nozzle. Such a sprayer is useful for many purposes. It may be used with light oil or heavy oils. By its use oil may be placed from 1 ft. to 20 ft. from the operator. This method is suitable to road trenches which usually form prolific breeding places after heavy rains.

The country could be divided into districts, and for each district there should be someone appointed, whose duty it should be to ride round his district once a week and to apply oil to all trenches holding water. The knapsack sprayer holds any quantity of oil up to five gallons, and is carried, as its name implies, like a knapsack on the shoulders, and can therefore be carried easily by a man on horseback. This apparatus can also be used for oiling roadside pools and marshy places. But for marshy land a relatively large quantity of oil is required, as the oil does not spread readily among weeds.

(3) Spraying machines with hand pumps are used in small flat-bottomed boats for oiling sluggish streams where such bodies of water cannot be more economically controlled by drainage, cleaning, or fish control. These would be suitable for such places as Tomlinson's Flash, North Sound Stream, Bendal's Stream, &c. The cost would have to be ascertained. The initial cost is not excessive. The cost of oiling would, I think, work out roughly at £6 per mile of water per annum. By experimenting on one stream we could determine whether the result is worth the money spent.

(4) Oil drips can be considered as an alternative method for continuous application to streams or ditches of moving water. There are many kinds of drips. A cheap and easily made drip can be made from an ordinary kerosene tin. A wad of loose tow is then wrapped round the head of the nail. The nail is then pushed through the hole in the can, which is filled with crude oil and then locked.

The can is then suspended on a stand over the ditch or stream. The flow of oil is regulated by pulling the point of the nail downwards or pushing it upwards. These drips can be left in place for two or three days each week at stated intervals along the stream. Experiments would be necessary to determine the exact intervals, the amount of oil used, and the relative cost of the measure, but it is possible that it might prove more economical than (3).

(5) Small collections of water can be controlled by throwing into them a small bundle of cotton waste or tow dipped in crude oil.

This is the cheapest of all methods. Experiments would be necessary to determine if this method would be available in dealing also with larger collections of water.

(*c*) Drainage is applicable to marshy and swampy land. It requires very careful application. I have known of cases in which the drainage of marshy land into a field resulted in the field becoming just as marshy as the land which had previously been drained. Such work is obviously futile. Marshy land near the sea can generally be drained into the sea, that near a stream can be drained into the stream, but low-lying land which is not near either a stream or the sea presents many difficulties in treatment. Generally speaking, the most effective method of dealing with such land is to drain it so as to collect all the water into a pond at the lowest point, which pond can then be dealt with as a single item.

(*d*) Grading is applicable to all ditches and trenches to ensure as far as possible a free flow of water.

Paving is expensive as an initial measure, but has the advantage that it requires small cost of maintenance; it is suitable for ditches cut for drainage purposes, as it ensures that these ditches do not become blocked.

Other purposes for which it might be of use would be apparent only in the field of operation.

The relative cost of efficiency of these measures can only be ascertained by practical experimental work in the field, but in view of the benefits which would result to the individual, to the landowners, to the Government, and to the community generally by the suppression or even the reduction of malarial and filarial disease in the colony, I would most respectfully represent that the public money could not be better spent than in the establishment of an experimental area for the carrying out of anti-malarial measures having in view the eventual institution of an anti-malarial campaign throughout the island. I venture to represent further that the present moment, when the interest of the managers and labourers has been attracted to the economic value of eradication of disease by the work done in the Ankylostomiasis Campaign, is an opportune time for enlisting the co-operation of the public in anti-malarial work.

MESOPOTAMIA.—In Parliament the condition of the troops in Mesopotamia is claiming attention. When General Moore assumed command of the forces on August 28, he states that the difficulties which had hitherto hindered operations there were being overcome. In reply to questions, the Financial Secretary to the Government stated that the facilities of transport in the Euphrates had been increased by 64 per cent., and would shortly amount to 100 per cent., and that there is sufficient transport available to take up all medical stores required. It is also stated that dentists and dental wants are now amply supplied.

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THE JOURNAL OF

Tropical Medicine and Hygiene

NOVEMBER 15, 1916.

THE QUESTION OF PASSING ARMY UNFITS FOR THE TROPICS.

(*Continued from p.* 252.)

In the first part of this article on this subject the heart formed the main organ dealt with in the choice or refusal of men for tropical life. Other organs, however, are not to be neglected. The condition of the respiratory organs, of course, requires consideration, and lesions of the lungs of the tubercular type are perhaps the most easily decided. Acute trouble of the kind presents no difficulty; it is one which must lead to rejection, and even old damage to the lung in which a "cure" has been effected may be placed in the same category. Old pleuritic troubles, especially when occurring in childhood or later in youths need not be seriously considered, for, in spite of all that is said, the author considers that the majority of persons who are accredited with having had pleurisy are not tubercular. Pleurisy is really a "wide word." A pneumonia is always attended by pleurisy to some degree, but that does not imply tubercle. It is the subject of asthma, hay fever, &c., which causes most anxiety as to fitness, for no one can say but that an asthmatical person in this country may get rid of his asthma in the Tropics, whether the climate is moist or dry, or whether the residence is to be on high or low ground. There is no knowledge available whereby this subject can be decided upon.

Kidney troubles when gross present no difficulty in arriving at a definite conclusion, but albuminuria does not always imply kidney trouble. The young man who has had a cold bath in wintry weather who comes up for examination before 12 noon may have albumin in the urine, and often does, without there being any suggestion of ill-health. The insurance offices—so selective in their choice—consider it a condition sufficient for them to impose an extra premium or rejection. But medical men are not to be enslaved by the opinions and methods of insurance companies in such a matter. Tell the lad not to take a cold bath but a sponge all over with hot water instead, and the albumin disappears, perhaps, and most probably, never to return. Even the history given of a calculus or series of calculi having been passed from the kidney need not necessarily debar a man from going to the Tropics if he is over 25 years of age and there has been nothing wrong for a year or two. It depends also on the nature of the calculus; neither phosphaturia nor oxaluria is prohibitive, but uric acid is more serious and may be taken as a good reason for refusing a candidate. Varicose veins and varicocele, unless very advanced, need not be too seriously taken, but when advanced they should be cured, which at most would only mean a delay of a month before starting for abroad.

Since writing the first part of the article on the above subject (see Journal for November 1, 1916, pp. 251-2) the following case has been brought to the author's notice:—

A young man of 21, sent by a firm of merchants, presented himself for examination to go abroad. He was suffering from a somewhat dilated heart, due to swimming to some excess; there was no valvular disease, and he was well otherwise. After carefully warning the candidate as to taking care of himself he was passed with reserve, but as the firm had repeatedly said not to be too particular the hesitation was overcome. The young man proceeded to the Tropics to a rubber plantation, and after being there fourteen days he felt upset after a long walk in the heat of the day, and applied

to the doctor. When the doctor examined the heart he found an excited heart and circulation, and after consultation with a neighbouring doctor and advised, "as the man had not half a heart, and if he got malaria he would succumb, &c.," the man was sent home there and then, to the chagrin and monetary loss of the firm which paid for his going out. The doctor at home who passed him with reserve gets the blame of course, and is dealt with accordingly.

Those of us who are doing the work of examining candidates about to proceed to the Tropics who have been rejected or discharged by the Army authorities, have an unhappy time, as the directors of the firms state "not to be too particular just now," yet pitch the whole blame on the doctor when their advice is taken and anything goes wrong. The same thing is happening in the Army. The orders are to medical men not to be too particular, get the men in, and they do, and the State suffers in pocket by having a hospital patient instead of a soldier, and the efficiency of the Army suffers. In neither Army nor civil life should there be any patched-up passing. The trouble is bound to come, and when it does, it is the doctor that suffers in both position and reputation.

One hears opinions and knows of attempts to lay down hard-and-fast rules as to the kind of man who should be sent to the Tropics. "A man should have his head well screwed on" (with emphasis on the screwed) is a common statement, which, emanating from a doctor, is not calculated to help one much in deciding the physical condition of candidates for tropical life. If it means a man of sound sense, which it is generally taken to be, then it is not the doctor but the employer who should have made it his concern to inquire into the business or other capability of the candidate sent for examination.

Another man writes: "You set a hard task when you ask what are the men suitable for the Tropics. There is one type to which the answer is easy, the grumpy, nervous person who, whatever his physique, should never be sent out." The same writer says: "But not any hint of what a man is going to turn out when exposed to malaria can be gathered from his physique, and examiners of candidates in England would be more than human if they could do so. Many men of inferior physique, some indeed invalids, are unaffected by malaria. It is all a lottery.".

This writer knows his business, and speaks from experience and with common sense, that is the sense that comes from experience, and nothing else is of much use when dealing with a subject of this kiud.

J. C.

(To be continued.)

THE European population of Rhodesia amounts to 32,000, yet the total trade of the country amounted to about £8,000,000 during the twelve months preceding the War, that is, from July, 1913, to July, 1914.

Annotation.

The Origin of Hypernephroma of the Kidney.—Fraser (*Surg., Gyn. and Obstet.*, June, 1916) reports on a study of 34 cases. In one evidence shows conclusively that the tumour originated in an accessory nest of cortical adrenal cells. The patient was a female with pronounced male characteristics. A second tumour arose from multiple nests of adrenal cortical cells lying in or around the capsule of the kidney. In the remaining 32 instances of so-called renal hypernephromata, however, the morphological evidence indicates that the tumours were derived from renal adenomata. In other words, it would appear that the majority of cases of hypernephromata are misnamed and should be classified as nephromata, the term hypernephroma being reserved for malignant tumours arising from cortical adrenal cells.

OPENING OF THE FIRST RAILWAY IN PERSIA.—It will be an astonishment to most people that up to the present no railways exist in Persia. Recently the Russians have carried a railway line from the Russian frontier to Tabriz, the chief commercial city of Persia. Tabriz has a population of some 200,000 people, and is famed for its carpets, being in fact the chief carpet market of the world. A large trade is also carried on in cotton, dried fruits, tragacanth, and other important drugs. No doubt the railway will soon be carried to Teheran and hence to Beluchistan, where it will join up with India railways. Already the Indo-European telegraph system traverses Persia, and the railway has been built along the course followed by the telegraph line.

NIAGARA WIRE ROPEWAY.—A passenger cableway has recently been built across the Niagara Whirlpool. The passenger car is suspended from a running gear which travels on six parallel track cables of 1 in. crucible steel rope; it can carry twenty-four passengers sitting, and standing-room for twenty-two more. The breaking of one of the cables would not imperil the safety of the car.

TYPHOID inoculations amongst troops in France show that up to August 25, 1916, 903 cases with 47 deaths occurred amongst the inoculated; whilst 508 cases with 119 deaths occurred amongst the non-inoculated.

Paratyphoid cases numbered 2,118, of which 1,968 and 29 deaths occurred amongst the inoculated, and 150 cases with 7 deaths occurred amongst the non-inoculated.

THE Grand Canal of China is nearly 1,000 miles in length. Commenced in the sixth century B.C., it was completed in 1289 A.D.

Abstracts.

LIFE-HISTORY OF THE MENINGOCOCCUS AND OF OTHER BACTERIA.[1]

By J. G. Adami, F.R.S.

There are in every science certain admitted facts which do not fit in with current teaching. It is by a study of these real or apparent exceptions to the rule that advance is most surely accomplished.

Enteric fever is an instance. If in this year of grace there is any bacillus that has firmly established itself as a pathogenic agent it is the *Bacillus typhosus*. A *stock culture*, when killed, will cause immunity; *when living, it will not cause the disease.*

Or take *B. suipestifer*. Hog cholera is set up by a filterable virus; if the blood serum of an affected hog be filtered through a "B" or even an "F" Chamberland filter, the filtrate will set up the disease in swine not previously affected by the disease. Note the paradox: The bacillus is constantly found in the intestines and in connexion with the intestinal lesions; it will not reproduce the disease, but this can be reproduced by an agent which will pass through filters which are impervious to forms as large as are bacilli.

And Wolbach,[2] in his valuable review of the filterable viruses, notes two other diseases—namely, distemper in dogs and scarlet fever in man—in which there is a similar constant presence of definite bacteria, with satisfactory evidence of filterable viruses as the essential causative agents. The observations of the last two or three years appear to add typhus fever to this category.

How is it possible to harmonize these apparently contradictory observations? Here the paper now published by Hort and Caulfeild upon cerebrospinal fever and the meningococcus[3] is not merely suggestive, but, I am inclined to think, is the beginning of a revolution in our conception of the life-history of pathogenic bacteria; nay, it may in years to come be regarded as one of the classics of bacteriological literature.

That Weichselbaum's meningococcus is intimately associated with this disease is as well established as that *B. typhosus* is pathognomonic of enteric fever. But we cannot by injecting laboratory cultures of the meningococcus reproduce the disease. To this extent, therefore, the meningococcus comes into the same category as the *B. typhosus* and the *B. suipestifer*.

But it is a notable advance; to show (1) that while cultures of meningococci obtained from the cerebrospinal fluid of patients do not reproduce the disease, that same fluid contains a filterable virus, a virus capable of passing through so fine a biscuit porcelain filter as the "Chamberland F"; (2) that unlike the meningococcus this virus inoculated into monkeys sets up an infectious process—namely, where it does not cause death within a few days it induces a fever which may continue for five weeks and more—a general disorder without localized inflammation of the meninges; and (3) they are able to cultivate this virus, obtaining, as did Rout and Nocard with the "ultra-microscopic" organism of pleuro-pneumonia of cattle, an evident clouding of fluid media, and after a series of passages outside the body they have been able to inoculate monkeys, induce the characteristic prolonged fever, and from animals so inoculated have regained the filterable virus.

These are very remarkable results. They open, it appears to me, a new field for research into the bacteriology of disease. It is true that these observers have not reproduced cerebrospinal fever in the inoculated animals; they have, however, set up a definitely infectious disorder with fever, accomplishing more than is obtainable with pure cultures of the meningococcus.

What is the meaning of this association of meningococcus and filterable virus? Previous workers with diseases belonging to this group have at most suggested a symbiosis; that the one, the filterable virus, prepares the way for the growth of the bacterial species. Hort suggests, and believes that he has evidence supporting the suggestion, that filterable virus and coccus are two phases in the life-history of one organism.

Have we all these decades been wrong in our faith that bacteria are the simplest of all living forms of life, possessed of asexual multiplication by fission only? (Sporulation as exhibited by some species is, it may be noted, not a mode of multiplication, but of tiding the race over evil days.) May there not be intercalated other phases in the life-history? Not a single tubercle bacillus might be detectable in sections from a caseous tubercle, and yet inoculate some of the caseous material into a guinea-pig, and disseminated tuberculosis results. Here is no question of spores, as generally understood. Heat the material to 80° C. for an hour, and it is rendered innocuous. If we dealt with heat-resisting spores this would not be the case. As a matter of fact, small Gram-positive granules can be seen in such caseous material, very similar to Much's granules in Hodgkin's disease, sometimes isolated, sometimes in short chains.

In 1901 I published a paper "On the Diplococcoid Form of the Colon Bacillus" in the *Journal of Experimental Medicine* that bears upon this point. In the liver and gall-bladder in cases of hepatic cirrhosis we found minute granules, generally in pairs, sometimes in rows of three, so small that they could only be defined by the $\frac{1}{15}$ in. immersion lens. In the bile we found larger (but still small) diplococcoid bodies, and making cultures of these, case after case developed *B. coli*. Preparations of Hort and Caulfeild's cultures of their filterable virus the appearances remind me of my elusive minute bodies. I admit that I regarded my bodies as degenerative and due to the action of the cells and body fluids upon the organisms. But it is within the bounds

[1] Abstracted from the *Brit. Med. Journ.*, October 14, 1916.
[2] *Ibid.*
[3] *Journ. of the Roy. Army Med. Corps* for September, 1916.

of possibility that, as with many of the protozoa, some bacteria, at least, may afford an encystment stage, followed by the liberation of minute elements, which in turn may grow into larger forms which now undergo asexual multiplication.

COLONIC INFECTIONS: SOME RARELY OBSERVED UNCLASSIFIED TYPES.[1]

By J. M. Lynch and W. L. McFarland.

Elliott and the authors have shown that the ileocæcal sphincter can be controlled by the injection of epinephrin. We have performed injections on many persons presenting ileocæcal insufficiency, as demonstrated by the Röntgen rays, and have shown that 10 minims of epinephrin is sufficient to control the leak, which later reappears. This fact may be of use in establishing a differential diagnosis between leakage due to loss of internal secretory or sympathetic tone and mechanical interference with the closure of the sphincter.

Another physiologic factor which has direct bearing on the topic under consideration is the recently described inhibitory centre, located, according to Keith and Cunningham, in the terminal ileum. Whether, as suggested by W. J. Mayo, this centre may be of such great importance in the syndrome of constipation that its removal may be the chief cause of the improvement which not infrequently follows resection of the terminal ileum or not is a moot question. Of its basic importance, however, there can be no doubt.

With these principles in mind, we have assembled the last twenty-one cases of purulent infection of the colon which have come under our observation in the last four years and which have been treated according to the above principles. Some of those cases were so severe in type and the constitutional conditions were so deplorable that a previous diagnosis of tuberculosis had been made.

Case 1.—L. M. was admitted January 1, 1916, complaining of blood in stools, diarrhœa, vomiting, abdominal cramps, and loss of weight. These symptoms were of seven months' duration, having come on gradually seven months before. The vomiting usually followed the ingestion of food, but without relation to the character of the food. It has persisted at irregular intervals, but has never contained any blood. There was diarrhœa with profuse, watery stools, from five to eight, every twenty-four hours, associated with some polyuria. Blood was not noted in the stools until three weeks before entrance. Painful swelling of the feet and ankles began six months before. The patient could not walk and was confined to the bed for a month, and treated in hospital for two weeks. He has had some pain in his hands, but they have never been swollen. Dyspnœa and orthopnœa developed during the six months previous to entrance. Three weeks before the mother noticed some red spots over the anterior surface of the tibiæ, which seemed to be tender.

On physical examination the patient was found to be poorly developed and very poorly nourished, and appeared chronically ill. He did not appear to be in pain, and showed no dyspnœa or cyanosis. The skin was pale, smooth, hot, and dry. There was no eruption on the chest, but on the anterior surfaces of both legs there were a number of small, rounded, nodular masses, slightly raised, and a little tender. The skin over the nodules was reddened, and there was a little areola extending beyond. The tongue was coated somewhat, tonsils cryptic, but not enlarged. Otherwise the head was negative. The superficial lymph nodes on both sides under the angles of the jaw, some in the axillæ, the epitrochlears on one side, and both inguinal groups of glands were palpable. The lungs were negative. The heart was slightly enlarged to the left, the sounds rapid, rather poor muscular quality, with a faint systolic murmur at the apex. The abdomen was slightly scaphoid, and moved slightly with respirations, which were chiefly thoracic in character. The abdominal wall was soft. There were no areas of cutaneous hyperæsthesia or muscular rigidity or hypersensitiveness. In the right lower quadrant, midway between the umbilicus and anterior superior spine was felt a compressible, tubular mass, non-tender, which slipped under the finger, and was thought to be a loop of intestine. The liver and spleen were not palpable, the lower pole of the right kidney palpable. A rectal examination revealed a tag just inside the sphincter, very much like a hæmorrhoid.

On January 7, 1916, the patient was seen by Dr. Fordyce, who regarded the skin lesions as probably tuberculous (tuberculids). A specimen taken for pathologic examination showed in frozen section chronic inflammation; the paraffin sections were unsatisfactory, and the sections for tubercle bacilli were negative. The blood cultures were sterile. The stools were negative for typhoid, parasites, blood, and tuberculosis. There was much pus, but no dysentery bacilli. On January 16 proctoscopic examination showed at the anus and extending up from the mucocutaneous junction several granulating ulcers. The sigmoidoscope inserted 18 cm. showed the mucous membrane granular with numerous areas of ulceration, which bled readily. A diagnosis was made of tubercular ulcerative sigmoiditis and proctitis.

A blood count showed red blood cells 5,700,000, hæmoglobin 80 per cent., white blood cells 22,200. polymorphonuclears 62 per cent., lymphocytes 32 per cent. On January 5 the white blood cells had been 26,800, polymorphonuclears 88 per cent., and lymphocytes 12 per cent.

Two Widal tests were made which showed in 1 to 20, good clumping; 1 to 40, slight clumping; and in 1 to 80, no clumping. The von Pirquet was very faintly positive.

On January 20 the white blood cells were 16,000,

[1] Abstracted from the *Journ. Amer. Med. Assoc.*, September 23, 1916.

polymorphonuclears 64 per cent., and lymphocytes 28 per cent. The urine was negative. The patient was seen by Dr. Brewer, who believed that the case was hopeless from a surgical standpoint, and not until operation was insisted on, because some patients improve markedly on ileostomy, followed by irrigations of the colon, did he consent to do the following operation.

On February 5, 1916, ileostomy was performed by Dr. Brewer. The cæcum, ascending colon, and transverse colon, as well as the descending and sigmoid colons, were found markedly thickened, and the peritoneal surface somewhat roughened. The ileum was quite normal in gross appearance, as was the rest of the small intestine. There were a few enlarged glands near the cæcum, which were firm, and one in the meso-appendix was removed for examination.

Procedure: A 3-inch vertical incision was made over the outer third of the right rectus about the level of the anterior superior spine. Exploration was done, the terminal ileum was brought into the wound, and the mesentery opened about 1½ in. from the ileocæcal junction. A glass rod was inserted into this opening, and the loop of intestine brought out of the peritoneal cavity. A few interrupted sutures were put through the peritoneum and aponeurosis. The usual appendectomy was done, the stump being inverted. There was an enlarged gland in the meso-appendix which was removed for examination. The gland proved to be a normal lymph gland. A diagnosis of chronic appendicitis was made.

Daily dressings were done, and the colon irrigated with a solution of 1:5,000 potassium permanganate. The patient was kept on the roof and given a liberal diet. His colour improved, the skin improved, and he gained strength, but apparently no weight. When he was able to be weighed, four weeks after operation, he weighed 57½ lb. (he had weighed 67 lb. before operation). Irrigations which at first brought away considerable blood and mucus gradually cleared up. After five weeks' feedings of buttermilk, from 4 to 8 oz. were alternated with the irrigations, two or three times daily, and patient gained 22 lb. in six weeks on this procedure. He has rapidly improved in every way, eats very heartily, and is quite active. He now weighs 79¾ lb. Proctoscopic examination showed the mucosa of the rectum and sigmoid quite normal in appearance.

This boy gained 22½ lb. within six weeks after the operation. He was seen by us quite recently, and we advised closing the ileostomy. The restoration of the function is perfect.

Case 2.—A. M., aged 23, was first seen September, 1911. The chief complaint at that time was epigastric pain coming on from one to two hours after taking food, and heartburn. Two weeks previously there had been an attack of diarrhœa lasting ten days. A gastric analysis made approximately six months previously showed a simple hyperacidity. Antacid treatment relieved all symptoms. The bowels, with the exception above noted, were regular, and the urine was normal.

Physical examination made September, 1911, revealed no abnormalities other than an occasional friction sound and an occasional inspiratory crepitant râle over the right apex posteriorly.

The onset of the condition occurred in July, 1912, when a slight amount of blood was noted at stool. About two months later bleeding began again. Examination revealed two fissures radiating forward from the rectum. Rectal examination was negative. Under protargol the fissures healed rapidly, but the bleeding continued. Proctoscopic examination in December, 1912, showed an intensely congested membrane studded with pinpoint ulcers. Mixed treatment internally, combined with silver nitrate irrigations locally, produced diarrhœa and augmented the amount of blood passed. In February, 1913, the patient was given a proctoscopic examination again, the same pathologic picture was noted, ordered a bismuth, iodoform, oil irrigation, to be retained all night, and a krameria, liquor antisepticus alkalinus irrigation for morning use. For two weeks slight improvement followed this treatment, but then the bleeding began in increased amounts.

Bacteriologic examination of the material showed streptococci of the viridans type and numbers of the *Bacillus coli* group. Guinea-pigs inoculated with some of the material died after some weeks. The necropsy on them was negative.

In order to study the natural repairs in peritoneal and non-peritoneal covered end-to-end anastomosis, the pelvic colon of a dog was drawn up, cut, and anastomosed end to end as far caudad as possible at two different places separated by an interval of 5 cm. This operation was performed February 3, 1914, and on February 16 necropsy was performed. There was little difference in the lumina of the anastomotic openings. The lower or non-peritoneal-covered was the smaller. The liver, spleen, and pancreas were congested. Microscopic sections of the anastomosed areas showed unions by fibrous tissue growing in from stroma, submucosa, and muscularis. There was very slightly increased vascularity of the caudad section (non-peritoneal), or no increase at all.

In order to study the causative agent in hæmorrhagic colitis, on March 27, 1914, hæmorrhagic material was injected into the rectums, previously curetted, of two guinea-pigs and one rabbit. On April 13 necropsy of one guinea-pig showed that the liver was congested, the mesenteric glands enlarged, and the appendix loaded with fæces. Cultures made from the glands showed a colon-like organism resembling morphologically the organism regained from the original material injected and previously examined bacteriologically. The remaining guinea-pig and rabbit are well and normal to all appearances. On April 3, 1914, the same material was similarly injected into two guinea-pigs and one cat. On the 11th one guinea-pig died. Necropsy showed that the retro-peritoneal and mesenteric glands were enlarged. No cultures were taken, but microscopic study was made of the liver, spleen, and glands. No destructive changes were discoverable in either structure. There was hyperplasia of the lymph nodes.

Three Wassermann tests of the blood proved negative. A stained smear of the rectal discharge showed a predominance of encapsulated diplococci, occasionally occurring in chains. The only other bacteria found consisted of large, thick bacilli. An examination of the passages from the bowels showed a Gram-positive diplococcus, a Gram-negative micrococcus, and several Gram-negative bacilli, together with pus and mucus. The analysis at frequent intervals regularly gave normal findings. On March 1, 1913, the hæmoglobin was 65 per cent. On March 8, 1913, the hæmoglobin was 70 per cent., red blood cells 4,600,000, white blood cells 9,600, polymorphonuclears 76 per cent., lymphocytes 22 per cent., eosinophiles 2 per cent.; the systolic blood-pressure was 125 mm. of mercury, and the diastolic 90 mm. Moderate poikilocytosis and anisocytosis was present.

On March 22, 1913, the white blood cells were 10,000, polymorphonuclears 74 per cent., lymphocytes 26 per cent. On the 26th a vaginal smear showed occasional large, round diplococci and thick bacilli. March 3 and 7, 5,000,000 and 10,000,000 *B. coli* C. were injected. Blood examination on June 10 to 13 showed hæmoglobin 70 per cent., red blood cells 4,800,000, white blood cells 7,200, polymorphonuclears 76 per cent., lymphocytes 24 per cent., and no abnormal cell formation.

These histories are given in full because they are classic examples, the one of an acute type, the other of a chronic type with exacerbations.

Of these twenty-one cases, eleven were definitely acute and ten were chronic, with acute exacerbation. The average age of the patients in the acute group was 26·6 years; of those in the chronic group, 37·7 years. The average duration of the acute type of the disease was 32·3 months; of the chronic, 70 months.

Thus, there are certain types of acute purulent and hæmorrhagic inflammations of the colon that cannot be attributed to any specific organism. They are characterized by sudden onset of diarrhœa, blood, mucus, and pus. Sometimes the pulse was rapid, nearly imperceptible, the temperature 104, and the patient presented a picture of the third week of typhoid. Emaciation is marked and prostration extreme. The stools have a fœtid odour, and pus is passed in such quantities as to suggest the evacuation of an abscess. The stench of this is overpowering.

In other cases, though the diarrhœa is severe and the amount of blood lost is considerable, still the digestive disturbances are slight, suggesting an increased peristalsis in the colon only.

The proctoscopic picture of the acute form is typical. The mucous membrane is œdematous and dark red, granular, pebbly, or bosselated in appearance. It closely resembles fish spawn, loosely strewn over the surface, and the mucous membrane appears to be lifted away from its subjacent structures. There are no definite ulcers, the entire intestine being one confluent ulcer.

As the acuteness diminishes the picture changes. The mucous membrane is less œdematous and covered by irregular patches of exudate, which closely resemble macerated skin. Between the patches are irregular oblong ulcers, varying in size and depth, with overhanging edges and worm-eaten bases. As the inflammation abates under treatment the mucous membrane becomes pale, and polygonal areas, separated by an arteriovenous network, give to the bowel a checker-board appearance. It still retains its granular character, and bleeds easily if touched.

Finally, the mucous membrane seems to become adherent to the muscular coat and loses that elasticity of motion so characteristic of a normal bowel.

After recovery, the dry, shiny, glassy appearance of atrophy appears. The histopathology is perhaps more variable than the gross pathology, and is therefore more difficult to give. It is based in many cases on the examination of small bits of tissue removed with a punch, or to small pieces removed during the operation for colostomy. It is that of an acute inflammation involving a mucous membrane and its subjacent structures. In all cases there has been marked congestion accompanied by œdema. Congestion and œdema may be limited to the mucosa or submucosa, or may involve the entire intestine wall. The mucosa may be covered with an exudate composed of pus cells, bacteria, and inflammatory elements. It may be devoid of glands in case necrosis has progressed, or the inflammatory change may be limited to œdema, congestion, and accompanying swelling of gland epithelium. In one case the exudate throughout was more marked in the mucous and peritoneal coats. The crypts of Lieberkuehn had entirely disappeared and were replaced by an exudate composed of round cells. The blood-vessels were abundant on the free surface and engorged with blood. The submucosa and mucosa had entirely disappeared, their place being taken by the exudative layer, which rested directly on the muscular coat. Round-cell infiltration of varying degrees according to severity of process was of course observed. This may be limited to the mucosa, or involve the entire intestine and its peritoneal covering. Lymphatic tissue presented no changes except those produced by adjacent inflammation. Such parts of the plexus of Auerbach and that of Meissner as it has been possible to demonstrate appeared normal. The muscular coats were at times involved in the general reaction, and presented the usual appearance under such conditions. In two instances the cæcal wall was of tissue-paper thinness, though all structures were demonstrable. In one acute case submucous cell groups, simulating tubercles and containing giant cells, were found. The tubercles were in structure like those produced in mesenteric glands by foreign body irritation. Mucopurulent, bloodstained discharges from the lower intestine, so characteristic in these cases, have been repeatedly examined for bacterial and possible infusorial content. The results of these examinations were distinctly disappointing in so far as throwing any light on the etiology of the condition. No unusual forms of

bacteria or predominating forms of bacteria were found.

In 50 per cent. of the cases the appendix showed a similar pathology.

In addition to the twenty-one cases critically studied during the past four years, we have incorporated information gleaned from seventy-eight cases of our own, besides seventy cases collected from the literature. Of the latter, however, very few conformed to the type of infection with which we are dealing, being of the specific type.

Rosenheim writes of a number of cases in which the physical signs, clinical symptoms, and the course of disease closely resemble those observed by us. He advances several etiologic theories, change in chemical reaction of content of large intestine, change in activity and pathogenicity of intestinal bacteria, &c. His patients have been, as a rule, under middle age, ranging from 8 to 40 years, and he has noticed that many of them were deficient in stamina. Young, nervous, and anæmic individuals predominated, and sex exerted no apparent influence. The pathology, as seen by Rosenheim, is that of a true infection of the mucous membrane, occasionally complicated by infiltration of the intestinal walls and peritonitis. Erosions, and especially ulcers, were secondary manifestations. The colon was affected in varying extent and intensity. The sigmoid flexure was most commonly involved, and anatomic changes were always more marked in this segment. Multiple neuritis, endocarditis, and joint involvement were mentioned among the possible complications. (Three of the authors' cases presented very severe skin infections.) It is interesting to note that in 1908 Rosenheim said: "The severe chronic colonic inflammations here considered are not mentioned in text-books, and only occasionally noted in literature. Clinical pictures belonging to this class are here and there described as ulcerative colitis or dysentery." Zweig understood by ulcerative colitis "every form of intestinal catarrh which, beginning as an acute inflammatory process of the mucous membrane of the large intestine, is eventually productive of ulceration. Ulcers are usually in the rectum and sigmoid, but can extend to the cæcum, and vary from lentil size to that of a thaler. Symptoms are those of a general infection with frequent stools containing pus, blood, and mucus. The amount of blood may vary from an optically imperceptible quantity to one or two litres, which latter quantity was lost by one of Zweig's patients. The etiology was a matter of conjecture, but an unrecognized form of bacteria might be responsible. The change in virulence of *B. coli* should be considered. He observed three cases in which achylia gastrica was well marked, and perhaps the antizymotic action of hydrochloric acid produced an increase in virulence of bacteria of the intestine, acute inflammation with ulceration resulting. As predisposing causes he has found diverticula in three cases. Operative procedures mentioned by Zweig were artificial anus at various portions of the colon, intestine junctions, and appendicostomy. He advocated measures that assured the intestine absolute rest by complete diversion of the fæcal current.

A contribution to the surgical literature of colitis is made by Beck. Though Beck is usually quoted in articles on colitis gravis, the conditions observed by him were secondary to organic disturbance of the intestinal tract, such as carcinoma, and the specific infections, such as tuberculosis, typhoid, &c. The nervous elements were not considered by him as of primary value in colonic inflammations. Ileosigmoidostomy was the operation advocated by Beck, and employed by him in six cases.

In studying the literature one is impressed by the multiplicity of names and the hopeless intricacy of the nomenclature; also by the fact that the specific as well as non-specific forms are grouped under a single head. It is not to be wondered at, considering the newness of the topic and the difficulties under which one labours in isolating the specific cause of the differing dysenteries.

Many of the fatal cases with a diagnosis of bowel tuberculosis were in reality of the non-specific type of infection, and could have been saved by ileostomy. Case 1 illustrates this. The diagnosis was not always cleared up by the histologic findings, for we have noticed great difference of opinion among experts as to the interpretation of the microscopic change.

One is also impressed by the improper use of non-physiologic measures. We cannot, for instance, see the indication for an ileosigmoidostomy for acute infections of the colon as practised by one of the above authors.

There were eleven four plus acute cases. Of these, nine patients were operated on; two refused operation. Of those operated on, three were cured, three are pursuing the same clinical course and are rapidly improving, but sufficient time has not elapsed to place them under the cured cases. Two are improved. One was operated on by a colleague, but succumbed later to hæmorrhage from the bowel. An appendicostomy was done. We think that cure might have resulted had an ileostomy been used in its place.

The two who refused operation are improved under treatment, but suffer from acute exacerbation when treatment is discontinued.

Of the patients operated on two refused major operations (ileostomy), but submitted to appendicostomy. They are pursuing the same course as the two cases medically treated—namely, they have gained rapidly in weight and are apparently well, but from time to time they suffer from acute exacerbation.

We found it necessary in one case of ileostomy to perform a developmental reconstruction of the colon because a multiple segmental polyposis was grafted on the original infection. This case has suggested to us repeatedly the relationship between polyposis and continued inflammation of this type.

Of the three plus or subacute cases there were nine. Seven were operated on, four having been cured. Three were complicated by diffuse multiple

polyposis; although they have gained from 10 to 40 lb., numerous polyps are present, and we therefore are unable to place them among those definitely cured. Thus we cannot close them, and although all traces of inflammation have subsided, still we feel certain that if we were to turn on the current again they would undoubtedly have a recrudescence.

Of the remaining two, the first patient, an aged woman who had been bedridden and unable to recognize her family for more than a year, was mentally restored within a few days after ileostomy, and was able to return to her household duties. Although she finally died one year after the operation, necropsy showed intercurrent renal involvement. The results so far as justification of the operation went were brilliant. The restoration of this woman's intellect was amazing. The last case, that of a baby of five years' post-operative standing, is quiescent while the ileostomy is open.

Of the two not operated on, one was a patient with multiple polyposis, having from sixteen to eighteen mucopurulent, serosanguineous stools daily when she entered the hospital. Under medical treatment she gained in weight, and was having three movements daily when she returned home. We advised her son, a physician, that it would be necessary for her to have an operation to ensure cure.

This is a very interesting group, in that many had been incapacitated for years, had had incomplete operations performed and were despondent and pessimistic as far as their chances of recovery were concerned. Four out of the six suffered from stenosis at various levels of the canal, and required more than one operation before they were entirely cured. The stenosis was so extensive, in one case involving the descending colon, that end-to-side colosigmoidostomy had to be performed. This patient, who was a fireman on a railroad, has gained 40 lb. and is now in perfect health. The fact that he requested to be transferred from an electric to the more strenuous work of coaling is sufficient proof of his capacity for work since his operation.

Another patient of this group has a perfect restoration of function, notwithstanding the fact that she had a very marked stenosis of the rectum and part of the sigmoid, and had to live with a colostomy for two years. After this the inflammation had entirely subsided, the stenosis had spontaneously improved through fibrolysis; lateral anastomosis was done to prevent any recurrence at the most contracted portion of the stenotic area.

Of the subgroup double plus acute, containing two cases, both were operated on. One is absolutely well; the other is very much improved, having still some stenosis which requires constant medical supervision.

What deductions can be drawn from these twenty-one cases of colonic infection? First, that acute purulent infections of the colon can be cured only by putting the entire involved bowel at rest. Local treatment is indicated in every case, and should have a satisfactory trial before surgical measures are instituted. It has the advantage of putting the patient in the best possible position to withstand a surgical operation, because he always improves at least temporarily under proper local measures. The striking improvement after ileostomy is seen in the very acute cases.

The old idea that if a stoma were made in the small intestines the patient would lose weight and rapidly decline has been proved to be a fallacy. The gain in weight in every case supports the theory that we have long held that there is an inhibitory centre in the lower ileum, the activity of which is accentuated after ileostomy, and even though it sometimes takes weeks or months before this function is fully developed, still it does come eventually, and the majority of patients suffer little more inconvenience than do those who have a stoma in the colon. *The dictum which we laid down that a stoma, to be efficient, must always be placed oral to the infection, still holds good.*

Of the twenty-one patients six had appendicostomies, and while these improved temporarily and gained in weight, none is nearer to a cure than are those that have been treated by rectal irrigations. We lay particular stress on this because it was felt that appendicostomy would have accomplished the same result. Sufficient time has now elapsed to prove this to be erroneous.

A patient was seen in consultation about three years ago, of the same type as the patient in the second case cited in this article. We suggested ileostomy at the time, but he refused to consider it. Subsequently appendicostomy was performed, and the patient gained in weight, but has acute exacerbations.

There was one other case which proved exceedingly instructive and further confirmed us in our view that appendicostomy is not the operation in these cases. This was a case of acute infection: We performed an appendicostomy and the patient improved slowly. After six months he developed very large, deep, and elongated ulcers in the rectum. We then performed a colostomy. Almost immediately there was a marked improvement in the patient's condition. He gained 30 lb. within a month or two, and within a comparatively short period began to resume his occupation. During all the time he had appendicostomy, though improved, he was still unable to attend to his work. While this patient is not entirely cured, yet in the light of our present knowledge and experience with similar cases we feel sure that he will have a complete restoration of function. We mention this as a further argument in support of our theory that appendicostomy is not sufficient.

Patient B, of the three plus grade, had been sick for six years previous to coming under our care. The mistake had been made in his case of placing a stoma in the middle of the inflammatory area. This patient subsequently was restored to health, but required several operations, and the convalescence was considerably prolonged by the fact that the surgeon who first operated did not appreciate the principles underlying the condition.

Of the twenty-one cases, three were complicated by a multiple polyposis. In one case in which we had performed a previous ileostomy we found it

necessary to perform a reconstruction on account of a polyposis limited to the cæcum and ascending colon. This patient is absolutely well.

Of the two others, one has improved immensely under local treatment. This was the patient who refused to have ileostomy. She returned to her home in the South, and is now being cared for by her local family physician. The other had an ileostomy and has gained 40 lb. since the operation, and is a practising physician in a neighbouring State. He suffers no inconvenience; but still having some polyps left, he does not feel that his present symptoms would justify him in risking the radical operation, which would probably mean removal of the entire colon. From observations on this patient we feel sure that there is progressive regression of the polyps since operation.

From this study we have also gleaned some facts which will have an important bearing on the future treatment of strictures—namely, that if a stoma is made oral to the infection in every case, restoration of function will result. This particularly applies to strictures with multiple fistulous openings on the outside. The most brilliant results we have obtained have been in the above-mentioned cases. No attempt should be made to split open the fistulous tracts, as these gradually disappear with the infection, so that when one comes to close the stoma, instead of having an incontinent patient, as we formerly had, there has been complete restoration of function.

In conclusion we may state that purulent infections usually begin as an acute process, and may become subacute or chronic; that the segmental character of many infections suggests diminished tissue resistance due to a change in the vasomotor nerves as an etiologic factor; that active bacterial agents have not as yet been demonstrated, but that these perhaps belong to the normal bacterial flora of the intestinal canal; that a rapid increase in weight is compatible with a stoma in the small bowel; that purulent infections are very often overlooked because there is no definite ulceration. This mistake is caused by the extensive inflammation, for the blood and pus which covers the bowel may easily be supposed to come from some other part of the intestinal canal, and by the fact that the observer is dealing with an acute purulent infection which may be segmental in type. This should be appreciated early, because we believe that, particularly in the segmental type of infection, the best results are obtained by making a stoma early in the disease.

Medical treatment in all these cases, except in the acute, and even in the acute at times this method is well worth trying. A solution of potassium permanganate 1:5,000 is very helpful. In fact, some of the subacute cases we have been able to cure by using these irrigations of potassium permanganate or a teaspoonful of hydrogen peroxide to one quart of water. Medical treatment is worth trial in all cases, but physicians should be careful not to prolong it beyond the point where serious damage to the intestine may result. If it fails there should be immediate recourse to surgery.

Notes and News.

SIAMESE DRUGS AND SPICES.

Of the principal drugs obtained in Siam we may mention: (1) The gum benzoin, obtained from a tree similar to the *Styrax benzoin* of Sumatra; (2) gamboge, from *Garcinia hanburii;* (3) cutch, from *Acacia catechu*, used for tanning; (4) cardamoms, the fruit of *Amomum xanthoides*, and bastard cardamoms from the *A. villosum;* (5) pepper; (6) Cinnamon from *Cinnamomum silvestre*, the wild cinnamon; (7) nutmeg, from *Myristica fragrans*. Besides these we have: sesame seeds, lotus seeds, groundnut, cloves, ginger, turmeric, anise, tamarind, liquorice, and other products which have a local reputation but have not as yet reached European markets.

GOA POWDER.

In a report by a local observer at Bahia on "The Araroba, or Goa, Powder of Brazil," the following particulars are of interest: The powder is found as a pulp or in small solid pieces in crevices of the heart wood of the tree *Andira araroba*. The tree is known locally as the "amargoso do matto," and belongs to the leguminosæ; it grows in a wild state, obtaining a height of about 100 ft. and a diameter of 3 ft. To obtain the powder the trees are felled and split open, when the lumps of araroba, which is said to be a morbid growth, are removed, dried, and powdered. The product is of a yellowish colour, and yields about 50 per cent. of chrysarobin, which slowly oxidizes and appears as chrysophanic acid and glucose. The therapeutic effects of the powder in many skin affections in tropical countries are well known. There are several dangers attached to the production of the drugs, for the workers engaged in the process are apt to lose their sight should the powder enter the eye; the hair, eyebrows, and eyelashes are shed. These conditions are apt to arise, although the worker is protected by masks with glass eye-pieces and gloves. With the deposits in the wood a caustic liquid is present which burns the skin and produces sores difficult to heal.

PLAGUE AT BRISTOL, ENGLAND.

During the month of July, 1916, plague was detected in Bristol. The outbreak was very limited in both human beings and rats, and by August 10 the last case in human beings had occurred.

Active measures were taken in dealing with the disease, and apparently with good effect.

The whole contents of the rag factory in which plague broke out were destroyed by fire. All the rats about the premises were caught and destroyed. Of the seventy-four captured eight were found to be infected with plague.

Outside the rag factory none of the rats in Bristol

were found to be infected, so that beyond some factory hands and the rats on the premises no evidence of plague occurred in Bristol.

The stock of rags destroyed amounted to just over 200 tons. Before being taken out to be burnt as much as eight tons of disinfectants were sprayed on the bundles of rags, the premises were disinfected by first spraying and washing with another eight tons of disinfectants, and finally two tons of lime sprinkled about and used for lime-washing the walls of the warehouse and the offices and the stables. The staff of the establishment were freely supplied with bathing facilities.

It is interesting to note that none of the rags were imported; they came mostly from other towns and villages around Bristol. To all these places notification of the outbreak was immediately sent and investigations made that at none of them could any trace of plague in men or animals be found.

The origin of the outbreak is mysterious. Some go so far as to say that it had been purposely introduced by enemy bacteriologists; this may be set aside, as no proof exists. However, unless daily examination is made for plague in rats it is impossible to say whether the rats in any British port are infected or not. It must be remembered that Bristol makes the twelfth or thirteenth British seaport in which plague has occurred within the last fifteen years, and, in addition, there was a sharp attack of pneumonic plague in Essex some ten years ago, from which a few people died, and several varieties of animals were found infected.

All these warnings betoken care, constant care, and keen observance against this most insidious disease.

History shows that plague is wont to visit a country once in three hundred years; the last epidemic occurred in Britain some three hundred years ago, so that, in the ordinary course of things, it is due now.

The prompt and excellent methods by which the Bristol authorities dealt with the outbreak, however, gives us hope that we are fit to cope with the disease at its initial stages, and if so a serious epidemic is unlikely.

NEW METHOD OF ANTRAL CLEANING WITH TROCHAR.

After insertion of a trochar through the wall of the inferior meatus into the antrum of Highmore proceed as follows: The point of the trochar is turned downward so that it comes as near the floor of the antrum as possible. Both nostrils are then closed around the trochar tube with the finger, and the patient blows forcibly. This puts air pressure *viâ* the ostium maxillaris into the antrum, and forcibly blows out the pus through the cannula. It is much better to use a cannula of good size, and one has to manipulate it a few times to be sure the inner end is free. I believe that this method practically empties the antrum of fluid, which the ordinary method with a trochar does not do.

Reviews.

Efficiency in First Aid. By N. Corbet Fletcher, M.B., M.R.C.S. London: John Bale, Sons and Danielsson, Ltd., 83, Great Titchfield Street, W. Price 1s. net.

This work is essential to all who wish to maintain efficiency in first aid. It gives a general survey of notes on first aid, and could be used before lecturing, but is especially useful for self examination after each lecture to be certain that no essential point has faded from the memory. It also can be used by lecturers to ensure that they keep within a definite syllabus. Last, but not least, it is one of the best books, if not the best book, for revising knowledge after a course of lectures to ensure that the reader is ready at any moment to give first aid in any form of emergency.

The Maintenance of Health in the Tropics. By W. J. Simpson, C.M.G., M.D., F.R.C.P. London: John Bale, Sons and Danielsson, Ltd., 83, Great Titchfield Street, W. Price 3s. 6d. net.

It gives us much satisfaction to re-peruse this interesting work by such an experienced authority. It contains exactly the information required by the laity to obtain and secure good, we may almost say perfect, health—at all events, to free them from some inconveniences of a hot climate. Not the least beauty of the book is that it takes a reasonable commouseuse view on all subjects; for example, there is no subject on which there are so many erroneous opinions as in the wearing of belts and corsets. On this, and upon all other points, it is most commendable. We would suggest that the book should always be kept at hand to be lent or given, so as to save a considerable amount of the time of practitioners in the Tropics.

Handbook for Wives and Mothers in India. By Mildred E. Staley, M.B., L.M. W. Thacker and Co., 2, Creed Lane, Ludgate Hill, E.C. Price 5s. net.

The appearance of a second edition confirms the opinion we held of this book that it is well worthy of the study of all wives, mothers, and maidens who are going to India, or who are already there. We also consider that many useful hints may be obtained by those who have the care of female patients in any part of the Tropics. The first part contains subjects of general interest, such as general and personal hygiene; the second part deals with women's diseases; the third part with pregnancy and parturition; and part four with new-born infants and children, their ailments, diseases, and hygiene. So comprehensive is the book that no one is too young or too old to benefit by its careful perusal. Indeed, it might be well to make it a students' handbook for girls leaving school, or, at all events, for teachers and nurses and others whose opinion is often asked on matters of health.

Original Communication.

THE NEED OF AN ORGANIZED APPLICATION OF TROPICAL HYGIENE TO PREVENT EXCESSIVE WASTAGE FROM DISEASE IN OUR ARMIES IN THE EAST.

By W. J. Simpson, C.M.G., M.D., F.R.C.P.

Professor of Hygiene and Public Health in the University of London, King's College, and Lecturer in Tropical Hygiene, London School of Tropical Medicine, formerly Health Officer, Calcutta.

The Army medical authorities are to be congratulated on their well-merited success in preserving the health of the British troops in France, but these congratulations cannot be extended to their failure to protect from disease our armies in tropical and sub-tropical countries. It is an extraordinary thing that, notwithstanding the fact that our possessions in tropical regions are the largest in the world, there should have been no realization of the dangers from tropical diseases to be encountered by our troops in Egypt, the Dardanelles, and Mesopotamia, and that our armies should have been sent there without any effective preparation, organization, and equipment for the prevention of such diseases.

Lord Derby, in his statement in the House of Lords on November 1 regarding sickness in the Mesopotamian Army, mentioned that during the period April 27, 1916, to July 29, 1916, the admission of British troops to hospital averaged 2,739 per week, and the deaths 108 weekly, i.e., there were during three months over 30,000 admissions into hospital from disease and 1,400 deaths. There is no statement regarding the number of the Indian troops admitted or that died in the same short period, nor is there any reference to the sickness and mortality in the British and Indian troops, which is understood to have been appalling before this particular period. It is to be hoped that these figures will also be forthcoming as well as the causes of death. We know that many were from cholera, dysentery, typhoid fever, and other tropical but preventable diseases. The figures, notwithstanding the shortness of the period which they cover, and although they only include the suffering and loss of the British and not of the Indian, are sufficient to demonstrate that there has been a remarkable an inexcusable omission of preventive measures which are always specially necessary to be provided for in campaigns, pilgrimages, or other circumstances where large crowds gather in tropical climates. It is a curious fact that the necessity for tropical hygiene has constantly been ignored.

The number of hospitals, medical officers, nurses, personnel, and articles of equipment that have been recently sent to Mesopotamia form a very striking array of what was needed. It is certainly deserving of the cheers in the House of Lords with which the statement was greeted, indicating the relief which was felt that something was at last being done. Such activity is better late than never—on the principle that it is never too late to mend, but no activity now will save the thousands that have fallen and have suffered or alter the fact that these measures are just eighteen months too late.

The very magnitude of the medical and sanitary equipment now required is only a measure of the deplorable lack of them when they were most needed. It is obviously not a satisfying source of congratulation to be now supplying to the force the essentials that should have been ready and sent along with the troops. Even now we notice that large floating plants for purifying water are still under construction, and are to be sent out as soon as possible.

Anyone conversant with the hygienic requirements of troops, or any large body of men congregated together or in transit from place to place in the Tropics, would have known that such appliances were needed at the beginning, and that a calamity was bound to occur if precautions were not taken in time to prevent disease.

The condition of the Tigris and surrounding country and the boats required for the navigation of the river at the different periods of the year and its course through marshes, the rise and fall of the river and its depth, its rapidity, the season of floods and the climate to be encountered were or ought to have been known. Full particulars are given of these matters in Colonel Chesney's report of the Commission which surveyed the valley of the Tigris and Euphrates as far back as 1835, 1836, and 1837, and which was published with plans and maps in 1850. It was a Commission to determine the best route to India, and the Germans have not been slow to avail themselves of the valuable information in their design of the Bagdad railway. We, on the other hand, have ignored its value, and with disastrous results. Had a Board of Tropical Sanitation existed at the War Office, which should be the case, it would have been that Board's function to have studied the topographical, climatological, and health conditions of this region when an expedition was first mooted, in order to have every possible arrangement ready when the expedition started, and not only for this expedition, but for others in tropical and sub-tropical climates.

It will be for the future historian to determine, when all the facts concerning the amount of sickness in the Mesopotamian force are known, what share this physical disability of the Army had in rendering it immobile for so long. Unfortunately, this Mesopotamian disaster is not the first of its kind in this War. There was the same misconception of the dangers to be met with in Egypt and Gallipoli, and, if rumours are correct, even in Salonika.

Much has been said in criticizing the inception and plan of carrying out the military operations in Gallipoli, but the failure to preserve the health of the Dardanelles army has hitherto escaped comment. Yet a healthy Army, physically fit and able to undergo great exertion, is no mean factor in determining its success. In the past there are records of failure of expeditions owing to the ravages

of disease. The Gallipoli expedition will take its rank among them. One hundred thousand soldiers, or to be officially correct 96,000, removed from the Peninsula on account of sickness during the seven months of occupation would paralyse the efforts of any force if in the same proportion. An army which is physically unfit is not a conquering army, however brave and heroic its soldiers and officers may be. The extra Army Corps which was later said to be needed to carry the position would have been already on the spot had the soldiers been healthy. If instead of 100,000 sick there had been a healthy Army, and not one that was disabled through sickness, Constantinople would probably have been reached in spite of military blunders. The whole chain of events in the Balkans and Turkey would have been altered, and we should not have lost that prestige in the East which we enjoyed

ditions likely to be met with. It is the province of tropical hygiene to know the conditions and diseases in the Tropics and to provide a preventive organization. It is not prevention to allow diseases to become rampant in an army or community, and then to make herculean efforts to suppress them. This policy of dealing with preventable disease we had hoped belonged to the past, but it is obviously not the case. It corresponds to the proverbial shutting of the stable door when the horse has bolted.

Setting aside other considerations, such as loss of the services of the soldiers when needed and the serious reduction of the supply of soldiers urgently required, the policy is expensive, for it entails the provision of many hospitals for the treatment of the extra number of sick, besides the cost connected with the personnel, equipment and maintenance of such hospitals. Apart, then, from the avoidable

before the catastrophes in the Dardanelles and Mesopotamia. The procedure in both campaigns—Mesopotamia and the Dardanelles—has been the same. There has been no forethought, no grasp, or conception of the diseases likely to arise against which the troops were to be protected, no consideration of the measures to be taken for their prevention, and action has only been taken when news of disease and deaths to an alarming extent have reached the public. Then great activity is shown, a fall in the number of the sick and dying is recorded, and the failure to prevent or check preventable diseases at the outset is lost sight of in the praise for that which has been done too late. The rôle of preventive medicine in the Tropics as elsewhere is to prevent disease; its aim is to forestall epidemics, and by organization to anticipate the needs that will probably arise under the con-

suffering and loss of life which the policy involves it is economically unsound. Treatment is not prevention, nor are bacteriological laboratories more than adjuncts to the practice of preventive measures.

Excessive wastage from disease when the sources of man-power are not inexhaustible is an extravagance which we cannot afford, and which must be reduced if we are to secure for our Generals those numbers of healthy soldiers essential for final victory and for the achievement of those objects for which we entered the War. To accomplish this it is necessary to create a Board of Tropical Sanitation in the War Office composed of men with practical experience of tropical hygiene, whose business it will be to maintain healthy armies in the tropical and sub-tropical areas of the War; and also to appoint Inspector-Generals of Sanitation in touch with the Board for each Army Corps in the East as

Consultant Sanitary Officers and advisers to the Generals and to the Administrative and Executive Sanitary Officers, and to report on the efficiency or otherwise of the measures employed, bearing in mind the necessity of their adaptation to the ever-changing military situation and military exigencies. I am well aware that there is a Mediterranean Sanitary Committee which has done splendid work, but it is not enough in a war of this magnitude or for the localities in which it is being waged. This Committee should still remain and form an important part of the organization recommended. It would co-ordinate the work in the widely separated localities in the Near East, and it might be further supplemented by a similar Committee in the Middle East.

The war in the East is waged, and will continue to be waged, for a prolonged period in particularly dangerous zones for contracting preventable diseases, and demands exceptional vigilance and preparation and organization, and this demand in the light of the great developments in the East and their stupendous significance is as urgent now as it was nearly two years ago. The aspirations and premeditated designs of Germany in Europe are well illustrated in the accompanying map, which has been taken from a postcard, and which has been in my possession for nearly eight years. It is needless to say that it was from a German source, although it is printed in English. It is interesting from the point of view of this article as indicating that one of the chief zones in the Near East in which there will be much decisive fighting will be an area which has always been a hotbed of disease and epidemics. It is, however, only one of the Eastern areas. There are others outside Europe.

As recently as January, 1914, there was delivered a lecture by a German at the German Club in London, in which the prospective Empire of Germany was stated to be from Heligoland to the Persian Gulf. That aim is a menace to England's possessions in the East, and specially so when the railways under construction to the Persian Gulf and the frontiers of Egypt are completed.

Condensed Milk and Rice Water in Treatment of Diarrhœa (P. Lassablière, *Paris Médical*, September 16).—One part of condensed milk in four parts of rice water is the formula, and with one or two quarts of this a day gave excellent results in 256 cases of acute enteritis, and also in three cases of confirmed bacillary dysentery. No medication was given in seventy-two of the cases, the men getting nothing but the condensed milk in rice water, although they were having from six to thirty stools a day, with colics and sometimes pronounced tenesmus. On the milk-rice water they recovered completely in five days on an average. In a similar series of thirty-two cases treated with the usual other measures, recovery was not reached under twenty-six days.

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DECEMBER 1, 1916.

THE QUESTION OF PASSING ARMY UNFITS FOR THE TROPICS.

(*Continued from p.* 264.)

UNFITS rejected by the Army for temporary or removable causes but more often accepted and then dismissed as unfit, and then presenting themselves for work in civil life in the Tropics, are such cases as the following:—

(1) *Varicose Veins.*—It is two years and more since war began and yet many men knowing they had varicose veins took no steps to have them cured so that they might be in a fit state to serve their country. It is rather to be feared they hugged themselves daily with the comforting assurance that they had these veins, and that, therefore, they could not be called upon for general service. It is needless to dwell upon men endowed with this frame of mind, but that such an obstruction to service should be entertained is unpardonable. The proper way to deal with these men is to call them up, and if varicose veins are put forward as a reason for rejection the men ought to be compelled to have their veins cured, either in private or at the public expense, in civil or military hospitals. The same men who urge the state of their veins to be a reason for not serving in the Army readily submit to operation when the varicosity is found to be an obstruction to their getting an appointment in the Tropics. Of course, were the Government to insist on this being done, the man thus afflicted would suddenly discover that he did not believe in doctors, that he had a conscientious objection to operations, or that he was a Christian Scientist. Good and well if a Christian Scientist get those degenerates who dabble in this shameful procedure to cure him, if by their practices they can ensure a cure; but if our rulers remain content to give way to the opinions of those whose form of mental aberration runs to crafty ways of escaping service on the plea that the liberty of the subject must be respected, it goes to show that a deeper degeneracy exists amongst us than it is pleasant to contemplate.

(2) *Varicocele* is another trivial ailment which lends itself to rejection, and as the man thus afflicted has something which is palpable to himself and others he finds a consolation in its presence, and claims it as a cause for exemption. The operation is trivial, the time between operation and fitness does not exceed a month at most, and it is the duty of the authorities to see that the ailment is cured and that he joins as a fit man for service with the Army.

The same man presenting himself for service in civil life abroad readily submits to operation if he finds varicocele an objection to his getting an appointment; but he is unpatriotic enough to refuse operation on various grounds if requested to do so by the State.

(3) *Hernia.*—Many cases of rejection for the Army and Navy are due to hernia. Much that was said above concerning varicose veins may be repeated regarding hernia, as to its presence being continued and radical cure avoided in the hope of rendering the subject unfit for service. On many occasions, also, a truss is deliberately worn for the purpose of perpetrating a fraud, no hernia ever having been present. Should this man come as a candidate for service abroad the truss is left off and nothing said, and it is only by the effect upon the tissues above the groin that the examiner may be able to detect the fact that a truss has been worn. The question is, is it necessary to reject a man for civil tropical life who wears a truss for inguinal hernia which fits well, and after careful testing is proved to be efficient? There is no valid reason to reject him. In commercial life the candidate will always be at a centre where a truss can be obtained if the one he has gets too old for wear or gets broken.

For pronounced umbilical hernia, seeing the difficulty of adjustment and that security of retention by apparatus is precarious, the question will have to be specially considered; as a rule, such a man should not be sent abroad for any purpose until the umbilical hernia has been radically cured.

Incidentally, in the case of women, especially married women, none should be allowed to go to the Tropics who are the subjects of either umbilical or femoral hernia unless a radical cure has been performed. The difficulty of retention in either of these forms of hernia is justification for this decision, knowing how difficult it is to efficiently retain a hernia by any known apparatus in either the umbilical or femoral forms. The ethics of hernial affections as they affect recruiting for the Army is that every man within the age limits should have his hernia treated by operation, and if the result is good he is quite fit to take up general service in the Army. How many have done this? Few, if any, it is to be feared; the subject of hernia continues to wear his truss and invariably is rejected for service. The State should insist upon cure, or call him up, put him under treatment for radical cure, and when a sufficient lapse of time has intervened to show that the result is satisfactory, insist that he shall perform his duty to the State. The "Physical Shirker" is as much to be condemned as the "Conscientious Objector," and should be dealt with accordingly.

(4) *Undescended Testicle.*—In the Navy undescended testicle is considered sufficient to reject a recruit. It came about in this way: whilst a certain Director-General of the Navy was a young surgeon in the service a sailor got orchitis in an undescended testicle. The case was so difficult to diagnose and so troublesome to treat that the surgeon declared that if ever he became Director-General he would regard an undescended testicle as a barrier to anyone joining the Navy. This eventuality came about; hence the present regulation.

Whilst this Director-General was in power a young man was rejected for an undescended left testicle As this organ prevented his joining according to regulation he had it removed, and on going up again was once more rejected owing to defective formation; but the man had friends, who interested themselves in the matter and got the candidate accepted.

Should a man with an undescended testicle be accepted for civil life in the Tropics? Provisionally it may be said "yes." If the testicle can be felt in the inguinal canal the faulty position can be cured by operation, that is, the testicle can be brought down into the scrotum or, at any rate, through the external abdominal ring, and held there. If, however, it is not apparent the chances of disease occurring are so remote as to be practically negligible.

Talipes affections of the feet, although a good reason for rejection by the Army as far as service

in the field is concerned, need not hinder a man being accepted for civil life in the Tropics. Of course, on rubber and tea estates a good deal of walking may have to be done, but a moderate or even a marked amount of, say, talipes equinus, or even talipes equino-varus need not prove so detrimental to walking as to render him incapable of doing his day's work on the estate. For those engaged in sedentary work talipes does not prove a barrier to acceptance.

Annotations.

Magnesium Sulphate in Treatment of Chorea (Schroeder, *Ugeskrift for Læger*, September 7).—Nine cases of chorea minor in children and two cases in adults. The chorea was of two or three months' standing in most of the patients. The range was from two weeks to three years. Rebellious to all other measures tried, but yielding to subcutaneous injections of a 20 per cent. solution (by volume) of magnesium sulphate ($MgSO_4$) in small, slowly increased doses, from 0·2 grm. to 3 grm. a day, or, in the very severe cases, up to 8 grm. a day. The results were so good that in hospitals it might be justifiable to give this method of treatment a trial, keeping the patients under surveillance. The improvement under the dosage given and the return of symptoms when the drug was tentatively suspended confirmed its therapeutic possibilities. When Schroeder began this treatment he had no knowledge of others having applied it, but he later found records of its having been used by Calcaterra, Marinesco, Caronia, and Grober, but all injected the drug by the intravenous or intraspinal technique. The subcutaneous route does not seem to have been used.

Antiseptic Irrigation in Traumatic Meningitis (P. Costantini, *Gazzetta degli Ospedali e delle Cliniche*, September 10).—A young man developed severe meningitis four days after a bicycle accident with probable fracture of the base of the skull. Lumbar puncture showed the cerebrospinal fluid under high pressure and turbid. After withdrawal of 100 c.c., 5 c.c. of an isotonic solution of a colloidal silver preparation was injected into the spinal canal. Improvement was evident at once, and a complete cure followed in less than three weeks from the first signs of trouble. He repeated this local medication daily for five, for three, and for two days with intermissions of three days. The course was concluded with four daily injections of 3 c.c. of a 3 per cent. solution of phenol instead of the silver salt. He did not hesitate to withdraw from 80 to 100 c.c. of the fluid. The head was lowered below the rest of the body as soon as the drug was injected. The cerebrospinal fluid showed signs of acute inflammation, but bacteriologic tests were constantly negative. In Costantini's eighteen other cases of meningitis, meningococci were always found.

Technique for Intramuscular Injection of Drugs (A. Kissmeyer, *Ugeskrift for Læger*, September 7).—Neuritis of the sciatic nerve develops after intramuscular injection of salvarsan. To avoid such a complication the patient should stand, bending forward a little, supporting himself against a table or the back of a chair, bending slightly towards the side where the injection is to be made, to relax the muscles. On the reclining patient it is difficult to find the right place, as the anatomic conditions are somewhat altered. The physician sits on a high stool, back of the patient, and marks the crest of the ilium and a line two finger-breadths below the highest point of the crest. Another line is marked two finger-breadths behind the trochanter. Where these lines intersect is the best point to insert the needle to avoid nerves and vessels. The cannula is pushed in very slowly, supporting the hands by the ulnar margin against the patient. The tip of the cannula should point towards the middle and downward. When the cannula is in place, the patient is asked whether he feels any pain, especially pain radiating into the legs. If he does, the tip of the cannula is drawn partly out and turned to point it a little more towards the side. If the tip hits against bone, it should be withdrawn a trifle. After waiting a little to be sure that no blood drips from the cannula, the injection of the drug proceeds. The injection itself does not cause much pain if amounts not too large are used. His usual dose is 0·4 or 0·5 grm. salvarsan in 3·5 c.c. oil. The pain that follows may be soothed with a little sedative, and seldom is felt longer than for one day.

Optochin Amaurosis (A. Adler, *Therapeutische Monatshefte*, September).—Even the therapeutic dose of optochin is liable to seriously impair vision. In the first of the three cases the amaurosis lasted for twelve hours but then subsided, leaving permanent severe changes in the retina. In the second case the impairment of vision kept up for several months and vision is not completely normal even nearly a year later. The drug was suspended at the first signs of trouble, but the condition grew worse to complete amaurosis the following day. These patients were young women. In the third case the patient was a child under 2, and the amaurosis was complete, and persisted for a week after suspension of the optochin. In the seven cases on record in which the ophthalmoscopic findings are reported, the findings were closely similar to these three cases. They suggest that the amaurosis is a quinine amaurosis. With the latter drug, however, it develops only when large doses are given, while relatively small doses of the optochin have sufficed to bring it on, in one case only two 0·25 grm. doses. The visual disturbances occur in a far larger proportion of the patients using optochin than with quinine. In conclusion, it is not justifiable henceforth to use or recommend optochin until further study of the subject. It may be possible to obtain equally good results with smaller doses or to eliminate from the drug the special constituent which acts on the apparatus of vision.

Abstracts.

COMPARATIVE RESULTS IN ANTIRABIC TREATMENT WITH THE PASTEUR METHOD AND WITH DESICCATED VIRUS.[1]

By D. L. Harris.

Of the various modifications adopted, the earliest was based on the fact that Pasteur's attenuation of cords by drying resulted only in a numerical destruction of the organisms. A scheme was devised of diluting fresh virus and injecting increasing quantities from day to day. The use of this scheme had been followed by excellent results. Ferran advocated and used small quantities of emulsified fresh cord. Proescher injects a relatively thick emulsion of fresh brain, and gives fewer injections. Calmette introduced the use of glycerol for preserving the cords. Fermi kills the organism by emulsifying the cord in 1 per cent. phenol (carbolic acid) and injects this non-infective material. He claims his results are better than can be attained with the Pasteur method. Marie,[2] in the Pasteur Institute, gives a sensitized virus which has been acted on by antirabic serum. His results are better than those obtained in the institute before the adoption of this modification. Excellent results have followed the use of virus dialyzed according to the method proposed by Cummings.[3]

The modification of the Pasteur method described now is founded on Shackell's[4] very original investigations on the effect of desiccation *in vacuo* at a low temperature. This method has for its object the preservation of fixed virus, in order that it may be prepared in quantity and be always available for treatment. By using both brain and cord enough material is obtainable for thirty complete treatments with the virus from a single rabbit; and since the material can be stored until needed there is no waste, and no unnecessary work is required of the laboratory staff during periods when patients are lacking or very few. Furthermore, with this product, treatment may be administered in less than half the number of days required by the original method.

The preparation of the material is as follows: Brain and cord, stripped of pia and blood-vessels, are ground in a mortar into homogeneous, thick, paste-like mass; carbon dioxide snow, collected from a tank into a sterile cloth, is added to the paste until freezing is complete and until further grinding reduces the mass to a fine powder. This powder is transferred quickly to a cold beaker, and placed in a Schibler's jar which has been submerged in a mixture of salt and ice (−18° C.). In the upper part of the jar is a beaker of concentrated sulphuric acid. A vacuum of less than 2 mm. is produced and the powdered brain is kept at −18° C. in the salt and ice until desiccation is complete. A single brain and cord will be completely dehydrated in from thirty-six to forty-eight hours. A more detailed description of the technique may be found in the published papers relating to this method.[1] If the brain and cord have been thoroughly ground, completely frozen and absolutely dried at a temperature not above −18° C., the resulting powder will be almost as infective as the fresh untreated brain and cord. When kept *in vacuo* at 0° C. there is no appreciable loss in infectivity for several months. When kept in an ice box (8° to 10° C.) for 500 days this powder is five times as infective as an equal quantity by weight of Pasteur's cord that has dried five days.

Harvey and McKendrick[2] have shown that when cords are dried slowly over potassium hydroxide the loss of infectivity is proportionate to the loss of water. They conclude that the small amount of water remaining in the cord after the ninth day is insufficient to keep the rabies organisms alive. Vansteenbergh[3] had already succeeded, some years before, in preserving the infectivity of rabies virus by drying this very rapidly *in vacuo*. In his experiments the material was spread out in a very thin layer and the vacuum produced very quickly at room temperature. The dried powder retained its infectivity for some months if kept in the dark, free from moisture; but the amount of infectivity so preserved was very small. Our explanation of the apparently contradictory results of these two methods of dehydration is that in slow dehydration the salts and other soluble materials in the cells of the brain and cord become more and more concentrated until a point is reached at which this concentration becomes sufficiently toxic to kill the enclosed organisms of rabies by direct chemical action. In the brain and cord dried over potassium hydroxide the loss of infectivity is proportional to the resultant concentration of the soluble substance. Vansteenbergh's partial success in desiccation *in vacuo* is due to the rapidity of the dehydration and partial avoidaunce of too great concentration. If the cord and brain are frozen and then desiccated, cell after cell is deprived of its ice, molecule by molecule, by volatilization, and, depending on the degree of freezing, there is therefore little or no possible concentration of salts or other soluble products. So long as the dried brain is kept dry its infectivity alters very slowly; but if this powder, which is hydroscopic, is exposed to air, water is absorbed, deliquescence occurs, chemical action begins, and all the infectivity is quickly lost. The amount of infectivity remaining after vacuum desiccation depends on the degree to which the

[1] Abstracted from the *Journ. of the Amer. Med. Assoc.*, September 23.
[2] Marie: "L'étude expérimentale de la rage," Paris, 1903.
[3] Cummings: *Journ. Infect. Dis.*, 1914, xiv, No. 1.
[4] Shackell: *Amer. Journ. Physiol.*, 1909, xxiv, 325.

[1] Harris: *Journ. Infect. Dis.*, 1912, x, 369; *ibid.*, xi, 397; *ibid.*, 1913, xiii, 155; *ibid., Ann. de l'Inst. Pasteur*, 1912, xxvi, 372.
[2] Harvey and McKendrick: "Theory and Practice of Antirabic Immunity," Calcutta, 1907.
[3] Vansteenbergh: *Compt. rend. Soc. de Biol.*, 1908, lv, 1046.

material is kept frozen during the extraction. The preservation of infectivity afterward depends on its absolute freedom from moisture.

Numerous tests made with various lots of our desiccated virus showed the loss of infectivity to be constant and uniform, and demonstrated the value of the method as a means of preserving the virus. Experiments were therefore begun on dogs and rabbits to determine its value in immunization, and these showed conclusively that the material could be used with great advantage in antirabic immunization of rabbits and dogs. The results have recently been confirmed in the New York City Health Department laboratories.

The conclusion reached is that the desiccated virus produces immunity more quickly than the Pasteur cords.

I have used this material during the past four years in the treatment of patients, and have been able to collect data on 1,159 patients treated with it. Of these cases, 359 were treated by me, 222 in the State Board of Health laboratory of Indiana, and 618 in the Charity Hospital, New Orleans. Of this number, one died during the treatment, and one fourteen days after the first injection. With these two exceptions, there were no deaths and no cases of paralysis. If we follow the example of Pasteur, who included cases developing in less than fifteen days after completion of treatment, and exclude these two cases, the mortality is zero. But excluding one death in which symptoms developed on the tenth day during the treatment, and including the other, in which treatment had been completed, but in which symptoms developed on the fourteenth day after the first injection, there is a mortality of less than 0·1 per cent., a result that compares favourably with any of the other modifications.

Table I includes 319 patients treated in St. Louis and 618 in New Orleans.

TABLE I.—DATA OF NINE HUNDRED AND THIRTY-SEVEN PATIENTS TREATED FOR RABIES.

	Head	Hand and Forearm	Body and lower Extremity	Contact	Total
Rabid	40	209	124	98	471
Probably rabid	25	159	95	—	279
Unknown ..	7	61	67	1	136
Probably not rabid	6	28	17	—	51
Total ..	..	..	..	..	937

Table II includes 222 patients treated by the Indiana State Board of Health laboratory with virus furnished by Eli Lilly and Co.

The amount of desiccated virus and the number of injections used in the experimental work and in the cases treated were decided on after a study of the scheme of injecting 54·575 mg. of cord in fourteen days in light cases, and 94·47 mg. in twenty days in bites on the face and head. Most writers agree that immunity is produced by the more or less altered rabies organism, and that the degree of immunity is proportional to the number of infective specific organisms injected. The infectivity of the cord is such that $\frac{1}{10}$ mg. is the least amount that will constantly infect rabbits. Expressed in terms of infectivity, in mild cases 2,183 times the minimal infective dose is injected; in severe cases, 3,898. Harvey and McKendrick calculate that in the Pasteur light scheme this number of times the minimal infective dose is 2,160.

TABLE II.—DATA OF PATIENTS TREATED BY ELI LILLY VIRUS.

Sex	No. Patients
Male patients	67
Female patients	32
Children, both male and female	123
Total	222

Where bitten or exposed	No. Patients
Head	2
Face	26
Hands	67
Feet	13
Legs	36
Arm	25
Body	5
External genitals	1
Cut by knife	1
Abrasion on hands	45
Handling child dying of hydrophobia	1
	222

TABLE III.—RESULT OF EXAMINATION OF ANIMALS.

Exposure	No. Patients
Bitten by rabid dogs	99
Bitten by dogs with positive Gasserian ganglion	60
Bitten by dogs, probably rabid	28
Bitten by dogs which got away	25
Bitten by dogs, probably not rabid	1
Cut by knife	1
Bitten or exposed to infection from saliva from cows whose brains were found to contain Negri bodies	8
	222

TABLE IV.—TREATMENT.

	No. Patients
Seven injections, 6,750 units	62
Fourteen injections, 19,250 units	71
Eighteen injections, 27,350 units	99
	222

TABLE V.—NATURE OF THE WOUNDS AND EXPOSURE.

Character of Exposure	No. Patients
Slight bites	74
Severe bites	103
Exposed to infection by contact	44
Handling hydrophobia patients	1
	222

The minimal infective dose of desiccated brain and cord is $\frac{1}{3\,5\,0}$ mg., and one can easily inject many times the total infective doses usually contained in Pasteur's scheme with a much smaller proportion of foreign nerve material. I prefer to give 500 minimal infective doses, or units, at the first injection; 1,000 units at the second; 2,500 each at

the fifth, sixth, and seventh. In severe cases the daily dose after the fourth injection may be 3,000. The usual mild case is treated in six or seven days; severely bitten patients are treated ten to fifteen days. Mildly injured persons received from 7,000 to 10,000 units. Dangerously bitten patients have received 30,000 to 70,000 units, or twenty times more than that given by Pasteur. In the treatment of a dangerously bitten patient the following record will serve as an example:—

J. M., man, aged 24, bitten July 8, 1915, on the septum of the nose by his own dog. The wound bled freely, but was not cauterized. The dog developed rabies two days later, and died five days later. Negri bodies were present. Treatment was begun six days after the injury. Injections were made as shown in Table 6.

TABLE VI.—ILLUSTRATIVE ANTIRABIC TREATMENT.

Date	Amt., Mg.	No. Units
July 14	50	500
,, 15, a.m.	15	1,000
,, 15, p.m.	25	2,000
,, 16, a.m.	10	2,000
,, 16, p.m.	15	3,000
,, 17, a.m.	15	3,000
,, 17, p.m.	15	3,000
,, 18, ...	20	4,000
,, 19, a.m.	15	3,000
,, 19, p.m.	15	3,000
,, 20, a.m.	15	3,000
,, 20, p.m.	20	3,000
,, 21	20	4,000
,, 22	15	3,000
,, 23	20	4,000
,, 24	20	4,000
,, 25	20	4,000
,, 26	25	5,000
,, 27	20	4,000
,, 28	20	4,000
,, 29	20	4,000
Total	315	66,500

Of the 1,159 persons treated with this material two died of hydrophobia. At New Orleans the single failure was that of a 2-year-old negro child who received a slight wound over the right eye October 6, 1915. Eight days later the mother applied for treatment, and the treatment was begun on that day. On the eleventh day of a fifteen-day treatment the child developed symptoms of hydrophobia, and the treatment was discontinued. The child died two days later. The wound was not cauterized at the time the injury was inflicted, and when the patient came for treatment the wound was completely healed.

The other death occurred in my own series. The history in this case is as follows:—

L. P., man, aged 52, farmer, was bitten July 1, 1913, by his own dog, which was killed, and in whose brain Negri bodies were abundant. The patient was thrown to the ground by the dog, which then grabbed the hand in his mouth with the resulting extensive lacerations and deep penetrating wounds. Treatment was begun five days later, the injections being as shown in Table VII.

TABLE VII.—TREATMENT IN THE CASE OF L.P.

Date	No. Units
July 6, 1913, a.m.	500
,, 6, ,, p.m.	1,500
,, 7, ,, a.m.	1,000
,, 7, ,, p.m.	1,500
,, 8, ,, a.m.	2,000
,, 8, ,, p.m.	2,000
,, 9, ,, a.m.	2,500
,, 9, ,, p.m.	2,500
,, 10, ,, ...	2,500
,, 11, ,, ...	2,500
,, 12. ,, a.m.	2,500
,, 13, ,, p.m.	3,000
Total	24,000

The twelve injections were given within a period of seven days at the urgent request of the patient, who desired to return home at harvest time. After his return he worked in the sun during exceedingly hot weather and became very much exhausted. On July 21, twenty days after he was bitten and fifteen days after the first injection, symptoms of hydrophobia appeared. He died of convulsions on the twenty-seventh.

If the value of this material in antirabic treatment can be judged by this record of 1,159 cases treated with but these two failures, in both of whom the disease developed before the possibility of antibody formation, the results obtainable will compare favourably with those obtained by other modifications of the original method.

Assuming from these data that the material has an efficient immunizing power, we can see that it possesses another, though minor, advantage over the Pasteur method. The average time required for the complete administration of the treatment is less than one-half the time required by the Pasteur method. The 936 patients treated at New Orleans and by me averaged less than ten days per patient, a saving of more than 9,000 days of treatment over what would have been required had we followed the Pasteur scheme. This is a matter of great importance to those who are obliged to travel from home to the city for treatment. As a concrete instance, the State Board of Health of Indiana has a fund for caring for indigent patients while they are receiving antirabic treatment. In one year the amount spent by the State for board was $900 less than it would have been had these patients received the usual Pasteur scheme.

THE TREATMENT OF CERTAIN DISEASES OF PROTOZOAL ORIGIN BY TARTAR EMETIC, ALONE AND IN COMBINATION.[1]

By ALDO CASTELLANI.

THE great efficacy of tartar emetic in some diseases of protozoal origin has generally been recognized in trypanosomiasis, and in espundia and

[1] Abstracted from the *British Medical Journal*, October 21, 1916.

ulcerating granuloma, while I myself in the Tropics first used it in kala-azar.

This paper gives further results in the use of tartar emetic alone or in combination with the other drugs in yaws (framboesia), kala-azar, Oriental sore, and relapsing fever.

Recent modifications in the preparation of the mixture of 1914 are as follows:—

Tartar emetic	..	..	..	gr. j
Sod. bicarb.	..	..	..	gr. xv
Sod. salicyl.	..	..	..	gr. x
Potass. iodid.	..	..	..	℥j
Glycerine	..	..	..	ʒij
Or syrup	..	..	..	℥j
Or sod. tartarat.	..	..	..	gr. x
Aquae	..	..	ad	℥j

It is given in the same doses as the original formula, and, as is the case with the original mixture, only half doses should be given to European patients. It should always be given diluted with water.

Kala-azar.

Tartar emetic was first used in the treatment of kala-azar in 1914 by myself. In Corfu, where I have been recently stationed for several months, infantile leishmaniasis is fairly common, as shown by Gabbi and others, and I have had the opportunity of treating four cases there; all were children between 2 and 4 years of age. One of the children was in a dying condition when the treatment was started, and died five days after. The other three cases all recovered, and in them tartar emetic was given solely by intravenous injections in one; in another by intravenous injections, intramuscular injections, and by oral administration; in the third one the drug was given by intramuscular injections and by the mouth.

Intravenous Injections.

The usual 1 per cent. tartar emetic solution in sterilized normal saline answers well: 2 to 10 c.c. of this solution are given daily for five to ten days, then every other day or twice a week. At times, especially in cases of relapsing fever, the following formula was used:—

Tartar emetic	..	..	4 grm.
Sol. acid. carbolici (2 per cent.)		..	100 cc.

Half to 2 c.c. is diluted at the time of injection with sufficient sterile saline to bring it to 5 c.c., and the whole injected into a vein, taking the usual precautions. It is, of course, necessary to make sure that the needle is actually in the vein, and that none of the fluid escapes in the surrounding tissues.

Intramuscular Injections.

These are extremely convenient, and especially useful in children in whom the superficial veins are often small. Unfortunately, as well known, the usual solutions of tartar emetic and other antimonial salts are very painful when given in this way, and may induce the formation of an abscess. The following formulæ, however, will be found fairly satisfactory:—

Formula I.

Tartar emetic	..	..	..	gr. viij
Ac. carbol.	..	..	..	♏ x
Glycerine	..	..	..	ʒiij
Aq. dest.	..	..	ad	℥j

Half to 1 c.c. every other day in the gluteal regions by intramuscular injection.

At the time of the injection the patient, as a rule, feels absolutely no pain, but a few hours later in most cases there is a certain amount of inflammation accompanied by a modicum of pain, which is quite bearable, and followed by a slight amount of localized infiltration, comparable to what one sees after intramuscular injections of quinine hydrochloride or mercury perchloride salt solution (1 in 1,000), though generally very much less severe. If the pain and infiltration should be severe, hot fomentation will be found very useful. The presence of carbolic acid decreases the pain induced by tartar emetic and makes the solution sterile. The solution is prepared in bulk in a sterile bottle, and tested for sterility forty-eight hours after preparation; it may then be put up in small 1 c.c. ampoules, which it is advisable to keep in a cool, dark place.

Formula II.

Tartar emetic	..	..	..	gr. viij
Ac. carbol.	..	..	..	♏ x
Glycerine	..	..	..	ʒiij
Sod. bicarb.	..	..	..	gr. ½
Aq. dest.	..	..	ad	℥j

The only difference from No. 1 formula is the presence of sodium bicarbonate, which makes it slightly alkaline, while No. 1 is slightly acid. The results seem to be the same, and the pain induced by it appears to be about the same as with formula No. 1.

Formula III (Martindale).

Antimonii oxidi	..	..	..	gr. ⅛
Glycerine	..	..	āā	♏ xv
Aq. dest.	..	..		

(One ampoule)

This preparation is good and its use practically painless, but the impression is that the curative action of antimonium oxide is inferior to tartar emetic.

Oral Administration.

The oral administration of the drug is often useful in conjunction with the intravenous or intramuscular injections. The following is the formula of the mixture:—

Tartar emetic	..	..	..	gr. v.
Sod. bicarb.	..	..	..	gr. xxx
Glycerine	..	..	..	℥j
Aq. chlorof.	..	..	..	℥j
Aquae	..	..	ad	ʒiij

(℥j to ʒij in water t.d.)

In adults the dose can be doubled. It may be noted that in the very first case of kala-azar treated with tartar emetic, besides giving it intravenously,

it was also given by the mouth in the form of my yaws mixture.

Oriental Sore.

The curative effect of tartar emetic in dermal leishmaniasis has been noted by many observers. Recently a case in Corfu, a boy, aged 16, with a typical oriental sore on the left cheek; microscopical examination positive; received twelve intramuscular injections (formula No. 1), and took two teaspoonfuls of the tartar emetic mixture three times a day. A complete cure was obtained very rapidly. In this case the signs of improvement appeared so quickly that no local treatment was used, though the local application of antimonial ointment is often successful, even when it is the only treatment carried out.

Relapsing Fever.

Tartar emetic was used in fourteen cases of relapsing fever in Macedonia last year and three cases in Corfu this year. Tartar emetic appears to be beneficial in relapsing fever, but far less so than salvarsan, neo-salvarsan, and similar preparations. It seldom cuts short the first attack of fever, but in a large percentage of cases it has apparently prevented the relapses. I have generally given it once or twice daily by intravenous injections, using the usual 1 per cent. tartar emetic saline solution (2 to 10 c.c. at a time), or oftener, and I think with better results, the tartar emetic carbolic solution the formula of which I have already given.

In a few cases I have given also intramuscular injections (formulas Nos. 1 and 2) and by the mouth. For oral administration I have generally used the tartar emetic, glycerine, bicarbonate mixture I have already mentioned. At times I have used the yaws mixture (one-third doses), in which I have incorporated liquor arenicalis 3 to 5 minims in each case. The intravenous injections give the best results.

Conclusion.

Tartar emetic is of great efficacy in various protozoal diseases. Its powerful action in trypanosomiasis has been well proved, and it can be considered a specific in espundia, granuloma inguinale, kala-azar, and oriental sore. It is efficacious in yaws, especially if combined with other drugs, and seems to have a beneficial action also in relapsing fever.

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INTRAVENOUS INJECTION OF GYNOCARDATE OF SODA IN LEPROSY.[1]

By Sir Leonard Rogers.

Method of Preparation of Sodium Gynocardates.[2]

These substances may be prepared either from the cold-drawn chaulmoogra oil, or from the buttery substance obtained by further compression of the seed of *Taraktogenos kurzii* (products of which alone are dealt with in this paper, although hydnocarpus oils are also being investigated, but the soluble sodium soaps of which have been found to be more irritating when injected subcutaneously than those of *Taraktogenos kurzii*) with the aid of heat obtained by steam circulating around the compression chamber. Hitherto this product has been regarded as a waste product, although it contains a large proportion of the active substances of the oil. Briefly, the method of preparation is to saponify the oil or butter with caustic potash and absolute alcohol, the soaps thus obtained being converted into fatty acids by means of sulphuric acid. These fatty acids are dissolved in hot alcohol and separated into fractions with varying melting points by gradual cooling and removal of the acids, which solidify at differing degrees. The fractions thus obtained may be further purified by dissolving in ether and recovering again by evaporating off the solvent, by which means they are rendered somewhat less irritating when the sodium salts are injected subcutaneously, for which purpose they must be neutralized accurately with the aid of phenolphthalein. When about two-thirds of the fatty acids have thus been separated the residual third, which is liquid at room temperature in Calcutta (about 28° C.), is obtained by distilling off the alcohol, and may be provisionally termed gynocardic acid C. Of the first separated two-thirds those with the higher melting points of from 43° to 40·8° C. form sodium soaps which are insoluble, or only slightly soluble, in water, and may be termed fraction A. They include palmitic and chaulmoogric acids, and are unsuited for either hypodermic or intravenous use, while it is very doubtful if they are of any value internally. They constitute about half of the total fatty acids. The remaining acids of this two-thirds have melting points from 37° to 40° C., and form sodium soaps which are freely soluble in water and may be termed gynocardic acid B. A still larger number of fractions may be separated out if desired, as we have recently done. The best product for clinical use which we have yet obtained was got by extracting finely divided and dried Taraktogenos seeds with ether and subsequent fractionization as above. The sodium soaps of

[1] Abstracted from the *British Medical Journal*, October 21, 1916.

[2] Messrs. Smith, Stanistreet and Co. of Calcutta (London agents, Messrs. Evans, Sons, Lescher, and Webb, Ltd., 60, St. Bartholomew's Close) can supply gynocardate of soda made in accordance with my directions either in powder form or in solution in sterile capsules ready for intravenous injection.

fractions B and C mixed together caused very little local irritation when injected subcutaneously, while the observations on intravenous injections recorded later in this paper are mainly based on the use of this product, which clearly contains all the lower melting point acids of both the cold compressed oil and the butter obtained by further compression of the seeds with heat. It will be referred to as fractions B and C of the whole seed.

Further Results of Subcutaneous Injections of Gynocardate of Soda.

First, with regard to the further progress of the three cases. *Case* 1 has not been seen again, but I have received reports that the satisfactory condition recorded previously is maintained. *Case* 2 wrote to me several months after his return to Europe that a leading British authority had declared him to be free from all active signs of the disease, so he may be regarded as apparently cured, although a longer period must elapse before it will be evident if the recovery will be permanent. *Case* 3 is still under observation, although she has only been able to attend very irregularly for the injections. After a month's absence she returned with slight recrudescence of the macular patches, but improved again with further treatment, but is still not clear of the disease, having given the method no fair trial.

Owing to my cases having been, with one exception, entirely out-patients or very advanced cases in a leper asylum, and to the earlier preparations in particular having given rise to considerable local pain and induration, only one patient has been under observation for the full period of a year, and eight more have been under regular treatment for six months and over. Five of the cases were of the anæsthetic type and four tubercular. The former includes the patient who has been under observation for a full year, and at the end of eight months all the light patches had disappeared and sensation had returned in them, which was complete except in the largest patch, where there is still slight loss of response to a light touch. An ulcer early healed, and he has regained power in one foot which previously showed foot-drop. During the last four months he has only received occasional injections, so as to keep him under observation, and he continues free from symptoms and appears to be practically cured. Two other cases in which the hands were affected have nearly regained the lost anæsthesia and some power, and continue to improve steadily. The fourth case showed typical claw hands, with great loss of sensation and power, and also foot-drop, as well as anæsthetic patches on the face and neck. After six months' treatment he has regained nearly all the lost sensation, except in one hand, where it is partially restored, and much of the power, being able to shave himself with a razor, and his case is most promising. The fifth anæsthetic patient improved so much that after eight months he considered himself cured, and went to his country against advice. He returned after four months with some return of anæsthesia, and is improving again under the intravenous treatment. The results, then, in the anæsthetic cases may be regarded as very promising.

Of the four tubercular cases one advanced case in a boy has been under treatment for ten months, during which greatly thickened and nodular ears have become smooth, and his face is now normal. Very few broken-down bacilli could be found at the last microscopical examination, and he appears to be nearly free from the disease, the improvement having been most remarkable. The second case showed a number of tubercles on the chin and nose, up to ¼in. in diameter, a most advanced case. Here again the improvement after eight months had been great, although numerous bacilli can still be found, and progress is slow. It has been more rapid since intravenous injections have been given. Two other cases with well marked facial affection have also greatly improved after seven and eight months' treatment respectively, but are still not well. In addition, an earlier case with affection of the face, and hard nodes on the arms containing numerous bacilli at first, after treatment for four months has lost nearly all his lesions, and no leprosy bacilli could be found in the remains of a node recently examined, so in this case the outlook is very hopeful. On the whole the tubercular cases have responded rather more slowly to the treatment than the anæsthetic ones, while there is greater local pain and induration at the sites of the injections in the former class. It is not improbable that intramuscular injections of sodium gynocardate would be more rapidly absorbed and more effective than subcutaneous ones. Dr. Victor G. Heiser,[1] obtained his very favourable results in leprosy by intramuscular injections of chaulmoogra oil combined with camphorated oil and resorcin.

Technique and Advantages of Intravenous Injections of Sodium Gynocardates.

A 2 or 3 per cent. solution may be made in distilled water (or normal saline), and after sterilization in an autoclave ½ per cent. carbolic acid is added. For intravenous use the solution should be quite clear, and if any precipitate forms it should be filtered and resterilized. The veins in the forearm are distended by stretching a stout piece of rubber tubing around the upper arm, one end being put through in a loop under the other, so that it can be rapidly loosened by pulling out the loop. If the veins are very small the air bag of a sphygmomanometer may be used and pumped as tight as necessary to fully distend the veins. The selected vein is punctured through the skin of the forearm or hand with a fine sharp needle, and, if there is any doubt about the vessel having been entered, a drop of blood may be drawn up into the syringe, and the whole quickly injected before clotting can take

[1] *Amer. Journ. Trop. Dis.*, 1914, p. 300, and *New York Med. Journ.*, February 12, 1916, p. 289.

place. The pressure band may now be released, the needle withdrawn, and collodion applied on cotton-wool. Little or no irritation results if some of a 2 per cent. solution escapes into the tissues around the vein, so the same vessel may be used repeatedly.

The two great advantages of the intravenous over the subcutaneous method are its painlessness and greater efficiency. As nearly all my cases are Indian out-patients, over whom there is no control, some of them ceased to attend long before any material result could be expected from the subcutaneous injection on account of the pain and induration at the seat of injection. Since the intravenous route has been used no such disappointments have been experienced. Of much greater importance is the more rapid improvement which has been observed to follow the intravenous injections, which is already clearly evident. Several months are required to produce any decided improvement by the subcutaneous method, while, especially in tubercular cases, the progress is apt to be disappointingly slow even after it has started. It is far too early to say what will be the ultimate results of the intravenous medication, but my present experience is decidedly encouraging.

Local Reactions in the Affected Parts.

The most striking result is the occurrence of definite local reactions in the diseased tissues, sometimes accompanied by fever, which has been seen in several cases after from two-fifths to three-fifths of a grain of sodium gynocardate intravenously, of a degree that I have not seen occur more marked than after subcutaneous injections, although Dr. Heiser[1] has recorded some local reaction after intramuscular injections of chaulmoogra oil, and in the neighbourhood where the subcutaneous injections of gynocardates have been made improvement is most rapid. The most decided reaction was in the greatly thickened ears of a tubercular case, in whom fever occurred for three days with redness and swelling of the helix, accompanied by some serous discharge containing broken-down leprosy bacilli. After the subsidence of the reaction at the end of ten days the diseased tissues were decidedly softer and less indurated than before, while nodules on the face, not showing the local reaction, were also diminished in size. In another case with very large tubercles on the face, a similar but less acute reaction was also followed by distinct improvement. In two anæsthetic cases, with greatly thickened ulnar nerves, tenderness and slight swelling appeared in the affected portions after intravenous injections, which has been followed by some return of sensation in previously anæsthetic areas of the hand. One of these patients also had fever, but had been previously subject to it. It is thus clear that intravenous injections of the drug have produced selective local reactions in the diseased tissues, which have been most evident in those patients with the greatest amount of infiltration of the tissues with leprosy bacilli, so they are most interesting and suggestive. It is too early to say whether the drug should be pushed to the extent of producing such reactions, but they are decidedly beneficial when moderate in degree, while no ill effect has yet been seen to follow them, although the possibility of dissemination of the bacilli in the body must not be lost sight of.

[1] *Loc. cit.*

Conclusions.

After giving about 200 intravenous injections of gynocardate, my experience has led me to substitute it almost entirely for the subcutaneous method. Further experience is required to ascertain how far it is advisable to push the doses, but there can be little room for doubt that even ½ gr. intravenously is likely to have a greater effect than 4 gr. slowly absorbed from a subcutaneous injection. My present impression is that the intravenous method is likely to prove as great an advance on the subcutaneous one as the latter has in my hands on the oral administration of gynocardates or chaulmoogra oil. No claim is made to cure leprosy, although in time even this may eventually result from continued researches on the lines indicated, which are largely an extension of Dr. Heiser's important work on the treatment of leprosy by injections of chaulmoogra oil.

In conclusion, the reactions produced by gynocardates in leprous tissues, and the apparent destruction of Hansen's bacillus, raises the very important question as to whether some such similar reaction may not be obtained in the case of another human acid-fast bacillus—namely, that of tuberculous disease. Fortunately, this hypothesis can be tested by animal experiment.

Notices of Books.

MOSQUITO CONTROL IN PANAMA.

A volume of interest, written by J. A. Le Prince and A. J. Orenstein, and issued by G. Putnam's Sons, New York and London, gives an engrossing account of the work done to render the Panama Canal area hygienic and sanitary. The story is fairly well known, but only in a general way, but in the account given by the authors the details and the difficulties to be surmounted are set forth in an engaging and fascinating manner. Not only is the Panama environment dealt with, but the eradication of the malaria and yellow fever-bearing mosquitoes in Cuba is also included in the story of the Panama region. We welcome this account of the great work accomplished by Colonel Gorgas and his colleagues, and the fact that Mr. J. A. Le Prince, one of the authors, was the Chief Sanitary Inspector to the Isthmian Canal Commission from 1904 to 1914 lends authority to the account here set forth. The volume extends to 335 pages, and is sold at 10s. 6d.

Original Communication.

THE METEOROLOGY OF MALARIA.

Malarial Fevers in England.

By Mathew D. O'Connell, M.D.

In the Journal of Tropical Medicine and Hygiene of March 15, 1916, I gave hourly meteorological observations at Kew for a continuous period of forty-eight hours on August 12 and 13, 1911, and from comparison of these with those which raised body temperature above normal in the humid cotton-weaving sheds I concluded that the atmospheric conditions at Kew on the dates mentioned are not such as would raise body temperature as much as the atmospheric conditions in the humid cotton-weaving sheds did. But the latter only raised body temperature to 37·7° C. (100° F.). The conditions at Kew were not, therefore, such as would cause pyrexia.

a period when, according to the *Lancet*, malarial fevers were quite common in England.

Meteorological observations at Greenwich in 1843 were only recorded every two hours, and the hours and dates given in the table are those of the Gottingen reckoning. The records are taken from the volume of meteorological observations for 1843, for which I have to thank W. W. Bryan, Esq., Assistant to the Astronomer Royal.

In line with the record of each observation in the table I have placed, for comparison, details of atmospheric conditions which were found to raise body temperature to 37·7° C. (100° F.), and even higher in less than four hours. These are taken from Appendices to the Reports of the Departmental Committee on "Humidity and Ventilation in the Humid Cotton and Linen-weaving Sheds." I have added to the latter three observations marked (*), made by me in glasshouses artificially heated and humified. On entering these glasshouses I observed the body temperature rose in one instance from 98·4° F. to 99·5° F., and on another

Atmospheric conditions recorded at the Royal Observatory, Greenwich, August 31—September 1, 1843

Atmospheric conditions which raised body temperature above normal in the cotton-weaving sheds

Degree to which body temperature was raised in the cotton-weaving sheds

Date and hour on the Gottingen and Astronomical reckoning at Greenwich	Temperature of air, F.	Drying power of air per 10 cubic feet	Velocity of wind per hour	Remarks	Temperature of air, F.	Drying power of air per 10 cubic feet	Rate of movement of air per hour	Body temperature in mouth, F.	Pulse	Respiration
1843	Dry	Wet	Grains	Miles		Dry	Wet	Grains	Miles			
August 31, 12 hrs. midnight	58·7	58·7	0·0	calm	warm hazy fog	No observations of atmospheric conditions in the weaving sheds were recorded having a dry bulb temperature of air below 69·0 F., or a wet bulb temperature below 65·0 F.						
,, ,, 14 ,,	57·7	57·5	1·3	,,								
,, ,, 16 ,,	56·7	56·7	0·0	,,								
,, ,, 18 ,,	56·3	56·3	0·0	,,								
,, ,, 20 ,,	61·0	61·0	0·0	,,								
,, ,, 22 ,,	69·2	66·5	11·8	,,								
September 1, 0 ,, noon	75·3	69·2	28·3	,,								
,, ,, 2 ,,	76·7	71·1	27·7	,,	haze	69·0	65·0	17·0	100·0	100	26
,, ,, 4 ,,	77·3	70·3	33·0	,,	,,	A 77·0	70·0	33·0	100·0	100	26
,, ,, 6 ,,	72·7	69·3	13·0	,,	thick haze	77·0	70·0	33·0	100·0	100	26
,, ,, 8 ,,	67·6	66·6	5·0	,,	haze	72·0	67·0	18·0	100·0	72	14
,, ,, 10 ,,	66·6	65·7	5·1	,,	,,	*67·5	65·5	9·0	99·5	—	—
,, ,, 12 ,, midnight	66·8	65·5	6·4	,,	great haze	*66·5	64·0	10·5	99·4	—	—
					dense ,,	*66·5	64·0	10·5	99·5	—	—

No movement of the air was perceptible.

In the same way I have since compared the meteorological conditions at Kew for each day of the month of August in the years 1911, 1912, and 1913 with those which raised body temperature above normal in the humid cotton-weaving sheds, and conclude that atmospheric conditions which would cause pyrexia are very rare in the month of August in England at the present day, when, as we know, malarial fevers are not found.

If we turn to the time when malarial fevers were prevalent in England we find a difference. In an annotation in the *Lancet* of November 23, 1913, it is stated that malarial fevers were quite common in many parts of England until about sixty years previously—that is, until about the year 1853. In the accompanying table I give the meteorological conditions recorded at Greenwich in August, 1843, occasion from 98·8° F. to 99·4° F. in twenty-five minutes, or even less.

Comparing the atmospheric conditions at Greenwich in August, 1843, with those which raised body temperature above normal in the humid weaving sheds, it is seen that the condition at Greenwich from twenty-two hours on August 31 to eight hours on September 1 (that is, for *ten hours consecutively*) marked A in the table, were such as would raise body temperature more than the conditions in the humid weaving sheds did, for they present a greater impediment to loss of heat from the body. But the atmospheric conditions in the humid weaving sheds raised body temperature to 37·7° C. (100° F.), or even higher, in *less than four hours*. And if my own observations are correct, the period during which the atmospheric conditions at Greenwich

were such as would so produce pyrexia must be extended to sixteen hours consecutively.

It would take up too much space to give here other examples of atmospheric conditions at Greenwich in August, 1843, which would cause pyrexia in many. I have, however, compared the meteorological observations recorded at Greenwich on each day from August 1 to September 2, 1843, and find that they were such as would cause pyrexia on the dates and for the number of hours consecutively mentioned below:—

Year	Day	Month	Number of hours consecutively
1843 ..	9th ..	August ..	14
,, ..	13th ..	,, ..	6
,, ..	14th ..	,, ..	8
,, ..	17th ..	,, ..	10
,, ..	18th ..	,, ..	10
,, ..	19th ..	,, ..	12
,, ..	29th ..	,, ..	6
,, ..	30th ..	,, ..	4
,, ..	31st ..	,, ..	8
,, ..	1st ..	September ..	10

From this it would appear that in the month of August, 1843, when malarial fevers were quite common in the south-east of England, the atmospheric conditions at Greenwich were such as would cause pyrexia for a certain number of hours on ten different days: On August 9 the conditions were such as would cause pyrexia for fourteen hours, followed by conditions which would produce an apyretic interval of three days. On August 13 the conditions were such as would produce another paroxysm of pyrexia lasting six hours, separated by an apyretic interval of eighteen hours from the next paroxysm on August 14. After this there is a period of two days—August 15 and 16—during which the conditions were not such as would cause pyrexia. On the 17th, 18th, and 19th the atmospheric conditions were such as would cause paroxysms of pyrexia of ten or twelve hours' duration, separated by apyretic intervals of fourteen or twelve hours. Then follows an interval of nine days, during which the atmospheric conditions were not such as would cause pyrexia, followed by four consecutive days, August 29, 30, 31, and September 1, on each of which the atmospheric conditions were such as would cause pyrexia of from four to ten hours in duration with apyretic intervals of from twenty to fourteen hours.

Hence it would appear that any pyrexia produced by the bad atmospheric conditions, the malaria at Greenwich in August, 1843, must necessarily have been of intermittent type, quotidian, tertian, or quartan, or even exhibiting an apyretic interval of nine days between the paroxysms on August 19 and 29. But malarial fevers were, according to the *Lancet*, as previously mentioned, quite common in England previous to the year 1853. Were they caused by atmospheric conditions such as those found at Greenwich in August, 1843, as given in the above table?

Harrogate,
November 17, 1916.

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Tropical Medicine and Hygiene

DECEMBER 15, 1916.

IS THE SUGAR OF COMMERCE A NECESSARY ARTICLE OF DIET?

THE scarcity of alcohol and of sugar at the present moment opens up the question of the relation of the one to the other, and of both to vitality. The relation of the one to the other is well known to physiologists, and even to the laity, who, by the experience gained by the observations of ancestors, know that a hard drinker never cares for sweets, and that a man who eats sweet things in abundance is not a drunkard; and yet, widely as this common knowledge is spread, we do not regard the one as the complement of the other. For whilst the alcohol produced by the human body from sugar or starches is approved of as wholesome, that made by the brewer or distiller is viewed with suspicion, as if it were fraught with danger. The amount of alcohol produced within the human body in twenty-four hours is held to be 2 oz. of absolute alcohol. Assuming this to be a physiological fact, it means that an equivalent of 4 oz. of whisky, brandy, or

gin is supplied to the economy, for the spirits named stand to absolute alcohol as 50 to 100.

Were the humanly produced alcohol and the alcohol produced by brewers and distillers the same from a physiological standpoint, it would not matter which was taken to supply and maintain the bodily requirements. But these alcohols, although by the chemical analysis there appears to be no difference in the proportion of elements which go to form the substance "alcohol," yet do we know them to be widely different. By chemical analysis alone we cannot tell the difference between first-rate and indifferent brands of any wine or spirits; one may be deleterious and the other wholesome, yet it is beyond the power of analysis to reveal which is which. If such is the case when alcohol is produced artificially outside the body, where does the chemist stand as regards the production of alcohol within the human body? It is to be assumed that, as he can give us little information concerning distillery or laboratory produced alcohols, so is it to be presumed he knows less about alcohol produced by a vital process. The human alcohol distillery and the brewers' and distillers' vat and mash-tub are not calculated to give us identical products from the physiological point of view.

No man believes they do, and experience confirmed the belief. The German who a few years ago announced in a London court of law that he had three million bottles of hock on sale in London that had never seen the grape affords a lesson, an exaggerated one no doubt, of what artificially produced alcohol means as compared with that generated within the bodies of animals. Restrict an animal of starches and sugar, and give it instead whisky, or brandy, or allied spirits, intoxication becomes evident even when the amount is in proportion to that produced naturally within the given animal body. The alcohol seems different, judging by effects, just as freshly made spirit differs in its effects from "matured" spirits, be they whisky, brandy, &c. Again, the animal generated alcohol requires no maturing; as it is made so it is used; it is immediately poured into the circulation, a proof, if need be, that we are dealing with widely different substances, let the chemical analyses declare what they may.

Sugar would then seem to be a necessity if we are to supply our bodies with sufficient nourishment. The scarcity and limitation of the consumption of sugar would therefore appear to imply a lessening of the essential elements of the dietary necessary for bodily maintenance and for health. Yet it is not so. Sugar—that is, sugar as we understand the term in common parlance—is not a necessary article of diet. We have many examples illustrating this fact. In the first place, the sugars of our markets are a recent introduction; they came in with the discovery of the sugar-cane as a source of supply only the other day—when the history of man's dietary is considered—and yet to-day in many countries it is well-nigh an unknown quantity. To go no further than our own country. The farm servants' food in Scotland, until it may be twenty-five years ago, consisted of: Breakfast: Oatmeal porridge and oat-cakes with milk. Dinner: Potatoes and oat-cakes and milk. Supper: Green vegetables (kale chiefly), oatmeal cakes, and milk. No sugar from one year's end to the other. Where, then, did they get the alcohol which, as above stated, is essential to existence? "Oh! being Scotchmen, they took whisky instead, and thus obtained the amount of spirit physiological necessity demands." Let there be no ignorant glossing over the facts. These farm servants rarely touched alcohol; twice yearly at the feeing markets a few glasses of whisky constituted the sole amount consumed, except, it may be, some "treacle ale" supplied in harvest time. In tropical countries and amongst Mahommedans alcoholic beverages are not consumed by the people, but sugar *is* directly available in the form of fruits, which Nature supplies to them plentifully. In northern climates, however, fruits are a luxury, and constitute no part in the dietary of the people, so that neither sugar prepared at the refinery, nor that yielded by Nature in the form of fruits, nor the alcohol of the distiller and brewer need enter into the dietary of a people, *vide* the facts stated above concerning Scottish farm servants —not the town dwellers, miners, &c., in that country—and yet a finer race of men never existed. Whence did these men get the necessary alcohol? From the starch in their diet. Oatmeal and vegetables gave the starches necessary, and the milk the animal food which is essential. From the starches glucose (sugar) is prepared during the process of digestion, chiefly by the saliva in the mouth, and to a lesser degree by the pancreas. Once the sugar is generated the production of alcohol is assured, and the essential vitality is to hand.

Why, then, is sugar so sought after to-day, and we call out for a substance which until comparatively recent times was an unknown element of diet? How did people get on without sugar? To be sure, they had honey and fruits; but in northern climates both of these saccharine products were infinitesimal items in the dietary. It would seem that *modern* man is a sugar-consuming being; that he wants to obtain the alcoholic products necessary for his body directly from sugar instead of by the more indirect channel of starchy foods. Why should this change in man's dietary have occurred? It is a question that opens up many channels of reasoning, numerous physiological discussions, and multitudes of suggestions, some savouring of faddism and some of ignorance.

Why should alcohol, necessary for human maintenance, be generated from sugar direct instead of indirectly from starchy foods, and hence by way of starch to sugar, and finally to carbonic acid gas and alcohol? This would involve a long dissertation upon evolution and the like. Have man's powers of digestion failed? Is it that weakened digestion is incompetent to digest starches and convert them into sugar, or has the introduction of sugar weakened the power of digesting starch? Animals get their starchy foods from grass, either fresh or dried (hay), from turnips, beans, &c.; this, however, involves almost constant eating—at any rate, during

daylight hours. They devote a time to eating which a human being cannot afford to and earn a livelihood as well. A shorter process is, of course, essential, and the shortest process of all is to start from the sugar in place of starch.

Another question is: Are the artificially extracted sugars as good as sugar made by digestion in the mouth? This is doubtful—nay, more than doubtful; it is well-nigh certain that it is not so; as the distillers' alcohol differs from the human-produced variety, so may, and positively does, the refiners' sugar differ from that produced by the ptyalin from starchy foods in the mouth.

The end of the argument, if it ever will end, comes to this: that sugar—that is, the sugar of commerce—is not a necessity; that man at one time throve without it, and perhaps throve better. That the hurry of town life demands a speedier production of alcohol than by way of starches, salivary actions, glucose, and hence to alcohol. He has consequently largely cut out the first (starch) stage and advanced from the second (namely, sugar) so as to get his alcohol. Some even cut out the sugar stage and take to alcohol direct. We know the latter is "unhealthy," and historical evidence would go to show that it is better to commence with the starches than with the sugar; in fact, to revert to Nature and check the artificial tendencies engendered by town life.

J. C.

Annotations.

The Gastro-intestinal Findings in a Case of Sprue, with a Note on the Treatment based on these Findings (Thomas R. Brown, M.D., *Johns Hopkins Hospital Bulletin*, October, 1916).—The patient was a young woman, aged 24, married, with an absolutely negative family history and past history, and a normal digestive history except a tendency to constipation. She had lived in Porto Rico from March 13 to July 21, 1913, and from April, 1913, until the time she first came under observation (July 20, 1914), had had a persistent diarrhœa—from three to twelve stools daily, associated with an extremely bad taste in the mouth, very suggestive of rotten eggs, and always worse when the diarrhœa was most marked, the stools being large, gray, and soft. On account of these gray stools, which had evidently been wrongly interpreted as evidence of gall-bladder disease, a cholecystostomy, and incidentally an appendectomy had been done without any effect whatever upon the symptoms. While in Porto Rico the patient had drunk only boiled rain water, but had bathed in both salt and fresh water; she had had an eruption on her forearm suggesting mosquito bites, and had numerous ulcers in the mouth, especially on the lips. The case was definitely diagnosed as sprue, both in Porto Rico and in this country, by military physicians conversant with the disease, and in the presence of her symptom-complex it seemed hard to arrive at any other diagnosis. When first seen she presented the picture of extreme emaciation, weighing less than 70 lb., and giving a history of having lost 35 lb. during her illness. The thyroid, eyes, tonsils, teeth, heart, and lungs were normal; the abdomen was negative except for a slight splanchnoptosis; the pelvic organs were normal. The urine never showed anything pathological, and the Cammidge reaction was negative—the usual finding in sprue. The blood showed, R. B. C., 3,528,000; Hgb., 72 per cent.; W. B. C., 6,200, with 56 per cent. of polymorphonuclear neutrophiles, 31 per cent. of small and 11 per cent. of large mononuclears, and 1·5 per cent. of eosinophiles. During her month's stay in the hospital the temperature was never above 99° F.; the pulse rate varied from 70 to 94. The stools were very characteristic; they were of large size, soft, fermenting, gray or yellow-brown in colour, but not especially foul, usually of acid reaction, and containing some undigested meat, starch, and fat, but no pus, blood, amœbæ, ova, or parasites. The sigmoidoscopic examination was negative. On admission the gastric contents showed a complete absence of hydrochloric acid, with a marked diminution of pepsin. The quantitative estimation of the pancreatic ferment showed a complete absence of diastase, the ferment most satisfactorily studied, and also of trypsin and lipase, as far as could be determined. This absence of pancreatic ferments has been noted before in cases of sprue.

The treatment of the patient consisted in absolute rest, unlimited fresh air, oil rubs, a diet at first consisting exclusively of buttermilk, increased rapidly up to 8 oz. every two hours, zwieback, dry toast, and other simple food articles being gradually added, until after about six weeks the patient was on a fairly general mixed dietary, including the simple meats, green and starchy vegetables, the former in purée form, stewed fruits, fruit juices, butter and cream. Medicinally, she was given dilute hydrochloric acid and large doses of pancreatin—30 gr. daily, together with calcium carbonate and a little tannic acid. We did not use emetin. The patient improved very rapidly as regards weight, strength, and symptoms, the diarrhœa practically disappearing after a few days of treatment. When seen again in about four months' time she had gained a little over 20 lb. The gastric contents then showed a small amount of free hydrochloric acid, but examination of the stools still showed a complete absence of the pancreatic ferments. When seen again, after another four months, she had gained altogether 35 lb.—in other words, her weight had become normal. She seemed absolutely well, had no digestive symptoms, and was on a general mixed dietary, the only foods she was unable to digest being corn, asparagus and oysters. The gastric analysis now showed normal amounts of hydrochloric acid and pepsin; incidentally, it may be said that the dosage of acid had been gradually reduced and finally discontinued without the appearance of any unpleasant symptoms. The stools, however, still showed a complete absence of pancreatic ferment, and the patient herself had noted that, although stopping the hydrochloric acid produced no unpleasant symptoms, whenever the pancreatin was omitted for a

few days there would always be a return of the diarrhœa with the characteristic grey, frothy stool. The patient was heard from very recently, and is absolutely well except for the fact that she still has to take the pancreatin in order to prevent a return of the diarrhœa.

The diagnosis seems quite definite. Two of the diseases with which sprue is sometimes confused—pernicious anæmia and atrophy of the gastric mucosa—can certainly be eliminated, while too long a time (almost two years) has elapsed, and the condition of the patient is far too good to warrant a suspicion of malignant disease of the pancreas.

This persistence of the pancreatic achylia is of sufficient interest to warrant the reporting of this case, and suggests that, whatever the primary cause of the disease may be, certainly the appreciation of its effect upon the pancreatic secretion is of the utmost importance in the proper interpretation of the symptoms and signs in this disease.

The most striking features in our case were, first, the persistence of the complete absence of pancreatic secretions, not only during the stage of apparent illness, but even after the patient felt and seemed absolutely well; second, the essential rôle of the constant administration of pancreatin by mouth in the therapy of the disease; third, that whatever the cause of sprue, and at this writing it seems probable that it is due to an infection with monilia, the lack of pancreatic secretion seems persistent and fundamental, the absence of gastric juice variable and accidental; fourth, that as long as our patient still suffers from this pancreatic achylia she can in no wise be considered as cured, although clinically she is apparently well; and the ultimate outcome must still remain doubtful.

Carotid Tumours.—R. Winslow (*Annals of Surgery*, September, 1916) reports in detail two cases, and adds brief references to ten other cases.

The carotid body is a small structure situated at, or just posterior to, the bifurcation of the common carotid artery. It is not a gland in the usual acceptation of the term, but appears to belong to the sympathetic nervous system and to the chromaffin group. It is best developed in early fœtal life, and gradually disappears in later life. If it remains it is liable to change into a tumour presenting evidences of malignancy. The function of this ganglionic mass is not known. That this structure is prone to evil is shown by the ever-increasing number of "carotid tumours" that are being reported. These cases occur with practically equal frequency in males and females, and are found in almost the same ratio in the decades from 20 to 60. A few cases have been reported under 20 years of age, and about an equal number above 60. The youngest case reported was 7 and the oldest 74. The type of tumour is usually endothelioma or perithelioma, which is generally benign or but slightly malignant at first, but if not removed tends to become cancerous.

The symptoms seem to be quite indefinite. Generally there are no distinctive subjective symptoms, though there may be alteration of the voice from pressure on the recurrent laryngeal nerve, cough, slight dysphagia, radiating pains, or a sense of discomfort or tenderness. Sometimes there is an irregularity of the pupils from pressure on the cervical sympathetic ganglia. Usually the patient seeks advice on account of a slow-growing lump in the upper part of the neck, which has either taken on a more rapid growth or has increased gradually to such an extent as to produce deformity and to cause embarrassment. The growth is occasionally rapid, but there is generally a history of a lump that has been present for several years, and when advice is sought it may be as large as a pigeon's egg or a hen's egg. The tumour is single, egg-shaped, and usually unilateral; but at least three cases of bilateral carotid tumour have been reported. The location of the tumour is opposite the thyroid cartilage, and may extend upward to the base of the skull or downward toward the clavicle. The tumour is smooth, firm, movable laterally but not vertically, and sometimes there is an upheaval pulsation with bruit and thrill, from its relation to the carotid arteries. The growth is originally encapsulated, and does not infiltrate the surrounding tissues until malignancy is well advanced. Sometimes these growths are extremely vascular.

Positive diagnosis has seldom been made before operation; but the condition is being recognized more frequently as its clinical features are becoming better known. A tentative diagnosis of carotid tumour was made before operation, though he admits that he was not sure of the diagnosis until the tumour had been exposed and he saw its relation to the carotid artery. Carotid tumour has been most frequently mistaken for a tuberculous lymph-node, aberrant thyroid, carcinoma, or sarcoma of glands. A single, slow-growing, firm, smooth, discrete, usually painless oval lump, more or less fixed, situated in the superior carotid triangle opposite the thyroid cartilage and anterior to or under the sterno-mastoid muscle, should always cause us to suspect a neoplasm of the carotid body.

The treatment is operative; but operation should be undertaken only by the expert, since there is danger of wounding the hypoglossal, recurrent laryngeal, or pneumogastric nerves, and since ligation of the common carotid and internal jugular, with its attendant dangers, cerebral and otherwise, may be necessary. In some cases the growth may be shelled off the vessels, though danger of recurrence is much greater than when the vessels and tumour are removed *en masse*. In the fifty-nine cases in which the tumour has been reported extirpated there have been twelve deaths, a mortality of about 20 per cent. Since the only hope of removing these growths without ligation of the carotid and without danger of recurrence is in the early period of their development, while they are firmly encapsulated and loosely attached to the vessels, general practitioners as well as surgeons should bear them in mind when consulted by one having a deep, fixed tumour in the carotid region, and promptly refer the patient to a surgeon competent to deal with it.

Abstracts.

PITFALLS.[1]

By Jos. C. Verco, M.D.Lond.

Pneumothorax is a veritable pitfall. We should think of it in all puzzling cases of chest disease. It confounds doctors probably more than anything else, because it is not dreamed of, and yet directly it is remembered or hinted at it is quite easily detected. A patient may walk into our consulting-room with a complete pneumothorax of only thirty hours' duration, and seem but little inconvenienced, and die of it within three weeks. Its pathognomonic sign is weak or absent breathing on the more resonant side of the chest. Such comparative resonance is what leads us astray. We think the less resonant or comparatively dull side must be the diseased one, and this inextricably confuses us. But directly the significance of the weak breathing with hyper-resonance is grasped the other cardinal signs are looked for and found, and all fall into line at once; distension, cardiac displacement, cavernous breathing, bell sound, succussion splash, metallic tinkle, and alteration of line of fluid dulness with change of posture.

Some minor points may be mentioned. If fluid is present we must find out whether it is pus or serum for treatment sake. An ordinary hypodermic needle is useless; it is too short and too fine. If used, it may yield no fluid, and so increase bewilderment, when a longer and larger needle would immediately find fluid. An all-glass serum syringe, on which fit the needles of an ordinary Dieulafoy aspirator, is very effective, and an excellent instrument to carry about in one's bag.

But no fluid may be found, even with this, for three reasons: (*a*) In an old pyo-pneumothorax the cavity may be contracted, and the liver pulled up, and the needle enters this instead of the fluid above it. If so, try again a space or two higher. (*b*) If pus be present there may be a thick layer of fibrinous lymph or débris at the base which will not come through the needle. (*c*) Or as the patient leans forward, the level of the liquid recedes below the previous lines of dulness in the back marked out when he was sitting more erect, and the needle is pushed in above the level of the liquid, and none is obtained.

Note two other suggestions: (1) When no fluid enters the barrel of the syringe as the piston is withdrawn the result of the exploration is not necessarily negative. If the piston moves easily, without force, evidently the barrel fills with gas, and this is positive evidence, and proves a pneumothorax, or air would not be obtained. If now the gas in the syringe be driven back through the needle held close to the nose, it will often be found fœtid, and a pneumothorax will thus be still further substantiated. (2) To get pus when it is not very abundant, bring the recumbent patient to the edge of the bed, so as to project beyond it, and thrust the aspirating needle vertically upward into the back of the chest as he lies, and the pus, if present, will be drawn into the syringe.

Phthisis.

Never deny the presence of phthisis without complete examination of the chest in front in the erect and also in the recumbent posture, nor without listening for moist sounds, especially at the apices, while the patient coughs, when recumbent as well as when erect. Recumbency and cough are two great aids. Never deny it, though there are no definite pulmonary signs, if there is a long-standing huskiness, unless the sputum shows no tubercle bacilli, and the throat specialist reports no tubercular manifestations in the larynx; for pulmonary signs are much less easily detected in an early stage when the larynx is diseased.

Be careful about affirming phthisis because crepitations are found at one apex, even back and front, at a single examination, unless tubercle bacilli are found in the sputum; even though the patient may have been ailing for two or three months; especially if there has been some active disease at the beginning of that time from which the cough and weakness date. Sometimes pneumonic physical signs do not appear at the apex until after the febrile crisis has passed, and may then linger for several weeks before finally disappearing completely.

Be careful about diagnosing phthisis, even with persistent physical signs at one apex, but without tubercle in the sputum, though this may be occasionally or often mixed with blood. The patient, otherwise, may put us to shame by suddenly coughing a hydatid out on the floor, nearly as big as a hen's egg, and getting quite well. Or, after repeatedly searching in the sputum floated out in water, we may find a small piece of membrane like wet tissue paper, or even like rather firm, consistent mucus, showing the lamination so characteristic of hydatid origin.

We should be still more wary of affirming phthisis in chronic disease at a pulmonary base, though of several weeks' or months' duration. It is much more likely to be something else. It may be the residuum of a broncho-pneumonia of influenzal origin, or of a pleuro-pneumonia, and with an elevated temperature lasting many weeks may yet quite clear up. It may be a hydatid which ruptured and was coughed up years ago, as many as forty, and has left signs of consolidation or of a cavity behind, with occasional attacks of free hæmoptysis. It may be due to inspiration of a foreign body. A lad came out from England at the advice of a leading London consultant, on account of phthisis, for the sake of our climate. He had a bad cough, with much muco-purulent sputum. His physical signs were those of consolidation at his right pulmonary base. Microscopic examination of his sputum, which was very malodorous, showed

[1] Abstracted from the *Medical Journal of Australia*, August 5, 1916.

no tubercle bacilli, but abundant streptococci. The case, which had begun as a pleurisy, seemed anomalous as a phthisis, and more like an abscess. Seeking a cause for this, he was asked whether he had ever accidentally inspired any foreign body. He was not aware that he had. However, he remembered on the day before his pleurisy arose, when getting ready to bathe, he put his collar-stud into his mouth, and then began to cough and lost his stud, but supposed the cough had forced it out of his mouth. X-rays showed a triangular consolidation at the right base, tailing off towards the root of the lung. No stud could be distinguished from the shadow of the spine. He was returned with his new diagnosis to the London physician. An eminent surgeon opened his windpipe, but could not extract the stud by this route, so later he opened the right chest and struck the abscess, but failed to reach the foreign body. Pyæmia followed, with facial abscess, death supervened, and, at the *post-mortem*, the stud was recovered. Basal consolidation is rarely phthisical.

The Tracheal Tug.

The tracheal tug is sometimes the key to a case; in fact, it has proved a better diagnostic of aortic aneurysm than unequal pupils or unequal pulses. Its special value is its presence when the usual physical signs of this affection are absent. A man with supposed phthisis came to our State for the benefit of its dry climate. He had aphonia, alternating with a husky voice; the laryngoscope revealed at once paralysis of his left vocal cord. He had a distressing cough. There were no moist sounds in his chest and no impaired resonance, but the respiratory murmur over his whole left lung was weak. None of the ordinary physical signs of thoracic aneurysm or mediastinal growth were to be detected. A marked tracheal tug proved absolutely the presence of an aneurysm. This was confirmed by a skiagraph, and ten days later, when lying in bed, he died within five minutes from a gushing hæmorrhage. Another patient was sent to me with asthma and bronchitis, but the symptoms were not quite typical, and his chest examination was inconclusive. An unmistakable tracheal tug was quite conclusive, and though treated on Tuffnell's plan, he died of aneurysm.

Asthma.

We need to be chary of diagnosing asthma. Like "idiopathic or functional disease," it is liable to be with us an "asylum ignorantiæ" and a mistake. A quite recent asthma, with marked dyspnœa, sounds suspiciously like something else, and we should carefully seek for and exclude organic disease. One case just mentioned was aortic aneurysm revealed by a trachcal tug. Another case of seeming asthma showed, on physical examination, hyper-resonance of the left chest, with nearly absent respiratory murmur on the same side. This suggested pneumothorax and other evidences were then conclusively forthcoming. Direct inquiry now elicited a confirmatory history of sudden pain and dyspnœa coming on while straining and never disappearing. Another case of asthma was sent from England for the sake of the Australian climate by one of the most widely known London physicians. But his complaint seemed atypical and unusual; his breathing suggested stridor rather than asthmatic dyspnœa, and gave the impression of laryngeal or tracheal obstruction instead of bronchial; so his glottis was examined, and papillomata were visible in the mirror. He was transferred to a throat specialist, who removed them and with them his "asthma." He was at once sent back cured, with a note of explanation to his surprised London physician. "Asthma," when it is really marked Cheyne-Stokes' breathing, which is often much more distressing by night than by day, we will recognize as only a symptom of the associated valvular affection of the heart, and not as a substantive disease, and seek to relieve it by toning up the heart with rest and appropriate drugs rather than by trying to combat the dyspnœa with so-called antispasmodics. Immediate palliation of distress we may effect by direct sedatives. Another distressing "asthma" is a symptom of chronic renal disease, with cardiac hypertrophy, high tension, and commencing myocardial degeneration.

Kidney Disease.

Speaking of kidney disease suggests this rule. In cases of apparent advanced chronic nephritis think of myxœdema. A lady came from another State, after much treatment, with the diagnosis of incurable kidney affection. She was promised at her first visit complete and speedy cure, much to her pleasure and surprise. Though she had a little albuminuria, she had manifest myxœdema. In three months, with no treatment but thyroid extract, she was well, and returned home so changed as to need reintroduction to her old friends. Another patient, ailing for twenty-one years with "incurable heart and kidney disease," who had lost all her hair, and whose mental and physical condition was deplorable, responded at once to thyroid extract; her hair grew abundantly, and she became quite active again in body and in mind. And this case suggests another admonition. In early melancholia look for evidences of hypothyroidism, and in early, mild, or intermittent delusional excitement for signs of hyperthyroidism. We may find one or other of these, and by appropriate treatment with internal secretions may keep our patients out of the mental hospital.

To return to kidney disease, the most easy and reliable method of testing for albumin has proved to be with acid, brine, and heat. To a test-tube two-thirds full of urine, whether acid or alkaline, add two or three drops of strong acetic acid, then add one-sixth of its volume of a saturated solution of common salt, and mix by pouring into another

test-tube. Heat the top inch; any opacity thus produced shows albumin, and can be detected by contrast with the clear urine below. By the aid of an electric light, or held in front of a piece of black cloth, the faintest cloud can be seen. It is much more delicate than the cold nitric acid test, and has the special advantage of being almost quite free from fallacies.

Two cautions are required. First, if the urine is very alkaline, sufficient acetic acid must be added to render it definitely acid, otherwise, on heating, phosphates may appear and give a cloud. Second, if the urine is of high specific gravity from concentration, on adding the acetic acid a cloud may appear; this is not albumin but urates, and will clear up at once with heat. In fact, any cloud appearing with cold acetic acid is not albumin. It may be one of several things, which I need not here discuss.

Frequently, when urine is of high specific gravity from concentration, it gives a slight sugar reaction with Fehling's solution, and doubt may exist as to whether it indicates disease or not. This is, however, easily decided. Add water to the urine until the specific gravity is reduced to 1015. If, on being now tested with Fehling's solution, it gives a sugar reaction, there is pathological glycosuria; if it does not, there is none; the reaction is only due to concentration of the urine. The explanation is this: healthy urine contains sugar, but in such minute amount as to be detected only by specially delicate chemical analysis, and not by the ordinary Fehling method. If the normal amount of sugar is excreted, but the urine is very reduced in quantity, that is to say, is concentrated and of high specific gravity, the relative amount of sugar in a sample may be increased sufficiently to give a reaction with Fehling; but if the concentration is now reduced by adding water until the specific gravity is lowered to 1015, the sugar is no longer in relative abnormal amount but only in normal, and hence gives no reaction with Fehling. Frequently in life assurance reports a referee will record "Urine 1032, faint reaction for sugar with Fehling's solution," and will recommend postponement for analysis of further specimens. This is unnecessary. If the referee will reduce the specific gravity of the sample in hand to 1015 and test it again, absence of reaction excludes pathological glycosuria at once, and he can recommend acceptance, and so save much time and trouble.

In feeling the pulse, we should remember the radial often divides in the forearm, and at the wrist may be very small; and so in an apparently serious case may deceive. Feel the other radial at the wrist; it may be normal in size. If this is very small, feel for the artery behind the wrist, or the *superficialis volæ*, or a large ulnar. I was very nearly taken in by a man in great distress, whose pulse on the right was very small, and suggested serious circulatory trouble; but his left was large and full, and confirmed the suspicion of excitement from over-stimulation with alcohol, which proved correct.

In counting respirations, we should recollect how difficult, if not impossible, it is to breathe naturally if we are aware that our breathing is being noticed. A good plan is to count the pulse, and, when this has been done, continue to hold the wrist with one hand and the watch in the other, and, while seemingly still counting the pulse, out of the corner of the eye pick up some fold in the bedding over the patient's chest or abdomen and count its movements with respiration. In this way its frequency and volume and regularity can be registered, unbeknown to the patient.

Nervous Affections.

Hysteria is often very difficult to diagnose and to exclude. We must never determine a complaint to be simply hysteria unless we are quite sure there are no signs whatever of structural disease. In hysterical patients almost any organic affection may excite hysterical symptoms. Hence, conversely, a patient may have hysteria and at the same time have almost any structural ailment. We must say to ourselves, "Evidently she has some hysteria, but what has she besides which produces it?"

Certain signs are never hysterical, and are therefore good diagnostics. (1) Incontinence of urine. This at once proves something other than hysteria. A hysteric may have retention, anuria, polyuria, frequent micturition, but not incontinence; she never wets the bed.

(2) A Babinsky extensor reflex from the sole. Exaggerated deep reflexes, tremors, paralysis, and losses of sensation are found in hysteria, but a Babinsky in an adult means an organic lesion.

(3) A divergent squint. A hysteric may have this from old myopia or other causes; but if it has arisen during her present illness she has some organic lesion. She may develop a convergent squint spontaneously or on suggestion, and this will intermit; but never a divergent strabismus; she cannot mimic this.

If an internal squint is associated with dilated pupils it is not hysteria; in this they are always contracted, as they are when we converge our eyes towards a near point, as in looking at the end of our nose.

Locomotor ataxy is rather a misleading disease. We need specially to think of alcoholic peripheral neuritis in connection with it; not merely for the sake of correct diagnosis, but of prognosis, and especially of treatment. The forecast of the one is dark with despair, the other may be relieved by rays of hope. With the one diagnosis we practically consign a patient to physical perdition, with the other, by recognizing the alcoholic element, we may, by appropriate advice and treatment, permanently and possibly completely cure him. We must therefore seek the reflex to light in his pupils, try and elicit a knee-jerk, look for tenderness in muscles and nerves, for definite loss of power, and for a history of alcoholic over-stimulation. Mistake means so much to the man; we must not make it.

In all cases of apparent gastric cancer, gastric

or duodenal ulcer, pyloric obstruction, or gastralgia, locomotor ataxia should be remembered. It should be absolutely excluded before we advise or perform an exploring, relieving, or curing laparotomy. Examine for Argyll-Robertson pupil, loss of knee-jerk, and Rombergism. Inquire for lightning pains, and staggering or unsteadiness in the dark, and for marked and prolonged intermittence in the gastric symptoms. If we do not we may leave in our median abdominal scar an indelible memorial of mistaken diagnosis, for it will not cure tabetic crises.

Epilepsy is at times one of the most difficult complaints to recognize. Most cases are quite easy, the attacks are typical, and the history is complete. Others need much and very careful inquiry. How often is it regarded as "faints!" Whenever a man is liable to frequent faints he most likely has epilepsy, especially if they occur without very definite cause. If a woman has them when alone they are mostly epileptic.

One young man would come in from his work and sit down to a meal and suddenly go fast asleep, and could not be roused, but had to be lifted bodily out of his chair and dragged off to his bed. Sometimes, when company was present, he would come indoors and lie down on the couch in the room, and instantly be snoring and could not be wakened; then, after an hour or more he would suddenly rouse up and be apparently quite well and return to his work. He was really suffering from post-epileptic coma.

Probably the best diagnostic is loss of consciousness. If this does not occur epilepsy cannot be diagnosed, except, of course, in some kinds of Jacksonian epilepsy, when convulsions or jerkings are plain and the diagnosis is thus conspicuous. In supposed faints, if consciousness is suddenly lost and very rapidly regained, they are epileptic. The suddenness of onset and of recovery are valuable indications. Fainting must be very profound indeed, and must be associated with a very manifest cause to induce loss of consciousness.

The most frequent evidence of loss of consciousness is falling down. If a person frequently falls down causelessly and faints off he is epileptic. If a female falls down when she is by herself, she is probably epileptic and not hysteric. If she falls down only in company and never hurts herself, she may be a hysteric or a malingerer, but if she injures herself she is probably epileptic.

If the tongue is bitten, or less often the cheek or lip, epilepsy is probable; or if there is involuntary micturition. The absence of either of these accidents does not disprove, but their presence is very strong proof. They are sometimes very helpful signs. If a person on waking in the morning finds his tongue or lip or cheek sore and a bloodstain on the pillow, he very likely has had a fit in his sleep. If he discovers he has unconsciously wet the bed he has very likely had a fit. This sign is further helpful.

If we are treating an epileptic, and have apparently stopped the fits, we may, on inquiry, elicit the fact of occasional nocturnal enuresis, which is a fairly sure indication of the failure of a complete cure. Though his diurnal fits have ceased, his nocturnal have not.

This leads me to mention another sign of epilepsy which inquiry may elicit. Patients may find on rising in the morning the sheets on their bed badly torn, a circumstance for which they cannot account, because they are unaware of their struggles during a seizure. Again, they may wake to find themselves shivering with cold, and their blankets and sheets in a heap on the floor; or themselves on the floor, with more or less of their bedding; evidently, they had not wakened by their fall out of bed. These circumstances give a very distinct significance to faint or giddy turns through the day.

Children sometimes through the day will get sudden and inexplicable paroxysms of rage or restlessness or mischief, during which nothing can be done with them; these may last for several minutes; then almost suddenly they become sensible, quiet, and docile. These paroxysms come at intervals more or less regular. They are often, nearly always, if not always, epileptic, or perhaps post-epileptic, coming on immediately after some unnoticed petit mal.

Some instances of night terror in children, who wake and suddenly act like little maniacs, and cannot be coaxed or shaken into consciousness or quietness, then abruptly become manageable and sensible, are probably also epileptic.

We need to remember, too, how sometimes the supposed cause of epilepsy is really the proof and consequence of it. A groom was driving me in my buggy, the reins fell from his fingers, and he had jerking of his hands and face, and was plainly unconscious. In a few seconds he had recovered his senses and his reins. What was to have prevented him from falling off his seat, and thence onwards his epilepsy would very likely have been attributed to injury to his head and been regarded as Jacksonian. We get a history from a patient that he was riding a horse or driving a cart, and fell off and was picked up unconscious, but quickly recovered, and drove his cart or mounted his horse and rode home; and thereafter he got periodic fits which are manifestly epileptic. But why did he fall? The horse did not stumble, the cart did not jolt, there was no apparent reason; he simply fell off. Really because he had an epileptic fit, and inquiry will often elicit evidences of petit mal, or of nocturnal attacks, the significance of which had not been suspected.

A child is occasionally, though very rarely, left almost or quite stone deaf, without any motor palsy, after an attack of apparent cerebral meningitis. It has had really double otitis interna, and not cerebral meningitis. Therefore, if a child has headache, screaming, vomiting, and fever, and is quite deaf, but has no motor palsies, nor cerebral pulse or breathing, do not diagnose cerebral meningitis and predict death; it is most likely otitis, and the child may recover, but stone deaf, and if an infant or a young child may be a deaf mute. I have known more than one such case.

In "sciatica," especially in patients of middle age or beyond, always examine the hip-joint in the recumbent posture, for limitation of movement, due to mono-articular arthritis. Its discovery will save a lot of medicine and disappointment. If not found, examine *per rectum;* you may feel a big cystic enchondroma pressing on the nerve within the pelvis.

If the sciatica is double, be doubly doubtful of your diagnosis. Very likely the disease is spinal, in the bones or in the cord; or pelvic, as an internal growth.

Once a patient consulted me with "rheumatics in both knees," which had been blistered and plastered and painted and rubbed most assiduously, because of the pain about them. Yet not one objective sign of disease did they show. But both hips were immovably fixed by double osteo-arthritis. The shifting of the locality of his complaint was a surprise to him; but he was easily convinced, and induced to leave his knees alone.

Speaking of the hips, never diagnose tuberculosis, or treat it, in an infant, or in a young child, without making adequate investigation as to its diet, whether this consists wholly or chiefly of Allenbury's or other patent food. More than one instance is known where the child barely escaped splints and plaster through the suggestion of infantile scurvy.

In a persistent synovial distension of a large joint, before deciding to operate, examine the fingers and wrists and jaw joints, so as to exclude osteo-arthritis, as well as the knee-jerks and pupils, lest it be tabetic.

Zona is another trap for the unwary. When neuralgic pain is present without a rash, do not make an absolute diagnosis of myalgia or neuralgia, but think of zona, and tell the patient to watch for blisters over the painful area. If you do not they may appear and overthrow the diagnosis, and be regarded as the consequence of the use of your liniment. If you do, and they should appear, your foresight seems little short of prophetic; and if they should not, you did not predict them.

When in full bloom with its blisters it has been mistaken for an erysipelas, but the neuralgic character of its pain, and its distribution over the area of a nerve, should prevent this. When it has disappeared and is replaced by the paroxysmal neuralgia which sometimes follows it, especially in middle or old age, it may be puzzling, particularly if the primary disease has not been recognized, or if it has not been seen by the doctor who is consulted. Special circumstances may make it specially puzzling. A man had attacks of pain over his gall-bladder, very severe and very frequent. Biliary colic was diagnosed and operation proposed. But their frequency and peculiar periodicity, the absence of tenderness localized over the gall-bladder, a history obtained by leading questions, of a rash along the line of an intercostal nerve, led to an alternative diagnosis of post-zonal neuralgia, and abandonment of operation. He left for another State, where he consulted leading physicians and surgeons for this pain. For some time the zonal theory was rejected in favour of biliary colic, but was finally favoured and then allowed.

An enlarged gland above the clavicle, at the root of the neck, is well worth seeking, especially in possible cases of cancer of the œsophagus, stomach, liver, or lung. It will not be found in most cases of these complaints, but now and again it rewards a search, and generally certifies malignancy. Sometimes it is quite easily felt, very hard, and occasionally nodular; at others it hides beneath the sterno-mastoid, and can only be palpated with the thumb under the inner edge of the muscle and a finger over or behind it. It may be very low, behind the clavicle. It is well to feel deep down behind the sternum. Sometimes one can reach with the finger the upper border of a mass pressing upon the trachea from one side and from behind, between the wind-pipe and the spine, which is causing serious dyspnœa, and yet gives no detectable physical signs in the front of the chest.

There is another little area in the neck well worth remembering and examining, viz., where the cervical nerves forming the brachial plexus issue from the side of the spinal column, and where tenderness on pressure indicates a brachial neuritis, and diagnoses this complaint from such distantly related but confounded complaints as angina pectoris, Scrivener's palsy, cancer of the breast, apical pulmonary phthisis, &c.

In skin disease you see a solitary red patch, perhaps 6 in. by 4 in., raised, red, neither weeping nor itching, which has existed for some years, no varicose veins, "no spots anywhere else." Nevertheless, closely examine the knees and elbows. On one or more of these may be found a tiny area with dry, silvery scales. This is enough, and spells "psoriasis" without any question.

Chronic urticaria is a most elusive complaint until it is thought of. Then it is happily snared by its little lines or spots of pink, its shifting site, its ephemeral duration, its intolerable prickling and stinging, especially on exposure to changes of temperature, its scratch marks, and, finally, the experimental dermatographia.

In multiple obscure lumps in the abdomen, before diagnosing malignancy, from which there is no retreat, think of multiple serositis, the old poly-orrhomenitis, tubercular peritonitis, and examine for single or double hydrothorax or hydropericardium, and take the temperature. Think of leukæmia, and examine a blood-picture for myelocytes, and look for enlarged peripheral glands. Think of multiple hydatids, which may be felt in the belly or in the pelvis as hard as fibroids, and explore. Think of syphilis, and hunt for a history or for stigmata, and get a Wassermann test of the blood; and if you have any inducement, give anti-syphilitic treatment. One man deeply impressed me with his attitude towards supposed incurable and malignant cases. He said: "I never abandon them, but keep on doing the best, and oftentimes I pull the nuts out of the fire."

In appendicitis, beware of right renal calculus or pyelitis. Inquire for diagnostic symptoms and

istory, and especially examine the urine for blood and pus; and if either of the latter is detected, or if the former in any degree suggest a stone, do not neglect to get a skiagraph of the kidney and ureter, or two operations may be required instead of one to remove the pains.

When patients complain of diarrhœa, with frequent small, liquid motions, and much straining, especially if they are old or bedridden, or after operation, always think of constipation; and before prescribing astringents and intestinal sedatives, examine *per rectum* for a large solid mass of fæces, which is causing the tenesmus and catarrh of the bowel.

When patients have frequent urination, and pass only small quantities of water, with straining, do not administer sedatives and alkalies to relieve irritability of the bladder; but think of retention and distension, especially after abdominal operations and in spinal trouble; examine for a "central hypogastric tumour," and if necessary *per vaginam* or *per rectum* for the distended bladder. A catheter may summarily cure vesical irritability, which you have failed to relieve with drugs.

This suggests another caution. If on examining a patient you find a large central hypogastric tumour, if the patient is a woman, do not jump to the conclusion she is pregnant if she is married, and especially if she is unmarried, nor that she has an ovarian or a parovarian cyst; or if the patient is a man that he has a hydatid. Ask first if there is any retention of urine, because it may be a distended bladder. And if the patient or the nurse tells you the patient is passing quite enough water, and quite often enough, do not rely on this statement, but examine *per rectum* or *per vaginam*, or both, and see if there is a distended bladder, and unless you are absolutely sure, pass a catheter. Otherwise, you may have such an experience as the following: The patient sent into hospital for removal of a very large ovarian tumour, and when under the anæsthetic, the surgeon was about to operate, he could find nothing; and the nurse told him, with a countenance quite unmoved, that just before bringing the patient into the theatre, according to custom, she passed a catheter and drew off 70 oz. of urine.

In cases of chronic disease do not fail to make occasional complete examinations, for various unexpected conditions are liable quietly and quickly to arise. It was the excellent custom in Dr. Church's wards to have what was called "a full day" twice a week—one day in the men's wards, and one in the women's. Then every case was thoroughly gone into. On the intervening days new cases were examined as they came in, and old cases were seen at the suggestion and discretion of the house physician. We ought to have "a full day" with our private patients at not too long intervals. Doubtless most of us have been surprised and somewhat chastened at a consultation, when the consultant has found a condition very evident and quite important which was not present when we made our last complete overhaul of the patient.

Acute intercurrent disease may arise in the course of chronic complaints and completely alter their aspect, and if not recognized as such may occasion a most grave and erroneous forecast. A case of phthisis of rather long duration: he was manifestly dangerously ill, and rapidly getting worse, with high temperatures, increased consolidation, and apparently marked exacerbation of his tubercular condition. He was given only a short time to live. But in a few days he had a crisis and at once convalesced, and was soon in his previous chronic state, to my discredit. A rather acute pneumonia had supervened upon his slowly progressive pulmonary tuberculosis and tripped me up.

Be careful how you trust to the observations of others, when it is possible to make your own. Often we must trust; we cannot always duplicate our predecessor's work. But wherever we can we should base our diagnosis on personal examination. Because another man has not struck a stone in the bladder or felt a cancer in the rectum, it does not follow there is none. Such a history should only prompt to more careful investigation and extra precaution. Perhaps he did not distend the bladder, or he used a sound with too long a beak or too short, or only used a metal catheter, or did not push up the pouch behind an enlarged prostate, or time may have allowed the stone to grow larger. Perhaps, when examining *per rectum*, his finger was not so long as yours, or he had on a rather thick rubber glove, or had not your *tactus eruditus*, or did not push the bowel down from above, and make it a bi-manual palpation, or was not so impressed with the probability of cancer, or failed to find it because it was not then so advanced. Sound for yourself, feel for yourself, and find what is present.

I was called in consultation to a woman with chronic disease of her bladder, and was told that a metal catheter had been passed and she had no stone. She got better of her acute symptoms. Some months afterwards she consulted me with a repetition of the same complaint, and saw me twice and was given a prescription. As she did not improve she wisely went to another doctor, who passed a sound, and struck a stone, which he removed—about the size of a hen's egg. It will probably not happen again.

Never jump to conclusions, and do not make spot diagnoses. I have often smiled inwardly at one experience of many years ago. A lady called, and said she was thinking of getting married, and wished to know whether she was in a fit state. She was rather thin and pallid, but had no special symptoms of which she complained. I gave her an ordinary complete examination, and advised her not to commit matrimony until she had been operated on. Then she told me she had consulted a doctor, who had suggested she had better get wedded at once. Meeting him later, I asked him why he had given this advice. He replied that from her question and her manner he surmised she was pregnant, and so thought this was the best thing she could do under the circumstances. "But did you examine her?" "No. I thought she

might not let me." And so he missed a hydatid of the left lobe of the liver, nearly as big as a football, bulging out her left lower chest and epigastrium. We must not base our advice on surmise when we can ground it on observation; and we must examine our patients as thoroughly as the special circumstances warrant and permit. If we push our investigations as far as possible we shall be less likely to miss anything of importance, however trivial it may seem, and more likely to discover the real nature and full extent of our patients' maladies, and be the better able to relieve or cure them, and so fulfil the true purpose of our profession.

A FATALITY FOLLOWING ACUTE OTITIS.[1]

By I. W. Voorhees, M.D.

In January, 1916, the writer was consulted by a well-to-do gentleman from a Western city regarding pain and discharge in the right ear. Some three or four weeks previously he had passed through a fairly mild attack of grip (respiratory type) which had kept him in bed for a few days only. At the time he had come East for the Christmas holidays, and had been able to enjoy the festivities with friends in a suburb of New York City.

There had been considerable discharge of mucopus from the nose, and a persistent cough brought the same kind of material from the chest. Appetite was fair, bowels regular, and general health good in a man of 41 who had been always well. There had been no previous aural disease of any kind.

Two days preceding my examination the patient experienced severe pain in the right ear which lasted for three or four hours, followed by discharge. This pain had then practically disappeared, but a sensation of fullness remained. He complained of deafness, slight noises, and moderate discharge.

Examination of the nose showed swelling of the mucosa and a small amount of viscid yellowish discharge in the middle meati. The nasopharynx was red and swollen, yet the tubal orifices could be distinctly seen. The larynx was normal, but the tracheal mucous membrane was red, swollen, and plastered here and there with exudate. The left ear was normal in all respects. The right drum was red and somewhat swollen, but the chief landmarks were still present. There was a perforation in the antero-inferior quadrant through which a small amount of thin discharge was pulsating on its way outward. There was no mastoid tenderness.

The usual expectant treatment was instituted and the patient was advised to return in forty-eight hours. This he did not do, however, and was not seen until the fifth day following. He then came to my office and a thorough examination was carried out, including tuning-fork tests, &c. The condition was much the same in every respect. There was no pain or discomfort.

[1] Abstracted from *Medical Record*, September 23, 1916.

The patient sailed for Bermuda on the day following; the voyage was marred by rough weather, constant rain, and cold (it was the middle of January). The patient "caught cold," and when he arrived consulted a doctor. His ear was inspected, but nothing was related of its condition. At this time there was pain, but not much discharge. Symptoms in nose, throat, and chest were marked. The physician stopped the treatment outlined in New York, and gave the patient a nose wash to be snuffed up "out of the hand." The ear was to be syringed with a solution of peroxide every two hours.

From this time on the patient did poorly. He suffered much from right-sided headache and complained of general malaise. The daily temperature range averaged 101° F., mounting a little higher as time wore on. The patient, a graduate of Harvard and a highly intellectual man, kept a secret daily record of his condition, which in the light of subsequent facts proved of great interest. He tried to conceal his symptoms from his wife, because this was "a second honeymoon," and they had planned to remain on the island for three months. Nevertheless, headache, high temperature, and weakness continued until he was driven to bed with a nurse in constant attendance. As yet no definite diagnosis had been made, so at the insistence of the patient's wife a surgeon was brought in from one of the great British cruisers lying in the harbour. At the time, two weeks after sailing, the temperature was 104° F., the unilateral headache was intense, there was beginning paralysis of the right external rectus, and the surgeon looked upon the case as one of extreme gravity. While shaving the head preparatory to operation the patient suddenly died. The respiration stopped and could not be again started, but the heart continued beating for some minutes. Temperature at this time was 106° F. No autopsy was performed. The consensus of diagnostic opinion was: Mastoiditis, brain abscess, rupture into the lateral ventricle of the brain.

The case bears a tragic significance from which we may draw profitable conclusions:—

(1) Any apparently "simple" acute otitis media is capable of producing dire results.

(2) The appearance of the drum may be very misleading. Behind it may be lurking the deadly *Streptococcus mucosus*.

(3) A culture should be taken in every case, and the predominant germ identified if possible.

(4) Any abrupt cessation of discharge accompanied by severe unilateral headache is an unfailing sign of some complication calling for operation.

(5) No patient with an acute otitis should be allowed to get away from the watchful eye of a trained otologist until all symptoms have disappeared and a condition of *restitutio ad integrum* has been obtained.

Proportions of theine or caffeine in green tea, black tea, caffeine, and maté are given as 4·30, 4·60, 2·66, and 2·50 per cent. respectively.

Colonial Medical Reports.—No. 63.—Fiji (*continued*).

For 1912, the figures of cases treated by native medical practitioners are included in the tables which show a general increase over the number for 1911. The epidemic at the beginning of 1912 was very severe and lasted well into the middle of the year; after that there was a decline and the lower rate continued up to the end of the year, so that there were so few cases at the Colonial Hospital that the dysentery ward remained closed almost throughout the dysentery season (1912 to 1913). There were some isolated outbreaks in different parts of the Colony, but in most places it will be found that returns for 1913, when the report comes to be made, are in every case far fewer than they have been for many years past. Printed instructions issued in former years were repeated in English, Fijian, Hindustani, and Tamil, and were again widely circulated. It is not easy to account for the increase over 1911.

Enteric Fever.—At the Colonial Hospital 12 cases were treated with no deaths, against 17 cases with 3 deaths in 1911, and 6 cases with 1 death in 1910. At the provincial hospitals 16 cases with 1 death, against 15 cases with 3 deaths in 1911, and 34 cases and 3 deaths in 1910. At the plantation hospitals 9 cases and 2 deaths, against 11 cases and 4 deaths in 1911, and 2 cases and 1 death in 1910; a total of 37 cases and 3 deaths, against 43 cases and 10 deaths in 1911, and 42 cases and 5 deaths in 1910—a better return both for cases and deaths. As in former years, the cases treated at the Colonial Hospital came from the districts outside the Colony, for the most part, and most of the cases were again in the district of Rewa.

Tuberculosis.—Admissions for all forms of tuberculosis to various hospitals are tabulated below for comparison.—

Hospital	1910		1911		1912	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Colonial Hospital	120	35	117	19	68	6
Provincial Hospitals	145	16	176	17	124	11
Plantation Hospitals	48	32	54	32	63	38
Total	313	83	347	68	255	55

Cases of pulmonary tuberculosis treated at the Colonial Hospital and by the native medical practitioners were as under:—

Hospital	1910		1911		1912	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Colonial Hospital	77	28	91	19	49	4
N.M.P. Cases	—	—	—	—	260	30
Total	77	28	91	19	309	34

The return of the native medical practitioners is a new one. The figures for 1912 show an improvement over those of two former years. Again, to give a comparative statement similar to that given in the report for 1911 for the Colonial Hospital, provincial hospitals, and plantation hospitals for the years from 1910, it will be seen that the percentage of cases admitted to the Colonial Hospital to total admissions is less for 1912, while for the provincial and plantation hospitals it is slightly higher:—

Year	Tubercular disease in all forms		Total admissions to hospital	Total deaths in hospital	Percentage of cases of tuberculosis to total admissions
	Cases	Deaths			
Colonial Hospital.					
1909	65	12	1,823	86	3·56
1910	120	35	1,973	107	6·03
1911	117	19	2,084	95	5·61
1912	68	6	1,782	110	3·82
Provincial Hospitals.					
1909	107	11	3,236	86	3·30
1910	145	16	5,657	136	2·52
1911	176	17	5,855	115	2·00
1912	124	11	3,932	34	3·15
Plantation Hospitals.					
1909	25	22	10,777	179	0·23
1910	48	32	18,063	473	0·26
1911	54	32	16,070	307	0·33
1912	63	38	13,625	267	0·45

There is a gradual rise for the four years in the plantation hospital figures. At the Colonial Hospital the case percentage is one of the lowest since 1900.

Measles.—There were but few cases of measles treated anywhere in the Colony—9 in the Colonial Hospital and 38 in the plantation hospitals. As cases of measles arrive in the Colony with every immigrant ship and are sent to the plantation hospitals, there must always be a few cases from time to time observed. It is to be noted that natives, when they do contract the disease, do not suffer as they did in former epidemics in 1874 and 1903. In the latter year the epidemic was so universal and so serious that probably now the only natives left to have it are those who have been born since that date.

Influenza.—Very few cases were treated at the Colonial Hospital; 147 at the provincial hospitals: and 93 at the plantation hospitals. Cases were not severe, nor were sequelæ troublesome. There were no deaths.

Dengue Fever.—Forty-four cases were treated at the Colonial Hospital, 27 cases at the provincial hospitals, and 657 cases at the plantation hospitals. Patients suffering from this disease do not, as a rule, apply to hospital for treatment. In the case of the plantation hospitals, however, with rigid daily muster of labour, all cases of fever which are discovered are sent to hospital for treatment. Hence the large number of admissions to these hospitals. At all hospitals there are also admitted and treated a large number of cases of undetermined fever. Thus there were 49 cases of pyrexia at the Colonial Hospital, 983 cases of febriculæ at all the plantation hospitals. These febrile attacks may be, in some cases, mild influenza or mild dengue fever, or possibly in some cases, sand-fly fever. In the case of indentured Indians, some are no doubt cases of malaria, the remnant of the malaria from which they suffered in India previous to their arrival in Fiji.

Tinea imbricata.—This parasitic disease—Solomon or Tokalau ringworm—continues to be treated

RETURN OF DISEASES AND DEATHS IN 1912 IN THE PROVINCIAL HOSPITALS FOR NATIVE FIJIANS, HOSPITAL AT ROTUMA, AND PLANTATION HOSPITALS,

Fiji.

GENERAL DISEASES.

	Admissions	Deaths	Total Cases Treated
Alcoholism	1	—	1
Anæmia	34	1	34
Anthrax	—	—	—
Beriberi	1	—	1
Bilharziosis	—	—	—
Blackwater Fever	—	—	—
Chicken-pox	45	—	45
Cholera	—	—	—
Choleraic Diarrhœa	—	—	—
Congenital Malformation	—	—	—
Debility	236	19	236
Delirium Tremens	—	—	—
Dengue	684	—	684
Diabetes Mellitus	—	—	—
Diabetes Insipidus	—	—	—
Diphtheria	—	—	—
Dysentery	861	63	861
Enteric Fever	25	3	25
Erysipelas	2	1	2
Febricula	993	—	993
Filariasis	200	2	200
Gonorrhœa	784	—	784
Gout	—	—	—
Hydrophobia	—	—	—
Influenza	240	—	240
Kalar-Azar	—	—	—
Leprosy	98	1	98
(*a*) Nodular	—	—	—
(*b*) Anæsthetic	—	—	—
(*c*) Mixed	—	—	—
Malarial Fever—	—	—	—
(*a*) Intermittent	—	—	—
Quotidian	—	—	—
Tertian	—	—	—
Quartan	—	—	—
Irregular	—	—	—
Type undiagnosed	—	—	—
(*b*) Remittent	—	—	—
(*c*) Pernicious	—	—	—
(*d*) Malarial Cachexia	19	—	19
Malta Fever	—	—	—
Measles	38	1	38
Mumps	6	—	6
New Growths—	—	—	—
Non-malignant	8	1	8
Malignant	8	1	8
Old Age	—	—	—
Other Diseases	—	—	—
Pellagra	—	—	—
Plague	—	—	—
Pyæmia	3	2	3
Rachitis	—	—	—
Rheumatic Fever	1	1	1
Rheumatism	487	—	487
Rheumatoid Arthritis	—	—	—
Scarlet Fever	—	—	—
Scurvy	1	1	1
Septicæmia	3	1	3
Sleeping Sickness	—	—	—
Sloughing Phagedæna	—	—	—
Small pox	—	—	—
Syphilis	—	—	—
(*a*) Primary	149	—	149
(*b*) Secondary	172	1	172
(*c*) Tertiary	—	—	—
(*d*) Congenital	14	2	14
Tetanus	5	4	5
Trypanosoma Fever	—	—	—
Tubercle—	170	46	170
(*a*) Phthisis Pulmonalis	—	—	—
(*b*) Tuberculosis of Glands	—	—	—
(*c*) Lupus	—	—	—

GENERAL DISEASES—*continued.*	Admissions	Deaths	Total Cases Treated
(*d*) Tabes Mesenterica	—	—	—
(*e*) Tuberculous Disease of Bones	—	—	—
Other Tuberculous Diseases	—	—	—
Varicella	—	—	—
Whooping Cough	5	0	5
Yaws	919	1	919
Yellow Fever	—	—	—

LOCAL DISEASES.

Diseases of the—			
Cellular Tissue	960	4	960
Circulatory System	42	7	42
(*a*) Valvular Disease of Heart	—	—	—
(*b*) Other Diseases	—	—	—
Digestive System—	1593	51	1593
(*a*) Diarrhœa	—	—	—
(*b*) Hill Diarrhœa	—	—	—
(*c*) Hepatitis	—	—	—
Congestion of Liver	—	—	—
(*d*) Abscess of Liver	—	—	—
(*e*) Tropical Liver	—	—	—
(*f*) Jaundice, Catarrhal	—	—	—
(*g*) Cirrhosis of Liver	—	—	—
(*h*) Acute Yellow Atrophy	—	—	—
(*i*) Sprue	—	—	—
(*j*) Other Diseases	—	—	—
Ear	77	2	77
Eye	893	—	893
Generative System—	—	—	—
Male Organs	249	—	249
Female Organs	240	6	240
Lymphatic System	299	12	299
Mental Diseases	—	—	—
Nervous System	144	10	144
Nose	6	—	6
Organs of Locomotion	81	2	81
Respiratory System	731	37	731
Skin—	1595	2	1595
(*a*) Scabies	32	—	32
(*b*) Ringworm	—	—	—
(*c*) Tinea Imbricata	351	—	351
(*d*) Favus	—	—	—
(*e*) Eczema	—	—	—
(*f*) Other Diseases	—	—	—
Urinary System	31	6	31
Injuries, General, Local—	1649	9	1649
(*a*) Sirlasis (Heatstroke)	5	—	5
(*b*) Sunstroke (Heat Prostration)	—	—	—
(*c*) Other Injuries	—	—	—
Parasites—	221	5	221
Ascaris lumbricoides	16	—	16
Oxyuris vermicularis	—	—	—
Dochmius duodenalis, or Ankylostoma duodenale	671	11	671
Filaria medinensis (Guinea-worm)	6	—	6
Tape-worm	—	—	—
Poisons—	—	—	—
Snake bites	—	—	—
Corrosive Acids	—	—	—
Metallic Poisons	—	—	—
Vegetable Alkaloids	—	—	—
Nature Unknown	—	—	—
Other Poisons	—	—	—
Surgical Operations—	18	4	18
Amputations, Major	—	—	—
,, Minor	—	—	—
Other Operations	—	—	—
Eye	—	—	—
(*a*) Cataract	—	—	—
(*b*) Iridectomy	—	—	—
(*c*) Other Eye Operations	—	—	—

with success by means of sulphur fumigation. Fumigating boxes are now in use at most of the provincial hospitals and also have been supplied to some native medical practitioners for local use. The improvement is marked, if only gradual, and a few years must make a great difference to the numbers, when the cases are regularly and systematically notified and collected for treatment as they now are.

Frambœsia.—Like tinea imbricata, frambœsia, yaws or coko, is notifiable under the Native Regulations. One hundred and forty cases were treated at the Colonial Hospital, mostly cases of secondary and tertiary manifestations of the disease; 903 cases were treated in all provincial hospitals. Salvarsan is fairly extensively used and its results are successful when combined with other methods of treatment.

Filariasis.—There is, as always, a large amount of filarial disease, though possibly it is less than it was. It is not easy to give any returns that can be at all accurate, for by far the majority of Fijian sufferers remain at home in their houses when ill and do not apply to hospital for treatment.

Work in connection with the improvement and canalization of watercourses has proceeded regularly in Suva during the year, and though the gang is but a small one, the work done by them under the Medical Officer of Health is useful and good.

Ankylostomiasis.—Six hundred and fifty-one cases of ankylostomiasis were treated at plantation hospitals with 11 deaths. The importance of the presence of the disease is well recognized by all medical officers, and constant and regular efforts are made to insist on proper use of latrines provided for the labour on all plantations. It is a fact, however, that many of them make use of the canefields as latrines. It is also to be noted that quite a considerable number of new arrivals from India in immigrant ships arrive in the Colony suffering from the disease and require to undergo treatment before they can be allotted to plantations; in some instances their condition is so grave that it is necessary to reject them and return them to India.

Leprosy.—The work at the Leper Station has gone steadily on. At the end of the year there were 154 patients at the asylum. The report of the Medical Superintendent is enclosed and in it will be found details of the condition of the station. Visits of inspection were made by me in February, June, and November, and detailed reports of each visit sent in. The number of lepers collected during the year has been fairly large; difficulties of transport and collection delay the more rapid filling of the station, more especially with patients from the more distant and scattered parts of the Colony. They will, however, be collected from these distant parts by degrees and as opportunity offers. It is a matter of great regret that the hurricane at the beginning of the year practically wiped out the growing crops, for it is to these that we look for giving the provision vote and making the station, at any rate so far as food goes, to a great extent self-supporting. On the occasion of each visit every patient was seen, their requests and complaints investigated and, whenever possible, complied with and remedied. Two requests stand out from among the rest for note. The first is a request from many Indian patients for opium. It is the opinion of the Medical Superintendent, with which I entirely agree, that to give these patients opium as a routine practice and indiscriminately cannot fail to have the worst effect on them morally and physically, and it was decided, therefore, that it should only be used in moderation for a very few old opium-eaters, on whom the total sudden deprivation might have a bad effect. The result of the decision is good, though it gave rise to some acute discontent at the time. They are now by far the better for it. The second request was a very urgent one from several Polynesians to be allowed to marry the Polynesian women. An attempt was made to allow village life by allowing the female patients to live in the villages; the evil result of this was at once apparent in the slovenliness of the patients, neglect of their towns, houses, and personal appearance, refusal to do the small amount of work required of them, and so forth. The practice was therefore stopped and now all female cases are looked upon as hospital patients and occupy the female hospitals under the direct charge and supervision of the nursing sisters. There can be no question that separation with such a mixed population of uneducated people is the proper course to adopt. The patients are now contented for the most part, well cared for, and as comfortable as their illness allows them to be. The work done during the year has been good, and the staff have, in spite of some changes, accomplished much towards the completion and organization of the station.

Vaccination.—The annual report on vaccination in the Colony is attached.

Colonial Hospital, Suva.—Admissions to the Colonial Hospital fell off mainly owing to the opening of the new Gaol Infirmary in the middle of the year. One thousand seven hundred and twenty-eight cases were treated as in-patients, against 1,973 in 1910, and 2,120 in 1911. There was a small increase in the number of European admissions, 211 in 1912, 195 in 1911, 202 in 1910. A Junior Medical Officer was in residence for part of the year, but had to be sent on relief work on several occasions, so that the full benefit of his services to the hospital were not obtained. The work done at the hospital was good, but the urgency for a new building becomes greater each year.

Inspection of Immigrants at Nukulau Depot.—Four immigrant steamers arrived during the year. The time occupied for the inspection may be taken as fifteen days, and with the time of getting a medical officer from his station to Suva and back, three weeks at least must be allowed for each ship. A medical officer is therefore, and has been in recent years, employed continuously for one quarter of the year for inspection work.

Nursing Staff, Colonial Hospital.—The matron was away on leave during the whole year, her leave having been extended to 1913. The nursing staff was kept at full strength, vacancies being filled by local applicants as they occurred.

Native Obstetric Nurses.—During 1912 twenty-four native obstetric nurses were employed in twenty-four districts. Ten new nurses completed their year of training at the Colonial Hospital and were sent out to ten new districts. Their work was in most cases appreciated by the people whom they looked after, and there is an increasing demand for their services, though it has to be confessed that in some districts they are looked upon with suspicion and made small use of. They have attended during the year 293 cases. Thirty-nine cases were attended in the Colonial Hospital, in which these nurses are trained.

Native Medical Practitioners.—Forty native medical practitioners were employed during the year in provincial hospitals and out-districts, Suva and Levuka Hospitals, and Suva Gaol; nine more passed the qualifying examination in December, but did not proceed to their new districts until January, 1913. The work of these men has been, on the whole, good. It was, however, found necessary to ask for authority for the dismissal from the service of three for constant disobedience and general bad conduct; their certificates were cancelled.

Suva Gaol Infirmary.—The infirmary for the Suva Gaol was completed and opened during the year, it is under the Resident Medical Superintendent of the Colonial Hospital, who is the Visiting Medical Officer. There were admitted to the Colonial Hospital before the Gaol Infirmary was opened and to the infirmary after it was opened 379 prisoners with 12 deaths. A native medical practitioner is in resident charge. His work is well reported on as very satisfactory by the Visiting Medical Officer. It will be found that the opening of the infirmary has a good effect on the reduction of the numbers of a certain class of Indian prison patient, for whom prison discipline is most necessary and for whom it was impossible to provide it in hospital. The past "dysentery season" has been a remarkably light one, and the lightness of the numbers and cases has been nowhere more marked than in the gaol, when compared with the seasons 1911-1912.

Levuka Hospital.—A small addition was made during the year to the native portion of the hospital, which was found to be insufficient to accommodate the native patients demanding treatment. The work of the staff was satisfactory.

Visits of inspection were paid during the year to Makogai, Levuka, Rewa, Navua, Lau, and Savusavu.

There were no new districts opened during the year, and the district of Savusavu was vacant after April. Continuous shortage of staff prevented the filling of this district.

Meteorological Extremes for the Year.

Highest barometer—30·188″ on June 13.
Lowest barometer—29·228″ on January 28.
Highest temperature—92·0° F. on March 18.
Lowest temperature—60·0° F. on August 25.
Greatest rainfall in one day—25·526″ on December 25.
Hurricane—Vanualevu, Taviuni and Lau, on January 28.

Report on Vaccination for the Year 1912, by G. W. A. Lynch, Chief Medical Officer.

The total number of vaccinations performed in the Colony during the year 1912 was 3,657, an increase of 553 over the figures of 1911.

There is, however, a very large total of unsuccessful results (601), which reduces very materially the total number of successes. In this connection, it is to be noted that, as has been reported before, the failures are found, for the most part, in those parts of the Colony to which postal access is most difficult, and therefore most delayed. Notably 135 failures in Lau, some of the islands of which province are very far off, as far as postal arrangements are concerned; 61 failures in the Yasawas, the islands of the Ba Province, to which the same remark applies; and the same is the case in Rotuma, where there were 55 failures.

There were also a good many gaps and vacancies in some of the native medical practitioners' districts, which had been vacant for the whole year, owing to dismissals and resignations; but for this fact the totals would have been considerably higher.

Province or Medical District	Successful	Doubtful	Unsuccessful	Absent from inspection	Total
Ba and Yasawas	207	1	61	—	269
Bua	114	10	—	—	124
Cakaudrove	203	31	25	—	259
Colo East	114	29	6	—	149
Colo North	144	4	22	—	170
Colo West	114	—	12	—	126
Kadavu	150	—	32	3	185
Lautoka	59	—	90	—	149
Lau	300	64	135	—	499
Lomaiviti	300	19	45	—	364
Macuata	193	10	38	4	245
Nadi	81	—	5	—	86
Nadroga	193	—	69	—	262
Namosi and Serua	89	—	—	—	89
Navua	37	5	—	—	42
Naitasiri	115	—	—	1	116
Ra	123	—	—	28	151
Rewa	131	—	6	—	137
Tailevu	64	6	—	—	70
Taviuni	34	—	—	—	34
Rotuma	76	—	55	—	131
Total	2,841	179	601	36	3,657

Report on the Public Lunatic Asylum, Suva, for the Year 1912, by G. Emerson Arnold, M.D., M.R.C.P., Acting Medical Superintendent.

During the year 1912 there were treated at the Public Lunatic Asylum fifty patients. Twenty-nine remained over from December 31, 1911; 21 were admitted during the year; 6 were discharged cured; 2 were discharged relieved; 1 not improved; and 10 died; 31 remained on December 31, 1912. The patients were 39 males and 11 females. There were 7 Europeans, 17 Fijians, 21 Indians, and 55 others. The Europeans were 4 males and 3 females. There were 10 deaths.

An outbreak of dysentery occurred among the native patients in the asylum during the early months of the year, and there were four deaths from this cause. None of the European patients and none of the attendants were attacked. Apart from this, the general health of the inmates of the asylum was good.

Colonial Medical Reports.—No. 63.—Fiji (*continued*).

New quarters for the European male patients are very badly needed and will, it is hoped, be provided in 1913. The other classes of patients are now well housed.

not proposed, however, to keep more than a few; other new arrivals will be destroyed a few days after birth, and the full supply of milk obtained from the mothers.

The result bears an encouraging appearance, and

RETURN OF DISEASES AND DEATHS IN 1912.

Disease	Remaining in Asylum at end of 1910	Yearly total Admissions	Yearly total Deaths	Total cases treated	Remaining in Asylum at end of 1911
Local diseases (Subsection III, Mental diseases)—					
Mania	10	12	6	22	11
Melancholia	5	2	—	7	4
Dementia	7	—	1	7	5
Delusional insanity	3	3	1	6	5
General paralysis of the insane	4	4	2	8	6
Total, 1912	29	21	10	50	31
Total, 1911	24	15	5	39	29

REPORT ON THE HOSPITAL AND ASYLUM DAIRY FOR THE YEAR 1912, BY G. W. A. LYNCH, M.B., CHIEF MEDICAL OFFICER.

The cost of establishment of the dairy, including fencing, dairy sheds, utensils, purchase of twelve cows and one bull in 1911 (December) was £350 15s.

The cost of milk supplied by the contractor in 1911 was, for asylum, £41 15s. 4d.; for hospital, £449 11s. 1d.; total, £491 6s. 5d. The cost of milk supplied by the contractor in 1912 was, for asylum, £4 0s. 2d.; for hospital, £250 16s. 8d.; total, £254 16s. 10d. The value of milk (estimated at the same rate as that of the contractor) supplied by the dairy in 1912 was, for asylum, £35 18s. 2d.; for hospital, £180 12s. 6d.; total, £216 10s. 8d. The working expenses of the dairy, including wages and rations of two (2) herdsmen and grass-cutters, bran for the herd, utensils, &c., were £73 10s., leaving a total net profit on the milk of £123 0s. 8d.

Rent of land is not included; it is an area of Government land that has been assigned for this purpose, and was not made use of for any special purpose before, except odd planting and grazing at a low rental to one or two Indians, or was unoccupied.

It does not appear to be too optimistic to consider that £100 is the saving to the Government on the outlay of £350 13s.

It is proposed in 1913, and has been approved on the Estimates, that a sum of £200 shall be spent for increasing the size of the dairy herd—it should be possible to double it. There will be an increase in the working expenses, but that increase will not be doubled while the supply of milk should be materially increased and more uniform.

The supply was greatest in February and thereafter declined with the drying-off of the cows till September, when there were but 300 pints for the whole month. It is now gradually increasing with the arrival of new calves.

In order to increase our herd we are endeavouring to raise some of the heifer calves, and that is, from the dairy point of view, an expensive process, since the mothers must not be milked dry and each calf uses at least one shilling's worth per diem. It is it is my opinion that with careful management, a dairy of sufficient size under proper management could be made to supply the hospital and asylum not only with milk, but with butter, which is a very expensive part of our provisioning, and that even with a European in charge, as there would have to be, a considerable saving would eventually be effected. A most important point to the hospital is the supply of pure milk, the quality of which can be relied upon.

ANNUAL REPORT FOR 1912 OF THE MEDICAL OFFICER OF HEALTH AND GOVERNMENT BACTERIOLOGIST.

Port of Suva.

The health of the port during the year has been good and no case of quarantinable disease has occurred.

The ports in immediate steamer communication with Suva were likewise free from quarantinable disease, though a case of plague occurred in the island of Hawaii in February.

The rat-catcher employed by the Health Department accounted for 2,232 rodents (1,478 rats and 754 mice) during the year. These rats and mice are daily inspected by me and any presenting appearance of disease are subjected to *post-mortem* examination before being destroyed. None showed plague lesions.

Town of Suva.

The health of the town during the year has been exceptionally good. During the night of January 27 a wide area hurricane occurred. The office and laboratory were battened up and no damage occurred.

Work of Sanitary Gang.—The work of the sanitary gang of ten prisoners during the year has been most satisfactory. It is, however, almost impossible for these ten men to keep pace with the extraordinary rapidity with which, in this humid climate, the water-courses become choked with a luxuriant growth of weeds and by the washing down of soil into them by rain.

Prevalence of Disease.—It is, I think, satisfactory

to note the lessened incidence of notifiable and preventible diseases in this district, and I think I am justified in concluding that the work of the sanitary gang has been the main factor in this direction.

This year of 1912 has been the first in which a systematic Register of Notifiable Diseases under the new Public Health Ordinance, 1911, has been kept. The register shows for the district the following notifications: Dysentery, 304 (district, 151; gaol, 153); typhoid, 11; tuberculosis, 12.

The dysentery figures are relatively large and represent mostly an outbreak amongst the prisoners in the Suva gaol. I think, however, when one reflects on the extraordinary difficulty always encountered in combating this disease in institutions such as gaols or asylums, especially in a humid tropical climate, it will be seen that there is no ground for alarm. Indian prisoners are notorious for the facility with which they purposefully acquire this disease, which entails a period of some weeks *dolce far niente* in the hospital.

All houses in which these notifiable diseases occur amongst natives are visited by the Sanitary Inspector, who, in every case, carries out such routine methods of disinfection, by spraying or fumigation of house, bedding, and clothes, as may be required.

Typhoid Fever and Dysentery.—With regard to these diseases in which the infection (*Materies morbi*) is conveyed mostly by flies from infected stools to food, it is a matter for congratulation that the "two-pan" system of scavenging has been adopted during the year. This system, as carried out by the Town Council, is most efficient and will, I believe, materially affect the incidence of these diseases. It is always to be remembered, however, that our native servants are a source of infection as they may, although not actually suffering from these diseases, be "carriers," and here comes the extreme difficulty of combating the spread of dysentery and typhoid.

Dengue Fever.—The incidence of this disease has certainly been very much reduced, there having been no definite epidemic during 1912 as in previous years, although, of course, sporadic cases occurred. There is little doubt that many cases diagnosed as "dengue" are, in fact, suffering from "unclassed tropical fevers," and this is to be accounted for by the fact that the primary and secondary eruptions of dengue are so ephemeral as to escape notice on the part of the patient before his calling in the medical attendant, which he rarely does until the secondary fever. The medical attendant thus becomes accustomed to the presumption that the case is one of dengue as he so rarely sees the rashes always to be seen in true dengue—roseola in the primary, and morbilliform in the secondary fever. Thus, I believe, error creeps in so that the incidence of this disease appears larger than it actually is. The epidemic of true dengue is remarkable in (1) its sudden onset; (2) the number of people simultaneously attacked; and (3) its abrupt termination. I have seen an epidemic suddenly appear, bowl over approximately a quarter of the population of the town and subside all in fourteen days.

Routine Work.—With regard to the routine health work in the district, systematic inspection has been carried out in a most satisfactory manner by the Sanitary Inspector and I have myself made frequent visits of inspection to all the areas in the district and special attention has been paid to native settlements. During the year 116 notices under the Public Health Ordinance, 1911, were served. The following prosecutions were instituted and the delinquents fined: Under Public Health Ordinance, 6; under Municipal Institutions Ordinance, 10. The work carried out by the Town Council during the year in paving and storm-water drainage have done much in the direction of rendering the town healthier and more wholesome.

Laboratory Work.—The entire analytical work was carried out in the Public Health Laboratory, in addition to the routine bacteriological and pathological investigations.

Report by F. Nangle Smartt, M.B., Acting District Medical Officer, Lautoka.

Statistics of population for this district for the year are not available.

Measles broke out in July, and started among the children of Lautoka estate, to which estate the outbreak was almost entirely confined. Eighteen cases occurred among indentured immigrants, with one death. There were four cases among the European population. The Fijians were not affected.

Varicella.—In December twelve cases occurred on Lovu estate—adults chiefly were affected. Six cases occurred among European children in Lautoka.

Dengue and Febricula.—These terms are used synonymously. Forty-six cases occurred during the first four months and twenty-one cases during the rest of the year; one case only occurred during the last three months of the year. The cases seen by me were not dengue as classically described.

Dysentery.—Fifty-four cases, with six deaths, were treated at the plantation hospital. In no instances was death due entirely to dysentery; in the fatal cases dysentery was either complicated by or with other diseases. The type of dysentery was mild. A few cases occurred among Europeans and also among Indians and Fijians (without deaths in my knowledge).

Digestive System.—Under this heading is included diarrhœa, enteritis, and gastro-enteritis. One hundred and seventy-two cases were treated at the plantation hospital, nearly all being children. The largest number of cases occurred in August, September, and October; and in October gastro-enteritis was of a severe type. There were sixteen deaths—all children—from these figures. European children also suffered, and among them were three deaths from enteritis.

Tuberculosis.—Nine cases were treated at the plantation hospital with seven deaths and no im-

provement. These cases were all pulmonary tuberculosis.

Respiratory System. — Thirty-six cases were treated at the plantation hospital. Three deaths occurred — all broncho-pneumonia of children. Asthma is fairly common; in this division the various preparations of suprarenal have been used with good if only temporary results. Three cases of chronic asthma were seen in which adrenalin was of no use.

Anæmia, due to ankylostomiasis, is common; 153 cases were admitted to the plantation hospital for this disease.

Contagious Diseases.—All cases among indentured immigrants are recorded. Among the rest of the population only those cases which have occurred during the last half of the year have been recorded.

Provincial Hospital.—There is no hospital for native Fijians in this district. There is every facility for sending sick people to the Nailaga hospital, but the natives do not avail themselves of these benefits.

Plantation Hospital.—There is one hospital serving seven estates with a total population of 1,540 immigrants and children. During the year 1,135 cases were admitted; there were forty-eight deaths.

Plantation Lines.—The lines have been kept clean and in good condition. Several recommendations for the improvement of water supplies were made and have, for the greater part, been carried out. Latrines have been kept clean and lime freely used.

General Sanitary Work.—Nothing calling for special remark has been done, and no serious outbreak of disease has occurred to call for special action. The sanitation of the district is not bad, but there is much room for improvement. An old latrine at the mill was condemned, and a new latrine, with septic tank, was erected in its place by the Colonial Sugar Refining Company. This company has now undertaken the reclamation of the foreshore of Lautoka; when this work is completed, a vast improvement to the locality will have been effected.

REPORT BY P. T. HARPER, ACTING DISTRICT MEDICAL OFFICER, REWA.

Population: Europeans, 300; births, 11; deaths, . Fijians, 15,855; births, 778; deaths, 504. Indians (no figures available in the district). With egard to the Fijians, the figures given above are he massed figures for the three provinces going o form the Rewa medical district. There has thus een a net increase in the total Fijian population f 274.

Diseases.—Framboesia: One hundred and seventywo cases of framboesia have been treated; nine eing Indians at the coolie hospitals; two half-castes en at Nausori; two Samoans seen at Nausori; and 59 being Fijians treated at Wainibokasi hospital. f the Fijians, eighteen were infants or children ith secondary yaws, and 141 were cases of tertiary aws. The universal prevalence of yaws among the Fijians furnishes an ample cause for the enormous infantile mortality and for the decrease in the native population. The disease is in every way comparable to syphilis in its remote effects upon the human body. Whether the disease is ever hereditary or not is not certain, hut the majority of the stillhirths and miscarriages are undoubtedly due to the fact that the mother is infected with yaws. There is only one treatment worth considering for secondary yaws, namely, that hy salvarsan, or some other derivative of arsenic of a similar nature.

Syphilis.—Fifty-one Indians with syphilis were treated at the coolie hospitals. There was one death.

Salvarsan Treatment.—Fifty cases of yaws and syphilis were treated hy salvarsan during the year; the number treated hy me during 1911 was 51. Of the 50 cases treated during 1912, 19 were Fijians, 13 of whom were affected with secondary yaws and 6 with tertiary yaws. One of these former (an infant, and one of twins), though apparently cured of yaws hy the salvarsan, caught dysentery from her elder sister, aged 9, who was admitted to hospital for dysentery, and died of that disease. The death occurred some weeks after treatment with salvarsan, and was not, in my opinion, due to the drug. The twins at the time of treatment were aged about 10 months, and were hoth in a most advanced stage of yaws cachexia and wasting, and neither of them had a square inch of unaffected skin on their body. The salvarsan cured them in a few weeks. The other Fijians were all cured or much improved by the treatment. Two half-castes and two Samoans were similarly treated for yaws; of one of these nothing further was heard. The other three were cured. Twenty-eight Indians were treated hy this drug for yaws or syphilis; one of these, an adult female with rupial syphilis, derived no benefit from the treatment, but got steadily worse. No treatment was of any avail; mercury was tried in many forms and large doses of quinine were given; she died two months after her last dose of salvarsan; my opinion is that in her case the giving of salvarsan was prejudicial. It was given intramuscularly and, in all, she received 3 grm., the first dose being ·6 grm. and the six subsequent doses being ·2 grm., spread over a period of over two months. Possibly this was an instance of anaphylactic reaction. The others all did well. Two of these Indians were suffering from syphilitic keratitis which had obstinately resisted other lines of treatment. They completely recovered after the salvarsan. All of the above cases of yaws and syphilis which were treated by salvarsan received the intramuscular injection except one, a very bad case of secondary syphilis with an extensive papulocrustaceous eruption, to whom an intravenous injection of ·6 grm. was given; he was cured. As a routine treatment of syphilis I have now adopted a full two years' course of mercury, given by the method of the late Colonel Lamhkin, preceded, as a rule, by the intramuscular injection of salvarsan. A number of the Fijian salvarsan cases were treated hy native medical practitioner Eroni Buresova, with

occasional advice from me. The hospital superintendent at Nausori hospital was taught to prepare the drug both for intramuscular and for intravenous administration. For the former, various oily emulsions were tried and discarded in favour of the aqueous solution. With proper dosage the risks seem minimal. The risks of giving the drug are certainly not so great as the risks of withholding it in suitable cases. One other case was treated with salvarsan, a case of simple psoriasis; there was no improvement.

Tuberculosis.—Thirty cases were treated at the Fijian hospital, with three deaths. A certain number left hospital to consult "witch doctors" or to die in their own villages. In all such cases full directions were given to the relations for the avoidance of infection. At the coolie hospitals thirty-one cases of tuberculosis were diagnosed, with fourteen deaths. In over forty *post-mortem* examinations on indentured Indians, who had died from various causes, signs of active or healed tuberculosis were looked for and were found in all except one. So that it is clear that practically all indentured Indians suffer at one time or another from a tuberculous infection. In three cases of marked tuberculosis of the lungs the patients had performed their full tasks without complaining until the actual day on which they were admitted to hospital, which furnishes a strong argument that the ordinary task of the indentured labourer is not a hardship for a healthy man.

Dysentery.—Dysentery was, as usual, most prevalent during the "fly" season. At the coolie hospitals 128 cases were treated, with nine deaths. Several of the deaths were of most debilitated subjects, in whom the disease was a terminal infection. In some cases the disease had been chronic for months. Diarrhœa, teething dysentery, "planters'" dysentery, and mucous colitis are not included in this return. A chart of the monthly incidence of dysentery is appended. Among the Fijians, forty-three cases were treated at Wainibokasi hospital, with four deaths. Of these four cases who died, in two the disease was a terminal infection, the original diseases being yaws and whooping-cough respectively.

Leprosy.—Forty-nine lepers were signed up and removed to Makogai from this district during 1912. Many others were examined and, if found free of the disease, were given a certificate to that effect, as, on one or two occasions, I was asked to examine people because the informant appeared to have a spite against the alleged leper. Three other lepers have been signed up. I estimate the number now left in this district at between one hundred and two hundred.

Pyorrhœa alveolaris.—Pyorrhœa alveolaris and dental decay are apparently as inevitable to the Fijian of middle age as secondary yaws is to the child. All Fijians admitted to Wainibokasi hospital are now made to wash their teeth regularly with an antiseptic mouth-wash. Undoubtedly the dirty state of their mouth renders them unhealthy and an easy prey to serious disease.

Ankylostomiasis.—At the Fijian hospital sixteen cases only were treated, and these were chiefly Indians. At the same time, there can be no doubt that the disease is markedly on the increase among the Fijians of this district, if not throughout the whole of Fiji. Fijians do not come to hospital for the disease because they do not need to have their bodies in good condition like the indentured Indians. A few very advanced cases were treated outside the hospitals with success. Some of these were Fijians. With the improvement in the sanitary arrangements of the free Indians, which will follow the work of the Local Authority, the dangers of a spread of the disease by free Indians will become less. Among the indentured Indians 369 cases were treated, with three deaths.

Gonorrhœa.—At the coolie hospitals seventy-four cases were treated. Arrangements were made to inspect the whole of the labour on certain estates where the rate of venereal disease was high. A start was made with Nausori labour and about 200 indentured and free men were examined. The infected were sent to hospital. The women resolutely refused to be examined unless a European nurse were provided for them. As events proved, the women were responsible for the spread of the infection, and they continue to spread it.

Enteric Fever.—There were twenty cases altogether—3 Europeans, 10 Fijians, 1 free Indian, and 6 indentured Indians; there was 1 death. The two (December) Davuilevu cases obviously derived their infection from Labasa. The most frequent common factors among the cases were that the majority came from villages or settlements on the river-bank, and that the case-rate per mensem was highest during the "fly" months. There are probably several foci where typhoid is endemic, and there are probably several means of infection, water and flies being amongst the most usual. Undoubtedly many of the cases of indisposition among all races, where the patient does not feel ill enough to consult a doctor, or where the symptoms are very slight, are really typhoid cases. This was seen at the Viria outbreak this year.

Puerperal Fever.—Puerperal fever seems to have its hold upon Manoca estate; arrangements have accordingly been made to send all parturient women from this estate to hospital for confinement. A woman from this estate, who had been confined recently, was brought into hospital with puerperal septicæmia; she is the third from that estate during the last few years. They all died. A different nurse attended each patient in a different part of the lines.

Mental Diseases. — Several cases of mental disease were examined, but unfortunately no record was kept of them. Three cases were sent in to Suva Asylum. Among other cases seen was a Fijian with incipient general paralysis of the insane, and one or two cases of melancholia and mania who were Indians.

Small Fevers.—Three hundred and thirty-six cases of dengue (so-called) and other small fevers were admitted to the coolie hospitals.

Colonial Medical Reports.—No. 63.—Fiji (*continued*).

Operations on Fijians.—Our opportunities for good would be much increased if we were allowed to operate on Fijians at our own discretion without obtaining the consent of the patient. I did operate on one Fijian without his consent. He was a case of strangulated inguinal hernia. Although he knew that his life had been saved by the operation (and not merely that, but also that he had got rid of a very troublesome rupture), he was for some time afterwards most offended at the liberty taken with him. Several cases needing amputation, &c., refused operation; they will die in 1913, at latest, and so the year 1913 will start with a balance on the wrong side as regards the increase in the native population.

Post-mortem Examinations.—Post-mortem examinations are performed on all cases dying in the hoolie hospitals as soon after death as possible. It is a great pity that the Fijians will not allow *post-mortem* examinations on their dead, as this is the only way we can learn scientifically about a race of whose constitution and diseases at present very little is known.

Provincial Hospital, Wainibokasi.—Admissions, 54; deaths, 17. The old tax-inspector's house was old and removed, and the old leper house was burnt. Two new houses were built by the Works Department, and three new Fijian houses were built by the Tokatoka, Dreketi, and Noco districts. This considerably increases the accommodation for patients. Pan latrines have been abolished and pit latrines put in. The whole hospital compound has been well fenced-in and a strong gate put up.

Plantation Hospitals.—Admissions, 2,219; deaths, 41. Nausori hospital has been tinkered up as occasion required. In the near future a certain amount of rebuilding will be required. The equipment has been kept up to a point of high excellence for a hoolie hospital. Koronivia hospital is clean and good enough for the work required from it. Baulevu hospital is under repairs, as dysentery is endemic in the vicinity.

Native Town Sanitation.—Inspections have been performed by the native medical practitioners throughout the year. During the warm season inspections are also being made by the Sanitary Inspector and myself. Many of the districts are low-lying, and some are actually situated on mangrove swamp. Such whole districts (*e.g.*, Noco) would be better moved to the hilly inland country; otherwise the special difficulties of the district are the drinking water, the rapid growth of hush, and the proximity of numerous free Indian settlements.

Plantation Lines and Sanitation.—These have been visited at the regular times. Their condition as a whole, very satisfactory. The total death-rate has been in the neighbourhood of 26·9 per 1,000. The total death-rate for the whole of British India in the decennium ending 1909 was between 32·45 and 38·91 per 1,000. The chief causes of death were tuberculosis and dysentery. *Post-mortem* examinations were performed in over forty of the forty-eight deaths of indentured Indians in the district as well as on various other cases. Five lepers were removed from various estates to Makogai, or a leper rate of about 2·5 per 1,000 indentured Indians. The total leper rate for the whole of British India works out at about ·3 per 1,000 of the total population, which is almost certainly an understatement.

Seventy-one vaccinations have been performed by the district medical officer.

Meteorological Conditions.—The total rainfall for the year at Nausori was 112·31 inches, of which 30·30 inches fell in May and 23·4 inches in December.

A perfect specimen of stomoxys calcitrans was caught by me and forwarded to the Entomologist. It was his first perfect specimen of this fly.

Report by F. Hall, Medical Superintendent, Makogai Leper Asylum.

Admissions.—The number of admissions for the year was 125; one patient was discharged and eight died, leaving 153 patients in the asylum at the end of the year.

General Health.—The general health of the community was excellent, and nothing could be more apparent than the marked beneficial effect on leprosy of good food, cleanliness, and regular habits. There are several cases now at the asylum who without any special treatment show such improvement that if they had had specific treatment one would be inclined to put them down as cures. Chaulmoogra oil is of the greatest use in preserving the nutrition and general well-being of fairly early cases, if they can take it in sufficient quantities, but it is liable to upset the digestion in old and debilitated subjects. Inunction, with its consequent massage, is also a great help.

Cases treated with Williams' Vaccine.—Twelve selected cases, including early nodular, macular, and parasthetic leprosy, have been treated for the past seven months with Captain Williams' (I.M.S.) vaccine, derived from the pleomorphic organism which he has isolated and grown, and which he believes to be the cause of leprosy. The supply has not been regular and it is, of course, too soon to look for any definite results, but the first and second batch of vaccine gave reaction, and during the course one only of those treated had attacks of the ordinary leprotic fever. The reaction cannot, of course, be looked on as a proof that the vaccine used is specific, for any disturbance to the leper economy promotes febrile attacks. The vaccine varies greatly in strength, and probably deteriorates rapidly. Those treated who were suffering from extensive bone lesions showed no improvement which could be put down to the vaccine, but in others old-standing sores healed and nodules softened and patches regained their normal colour, but equally beneficial results took place in those undergoing no specific treatment, but whose general health was improved.

Serum and Vaccine Treatment.—The splendid work that has recently been done to advance our

knowledge of the causative organism of leprosy, its cultivation, and experimental growth in animals, is giving an enormous impetus to vaccine or serum treatment, and filling the dull horizon of leper therapeutics with a bright ray of hope without enormous expense, the discovery of a specific and prophylactic treatment is the only hope of stamping out, and preventing the spread of the disease in this group, for, I take it, there is an undiagnosed for every diagnosed case, the disease being in too early a stage for ready discovery.

Second Medical Officer.—The appointment of a second medical officer is the only way in which we can step into line with those asylums that are making strenuous efforts to treat the disease; such an appointment, if the officer were a bacteriologist, might be of inestimable value to the community, and would enable us to give the lepers the only rational treatment.

Operative Work.—A considerable amount of operative work has been done during the year, fifty-six under anæsthetic; they included two amputations of legs, fourteen of fingers, and two excision of leprous tubercles impeding use of hands, four excisions of masses of leprotic glands, two cataract extractions (both did badly), two iridectomies, three paracentiesis cornæ, several nerve stretchings, and excisions of portions of nerves for intractable neuralgia, and many scrapings of bones and leprous ulcers; on the whole the results of operative treatment were encouraging. The most difficult cases to treat are those in which the tarsal bones are afflicted, often accompanied by intense pain, swelling, and tenderness of soft structures; incision and nerve stretching combined give some relief, but it is difficult to find the seat of the trouble as all the parts are more or less infiltrated with inflammatory products. Nasal lesions are also intractable; benzoyl chloride in parolene, perhaps gives the best results.

Dysentery.—There were two confined epidemics of dysentery, each starting immediately after the arrival of Rewa lepers; the total number of cases was only twelve, but there was one death and the epidemic caused considerable overcrowding of the hospital, already full, as all women are kept in hospital to preserve segregation of the sexes; additions for this purpose are urgently required.

I think we were fortunate in only having twelve cases as lepers appear to be most susceptible to dysentery.

Sanitary regulations are well observed and the towns are kept clean.

Conduct of Patients.—The sudden deprivation of freedom to a hundred and fifty persons afflicted with a disease which causes extreme mental depression made them at first discontented and somewhat unruly, but now, on the whole, the general conduct is good, and they conform to the rules of the asylum. All patients well enough are expected to perform certain communal work and grow food; most of them now have flourishing gardens, but it is doubtful whether the lepers will ever grow any appreciable quantity of food; all good land is hard won for cultivation and is a tangle of "werewere" and guava, the simple native method of cutting and burning is not sufficient for these imported pests, besides which all flat land is planted with coconuts, which the natives object to cutting down.

Plantations.—This has been a particularly unfortunate year for planting operations, the hurricane destroyed all the food crops, blew down a large number of bread-fruit trees, and ruined the crop of the others for twelve months. We had only 60·15 inches of rain, which was chiefly split up into showers of 30 to 80 points, followed by hot, dry winds and gales. The plantations have come into bearing during the last three months and 457 bunches of bananas, 2,112 lb. of kumalas, 408 lb. of cassava, and 130 lb. of dhal have been issued as rations, and surplus sold as produce on the station. There are now roughly twenty-three acres under crops of bananas, cassava, maize, rice, dhal, and cowpeas, as well as areas lying fallow under green manure.

Labour.—The labour, beside ordinary plantation work, was employed making a cart-road to Yanitu, a riding track through the centre of the island, fencing, clearing land for paddocks, and have now begun planting these with grass.

Eighteen head of cattle were slaughtered for food, and three destroyed for disease; some of the cattle purchased from Cicia last year are as wild as deer, they must be shot where they can be found—a difficult matter in this country—the cattle cannot be managed here cheaply or efficiently until we have proper paddocks.

The English sheep purchased in Suva for breeding purposes were an entire failure; they have been here a year and only produced one stillborn lamb. European sheep seem to lose all fecundity in the Tropics. I am trying to cross them with Indian rams; if they breed the offspring should have some of the desirable qualities of both parents; the Indian sheep are very small but extremely hardy and prolific.

Goats are doing well. We have some sixty half-bred Angoras, which furnish excellent mutton, they are the progeny of forty-eight Fiji nannies crossed with pure imported Angora billies.

Pigs did well, though, unfortunately, we lost nine well-grown young pigs through, I believe, eating old cassava; the breeding sows had fifteen still births which I put down to the same cause; two very old sows died, the *post-mortems* showing a chronic gastritis and cirrhotic livers; one young sow died from sapræmia after parturition.

Staff.—The staff of the asylum suffered from many changes. Two European warders left, and one gave notice in December; the mechanic also gave notice. These Europeans find the life lonely and quite void of amusement: skilled tradesmen can get better wages on the mainland where, they say, the living is cheaper. Nothing can be worse for the work here, or more distracting for those responsible for it than these frequent changes. I look forward to the time when the appointments will be made sufficiently attractive for good men to wish to make their homes here. The work is now heavy with all buildings new, it will be a great

deal more so in the near future, and especially so if repairs are not attended to at once.

Nurses.—The Sisters, both native and Europeau, worked with a whole-hearted devotion, and their efforts are very apparent in the marked improvement of the lepers in their charge. They have taught all the women to sew and these now, with the help of a sewing machine, make all their own clothes and a great many of the men's. They wash for the Fijians and Polynesiaus, and keep their own house and their surroundings clean and tidy.

The Indian labour worked fairly well. There was little or no sickness amongst them; four infants were born. The labour sent some £80 to India and deposited in the Government Savings Bank £73.

The sales of canteen were £588 3s. 6d.—money chiefly spent by labour and warders; £34 14s. 2d. of produce was sold to staff, not including £16 10s. paid for pigs into S.A., Levuka; pigs made a total of £30 10s., not included in sale of produce.

Eight turtle were caught and issued; curiously, lepers eat and relish the fat rich turtle, but say pork is very bad for their disease on account of the fat.

Dairy and Stock.—Dairying operations were not very successful, from several causes; one being that our bull was sick and eventually had to be destroyed. The Sisters who had charge of the hospital herd have no time to superintend this work and know very little about stock. Feed was very scarce at Dalici. At Nasau there was plenty of milk for children, nursing mothers, and the sick. Working stock, cattle, and riding ponies kept very well all the year, and there was no shortage of feed at Nasau as Indian cane and sorghum throve in spite of the dry weather. A large area is being cleared at Nasau and planted with grass in order that as soon as possible the dairy may be moved from Dalici, and I hope to keep hospital supplied with plenty of butter and milk.

Finally, I do not think any of us who saw the miserable, neglected condition of many of the lepers on their arrival here would deny the justification of asylum treatment of leprosy to-day, without taking into consideration that a big step has been taken towards stamping this disease out of Fiji; the next step will be in the laboratory, and may that be at Makogai, when, if the progress of our knowledge of the disease advances as it has now begun, within a reasonable number of years the island will be an asset of great worth to the Government.

Report by J. W. Hunt, M.B., District Medical Officer, Labasa.

The population of the province of Macuata as near as it is possible to give is:—

	Males	Females	Total
Europeans ..	129 ..	65 ..	194
Half-castes ..	66 ..	57 ..	123
Indians ..	4,278 ..	2,470 ..	6,748
Fijians ..	2,342 ..	2,113 ..	4,455
Others ..	24 ..	7 ..	31
Total ..	6,839 ..	4,712 ..	11,551

Amongst the Europeans there have been four deaths—a heavy mortality in such a small community. With regard to Fijians, figures are only available up to the time of the holding of the Provincial Council in October. They show, unfortunately, that for the preceding twelve months the excess of deaths over births is 26. The three districts mainly responsible for this decrease are Dreketi, Labasa, and Macuata. The excess of deaths over births in these districts was 12, 9, and 9 respectively. For the past five years the fluctuation has been as follows: 1907, decrease 59; 1908, increase 1; 1909, increase 14; 1910, decrease 24; 1911, increase 36. In considering the unfortunate decrease in the native Fijian population for the year due account must, I think, be taken of the disastrous hurricane in January. This destroyed most of the native food plantations, and was followed by a most abnormal and prolonged drought, lasting until towards the end of the year, with the exception of a few light showers. The food question, therefore, has been very acute throughout the province and sickness naturally more rife. Now that much-needed rains have set in the food plantations should soon be in a flourishing state again. Figures concerning Indians are not available except as regards indentured immigrants.

Diseases.—The chief disease from a mortality point of view during the past year has been dysentery. An epidemic, small as regards numbers affected, but great in virulence, broke out amongst the Europeans of Labasa at the end of March and continued through April. Two deaths took place from the disease at the cottage hospital. The epidemic was probably fly-, not water-borne. The proximity of the coolie hospital to many European resideuces, including barracks and quarters, is not to be lost sight of in this connection, and will be considered later on.

Enteric Fever.—There have been six cases of this disease under my notice, including three Europeans, one of whom died. It is noteworthy that all three European cases arose in the same locality; one was a case of ambulatory typhoid in whom the existence of the disease was not suspected until his arrival in Levuka, symptoms of a severe type having developed en route. There have been no cases reported from the coolie settlement. One case occurred in a free Indian living in the Labasa lines.

Measles.—A slight epidemic of this disease occurred in May, June, and July on plantations where newly allotted immigrants had recently arrived. Ten cases were treated in hospital. The disease did not spread.

Dengue Fever.—Dengue fever was very prevalent in January, but remarkable for the fewness of its cases during the remainder of the year.

Venereal Diseases.—In the coolie hospitals alone there were treated 77 cases of syphilis and 124 of gonorrhœa. The latter disease has been very common, especially on certain estates, *e.g.*, Wainikoro.

Diseases of the Eye.—Eye diseases were very common. Conjunctivitis and keratitis amongst the indentured Indians, and trachoma with its various

stages notably trichiasis, pannus, and staphyloma in Fijians. It is deplorable to see the number of Fijians who are absolutely blind, or on the way to become so, from this disease. An examination of the eyes of all Fijian patients admitted to the provincial hospital reveals an enormous percentage of them to be affected.

Intestinal Diseases.—These were most common, as is usual, amongst indentured coolies, the chief complaint being diarrhœa.

Skin Diseases.—Skin diseases are very common, chiefly ulceration of the lower extremities in Indians, and yaws, ulcers and ringworm in Fijians.

Respiratory Diseases.—There were a number of cases of bronchial asthma in indentured and free coolies working in the canefields. They were much benefited by the administration of adrenalin.

Provincial Hospital.—The total admissions at the provincial hospital for the year numbered 294 with 3 deaths—2 from dysentery and 1 from pneumonia. The number of out-patients treated were 846. Cases of ulceration, mostly tertiary manifestations of yaws, were responsible for by far the greatest number of admissions. It is a fact greatly to be regretted that so few cases of really serious illness in natives are brought to the hospital. They will come readily enough for trivial things like small ulcers, and aches and pains, but when they know themselves to be seriously ill the most persuasive arguments are generally of no avail. The Macuata natives are not peculiar in this respect, but they are certainly the dirtiest and most backward of Fijians.

Plantation Hospitals.—There are three in the district, viz., at Labasa, Bucaisau, and Wainikoro, serving about 1,800 indentured labour. Their equipment is satisfactory, and their staff adequate. The admissions and deaths for the year were: Admissions, 2,599; deaths, 39 (1·5 per cent.). As far as possible all serious cases are ordered into Labasa hospital where they can be more under the eye of the district medical officer than if they were at one of the outlying hospitals (which are eight and twenty-five miles distant).

Native Town Sanitation.—The district medical officer is only able to visit such native towns as are within reasonable distance of Labasa or the line of rail. They are, for the most part, small villages. They are fairly well kept, but the people themselves are very dirty and of unwholesome appearance. The native medical practitioners, of whom there are two, are constantly travelling and have had instructions to be particularly diligent in the matter of sanitation. They, however, meet with much passive resistance. An effort will be made this year to visit Dreketi and Visogo, the two centres at which the native practitioners are stationed. On account of the distance these places can very seldom be visited by the district medical officer, as his absence from Labasa for more than two or three days is inadvisable.

Plantation Hospitals.—There are nineteen plantations in Macuata employing indentured Indian labour, one being at Dreketi (copra) and the rest in the cane-growing area of North Macuata. Considerable improvement has been effected in the condition of these lines during the past year. They are now all kept well clipped for a space of 1 chain in all directions; floors have been levelled and lined and walls whitewashed. An additional septic tank latrine has been provided at Labasa and additional water supply has been installed in the form of standard pipes and traps. Bath-houses have been provided at Navualevu and Mataniwai, and a new nursery at Labasa lower lines, while the nursery at the upper lines has been rendered fly-proof.

Government Indian Settlements.—These have been periodically visited by the sanitary inspector and the district medical officer. No epidemic diseases have occurred. Sanitation cannot be considered as good, but the difficulties of providing anything better are at present insurmountable. All that is possible is, however, done to make the people keep their settlements clean. The same applies to Free Indian settlements.

Native Medical Practitioners.—Of these there are three in Macuata. One in charge of the provincial hospital, one at Visogo in North Macuata, and one at Dreketi in the South. All have done their work satisfactorily during the past year. The native medical practitioner, Dreketi, was granted one month's leave, of which he took advantage to get married. Both native medical practitioners send in a written quarterly report, and, in addition, keep diaries, and report in person to me at Labasa once a quarter when various matters are talked over and their work for the succeeding quarter planned out.

Native Obstetric Nurses.—There is one native obstetric nurse for the province. Her headquarters are at the hospital. She has attended very few cases during the year (10). This is not her fault but that of the people, who do not desire her help.

Vaccination.—Vaccination has proceeded steadily during the year. All the children of Indian immigrants at Labasa are now efficiently vaccinated. An effort is being made to train the native medical practitioners to greater economy in the use of vaccine.

General Sanitary Work.—Owing to an outbreak of enteric fever among Europeans in the low-lying neighbourhood of certain stores, an inspection was held and it was decided to order the construction of adequate drains for the quarters and to condemn the huts occupied by Indians which were close to those quarters. The necessary work has been carried out and new quarters for Indians erected at some distance from the European quarters. Owing to the proximity of the Labasa coolie hospital to the European dwellings and of the possibility of its forming a focus for the dissemination of such diseases as dysentery, it was decided to request the Colonial Sugar Refining Company to remove the hospital to a site previously noted as eminently suitable for it, further removed from European houses, fully exposed to the breeze, and with excellent natural drainage on all sides. It is satisfactory to be able to say that the owners have decided to accede to this proposal. This is by far the most important sanitary reform which has been effected in Labasa.

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The year has been most abnormally dry, the total rainfall being far below the average.

Towards the close of the year, a new ward for the accommodation of Indians other than indentured was completed at the provincial hospital, in order to obviate the necessity of sending such patients to the Colonial Hospital or the Company's hospital at Labasa. Surgical work.—The only important major operation performed during the year was for hepatic abscess in a European. The pleural cavity was opened, the two layers of the pleura being non-adherent; good recovery took place. The crushing season was responsible for many minor injuries, chiefly of extremities, and there were two serious injuries—one compound fracture of the tibia, and one fracture of the spine with paraplegia. The latter case ended in death.

REPORT BY H. MACDONALD, DISTRICT MEDICAL OFFICER, ROTUMA.

Vital Statistics.—With regard to vital statistics for the year—the Census was taken on Monday, December 2, when, from the returns furnished to Dr. Ramsay, the population was as shown below. The births and deaths for the whole year are also shown: Europeans, 25, 1 birth, 1 death; half-castes, 34, 1 birth, 1 death; other natives, 91, births and deaths, *nil;* Rotumans, 1,937, 106 births, 86 deaths; total, 2,087 persons, 108 births, 88 deaths. The births and deaths, as compared with the two previous years, are shown as follows: Births, 1910, 118; 1911, 79; 1912, 108. Deaths, 1910, 86; 1911, 489; 1912, 88. In 1910 and 1912 the births exceed the deaths by 32 and 20 respectively. The huge death-roll of 1911 is, of course, due to the measles epidemic of that year. Up to the year 1911, although in some years the number of deaths exceeded that of births, the tendency was to slow increase of the population. A good deal of leeway will have to be made up to repair the losses of that fatal year, but a fair beginning has been made in 1912. The birth-rate for the year is very high, viz., 51 per cent. per 1,000; but six children were still-born, and two prematurely; 19 of mixed parentage, and 10 were illegitimates. The death-rate is also very high, viz., 42·1 per 1,000; but one might expect that to be the case with such a high birth-rate.

Diseases Prevalent.—I have in former reports pointed out how susceptible the respiratory system of the natives here is to disease. Thus, half of the total number of deaths is due to diseases of that system. Phthisis pulmonalis comes first—always common here, but more so since the measles epidemic—with 24 deaths. Other diseases such as lobar and broncho-pneumonia, bronchitis, and pleurisy share 20 deaths between them. Diseases of the alimentary system were not very prevalent, but 12 deaths were caused by them—acute gastritis, 5; acute gastro-enteritis, 2; acute diarrhœa, 4; acute peritonitis, 1. Influenza is always more or less prevalent here and caused three deaths during the year. Diseases of the two systems I have mentioned and influenza form the bulk of the diseases which the natives here suffer from.

Admissions to Hospitals, &c.—There were 97 admissions and 4 deaths during the year. The disease principally treated was yaws—46 cases of this disease occurring in young children, being admitted during the year. Much progress has been made towards its eradication, but, as no co-operation can be got from the people themselves, fresh infections are disappointingly common. One case of beriberi occurring in a prisoner was treated during the month of September and reported on in my report for that month. Dr. Ramsay has recorded another admission in October from the same disease; the ease proved fatal.

Vaccination.—The results obtained from the supplies of lymph received in January, March, and April were entirely negative, but fairly good results were obtained in May and July. In the latter month, humanized lymph was made use of, as the results from calf lymph in the earlier part of the year had been so disappointing.

General Sanitary Matters.—The subject of the spread of pulmonary tuberculosis was brought prominently before the chiefs, and they were asked to impress upon their people the need for the complete destruction of the sputa of consumptives. This is a matter that has been brought under their notice before, but it is one that little attention is paid to, as the habit of the native to discharge his saliva anywhere is so ingrained in him that he can see no harm in it. The part played by flies in the spread of disease is one, too, that has been frequently alluded to. In making one's rounds one sees constantly the food of the people covered by them, the eyes of the children full of them, cattle, and particularly horses, plagued with them; but the remedy is difficult to apply. There are a large number of horses (of a kind) here, and, as flies breed in their ordure, the number of breeding-places is great. Protection of the person and of food from their attentions can only be attained by living in mosquito-proof houses and having the kitchens as much as possible made mosquito-proof. A few of the more intelligent class of natives might try to follow your directions, but the majority would neglect them. The villages are periodically visited, and all empty tins and cocoanuts which have been used for drinking purposes and other articles which might form receptacles for water and breeding-grounds for mosquitoes, are removed. The concrete water-tanks are given a thorough clean out yearly. Where the houses are built of concrete they are lime-washed once a year.

The rainfall for the year amounted to 152·25 in. —a somewhat higher fall than I have recorded in former years. As a rule, the drier months are those from June to September; but the weather cannot be depended on. Thus, in March, usually one of the wettest months, we had a fall of only 4·71 in., whereas in August we had one of 17·53 in. The greatest fall was recorded in October, viz., 22·80 in.

About 200 out-patients is a fair average number treated here every month; but many of the ailments are of a trifling nature.

REPORT BY V. W. T. MCGUSTY, ACTING DISTRICT MEDICAL OFFICER, BUA.

Vital Statistics.—The population, as roughly estimated, at the end of the year was as follows: Europeans, 38; Fijians, 3,617; indentured Indians, 96; free Indians, 300; and miscellaneous, 150. With regard to births and deaths, I am only able to give data concerning the Fijians. During the year there were 162 Fijian births and 105 deaths, showing an increase in the Fijian population of 57. In 1911 there were 148 births and 146 deaths; and in 1910 there were 157 births and 152 deaths. By comparison, therefore, with the two previous years the figures for 1912 are satisfactory, for they show not only an increased birth-rate, but also a diminished death-rate.

Diseases.—An exceptionally dry year was probably responsible for the good health which prevailed throughout the province in 1912. There was an absence of epidemic disease, and the three cases of dysentery, which were treated in the provincial hospital, Nabouwalu, were isolated ones. There was one case of enteric fever in a male European. There is a prevalence of filarial disease in the province which may be attributed to the swamps so often to be found in the vicinity of the villages.

Provincial Hospital.—There were 387 admissions to the provincial hospital during the year with eight deaths, which gives a mortality of 2·06 per cent. Of the 387 persons admitted, 161 were treated for yaws, 94 adults with the tertiary stage, and 66 children with the secondary stage. There was one case of primary yaws. There were only three cases of dysentery. There were seventeen admissions for filarial disease. The hurricane which took place on January 28 was responsible for the destruction of the ringworm house, and hence for the discontinuance of treatment, except as out-patients, of persons suffering from that disease.

Plantation Hospital.—Wainunu tea estate possesses the only plantation hospital in the province. Other planters send their sick to Nabouwalu. At Wainunu, as in the other parts of the province, there has been an absence of serious or epidemic disease. During the year 442 indentured Indians received treatment in the hospital, and there were two deaths, the one a woman, from tuberculosis, and the other an infant, from natural causes. All the other cases admitted to hospital were trivial.

Native Town Sanitation.—The sanitation of native towns varies. When a visit is expected it is generally good, and as a rule it is the reverse on surprise visits. On the whole, however, it may be said that there are signs of improvement in this direction. The latrines, though far from all that is desirable, are better; the use of mosquito-screens is becoming more general, and it would appear that the habit of spitting in the houses is gradually being given up. The draining of the many swamps which exist close to towns is still an unaccomplished fact, and is very deleterious to the health of the inhabitants of such towns.

Plantation Lines.—The plantation lines at Wainunu have been much improved by the introduction of proper latrine men at the end of the year. The number of labourers employed at Wainunu is 86. The number of labourers employed on other plantations is small, and varies from six to fifteen.

There are only two Indian settlements of any size in the province. One is at Luvululu, in Bua district, and the other is at Nasarawaqa, in Lekutu district. These were visited as often as time allowed, and they were kept in as sanitary a condition as possible.

Native Medical Practitioners.—Tomasi Mawi was stationed at the provincial hospital, Nabouwalu, until June last, when he was transferred to Ra. He had been some years in the province, and he had done much good work. He was succeeded by Wilisoni Cabealawa, whose work is good if he is under constant supervision. Wilisoni has shown much improvement towards the end of the year. With the exception of a few weeks at the beginning of the year there has been no travelling native medical practitioner in the province. A travelling native medical practitioner could do much towards improving the sanitation of native towns.

Native Obstetric Nurses.—There were two native obstetric nurses in the district. One was stationed at the provincial hospital, Nabouwalu, and she was very useful, both in the hospital and in attending obstetric cases in the village. The second native obstetric nurse was stationed at Daria in Wainunu district, and during the short time she has been there she has done good work.

Some 124 children were vaccinated during the year. Vaccinations among the Fijians were formerly done by the travelling native medical practitioner, and since he left the number vaccinated has doubtless fallen.

Inspection of Towns.—Fijian villages and Indian settlements were visited by the district medical officer and native medical practitioner, as much as time would allow. It is only by constantly repeated inspections that the towns can be kept in a sanitary condition.

That the year was an exceptionally dry one, and that a hurricane took place on January 28, were the only two meteorological facts of interest.

The year was a healthy one, due no doubt to the dryness of the season. The native crops failed owing to a drought which followed the hurricane, but with bush yams and rice supplied from Suva there were no ill results.

REPORT BY A. W. CAMPBELL, DISTRICT MEDICAL OFFICER, TAVIUNI.

Vital Statistics.—Population: Europeans, 135, 1 birth, 1 death; Fijians, 1,872, 55 births, 63 deaths; Indians, 550, 16 births, 9 deaths. Total, 2,557, 72 births, 73 deaths. Comparison of births and deaths, 1911 and 1912: Births, 1911, 79; 1912, 71; deaths, 1911, 64; 1912, 72.

Diseases.—The principal diseases from which the population suffered were (*a*) influenza, of which

there were a large number of cases affecting all races, but of a mild type, with few sequelæ; (*b*) dysentery, affecting chiefly the Fijian and Indian, also of a mild type; (*c*) bronchitis and other diseases of the respiratory tract, affecting chiefly the Fijian; (*d*) yaws, affecting only the Fijian; (*e*) conjunctivitis, both acute and chronic, and with many sequelæ, affecting chiefly the Fijian children whose eyes are grossly neglected, and also, to some extent, Indian and European children; (*f*) there were seven cases of enteric fever—three Europeans, three Fijians, and one Polynesian.

Provincial Hospital.—Admissions, 393; deaths, 14. Of the 14 deaths 4 occurred from dysentery, and of the 393 admissions 82 were suffering from this disease. No cases occurred during the whole year in either staff or patients; and only 3 occurred on the station, viz., 3 prisoners at the latter end of November and beginning of December.

Plantation Hospitals.—There is only one registered plantation hospital in the district—that at Vuna estate, the property of Messrs. Tarte Bros.; and from here the more serious cases and those requiring operation or prolonged hospital treatment are brought to Waiyevo.

Native Town Sanitation.—The condition of the native towns is good throughout the district. Nearly all are kept well weeded and clean, and have good supplies of running water. In one or two instances tanks are necessary, and have been made.

There is still room for considerable improvement with regard to excreta and latrines; and it is to be regretted that more time cannot be given to town visiting and inspection.

Plantation Lines and Sanitation.—There has been a vast general improvement in lines and their sanitation during the year. The lines at Tuvamila are a model in every respect. They are large, airy, and well ventilated, and kept scrupulously clean, and the latrine accommodation and disposal of excreta are excellent. The latrines throughout the district are very much improved. There is a septic tank at Vuna; in seven cases the latrines are built over the sea—a very cleanly disposal; in two cases they are over a cemented watercourse and carried direct to the sea; most of the remainder have the pan-system in use.

Native Medical Practitioners.—There is one native medical practitioner at the hospital, where he has done very good work, as witness the absence of dysentery among the staff and patients. There is also one at Natewa Bay, temporarily attached to this district in the absence of a district medical officer for Cakaudrove. His district is a large one and difficult to work, and the people are a somewhat rough lot; they are almost entirely Fijians.

The native medical practitioner stationed at the hospital has carried out vaccination at the native villages near the hospital, doing thirty-four cases, all of which were successful.

General Sanitary Work.—Apart from native towns and plantation lines already referred to there is little sanitary work. All the European settlers' latrines are cesspits, with the exception of one. At the last-named there is attached to one house a septic tank, and to another dwelling a water-closet drained direct to the sea.

The year was a very dry one, with the exception of the first two months, which were very wet. The general health of the district as regards Europeans and Indians was beneficially affected by the drought, but not so as regards Fijians.

Referring to European vital statistics, their value is but small, as in a majority of cases births take place out of the district—that is to say, European women expecting confinement usually go to the colonies or to Suva, where skilled nursing is more easily available. The district is an extensive one, including not only the islands of Taviuni (of which there are fifty miles of coast-line to be visited), Qamea, and Laucala, but also the island of Rabi, and forty miles of coast-line on Vanualevu across the Somosomo Straits. Inspection of these latter parts is difficult on account of distance and time occupied, and also on account of the extensive tide rips which occur in the Straits and the exposed position of the coast. Four visits were made during the year, usually in uncomfortable circumstances. This part of the district is growing somewhat rapidly, and is beginning to require more attention than can be given from this side. There are now there fourteen different European settlements, on eight of which indentured labour is employed, and this number will shortly be increased.

Report by R. F. de Boissiere, District Medical Officer, Kadavu.

Vital Statistics.—The total population of the province was estimated to be about 6,359 towards the end of October, 1911, and there is no reason to believe that the figures have materially changed since then, except in the case of the few Europeans and Indians, whose exact numbers may be seen in the following return: Europeans, 19, 1 birth, 1 death; Indians, 12, births and deaths not known; Fijians, 6,256, 273 births, 229 deaths. The birth-rate among Fijians was thus about 43·63, and the death-rate 36·60 per mille. The excess of births over deaths (44) is very gratifying in view of the excess of deaths during the last few years. Disregarding the small European and Indian population, the comparison of births and deaths among the Fijians for the years 1911 and 1912 may be seen from the following: Births, 1911, 232; 1912, 273. Deaths, 1911, 246; 1912, 229.

Diseases.—The chief causes of mortality were:—

Dysentery and Acute Diarrhœa.—Fifty-four deaths, or 23·58 per cent. of the total mortality, were due to these diseases. In so many cases it is difficult to distinguish between epidemic diarrhœa and dysentery, as in the same outbreak some people develop the former alone, while in the case of other patients the diarrhœa passes on into dysentery. At the provincial hospital at Vunisea, seventy-three cases of these diseases (dysentery, 15; diarrhœa, 58) were treated, with four deaths. On the whole,

I find the treatment by "saline aperients" the most satisfactory, especially when used in combination with intestinal antiseptics.

Tuberculosis.—Twenty-eight deaths, or 12·22 per cent. of the total mortality, were caused by tuberculosis of the lungs. The disease is certainly increasing among the Fijians, and in 1911 it was only responsible for 9 per cent. of the total deaths. In view of the filthy habits of the natives, it will be a matter of great difficulty to prevent the spread of the infection. It is rare for a patient to recover, as, if he comes to hospital at all, he expects to get "cured" in one or two weeks only, which, being quite impossible, he returns to his town to commence the trial of every Fijian herb and quack, persisting with these until the very end.

Yaws.—Twelve deaths, or 5·24 per cent. of the total mortality, were due to this disease. It is safe to say that if the natives would only avail themselves of the opportunities afforded them of obtaining proper hospital treatment, death from yaws would become very rare. At the provincial hospital at Vunisea, 125 cases of secondary yaws and 124 of tertiary yaws were treated without a single fatality. Every effort has been made to collect the children suffering from "coko," or secondary yaws, and they are segregated and treated in a special ward at the hospital, with very satisfactory results. Sixteen children suffering from "coko," and five adults suffering from various "sequelæ" of yaws, were treated with salvarsan. I hope to submit a report thereon later on. The majority of cases, however, were treated with pot. iodi. and syr. ferri iodi. and, in some instances, with hydrarg. cum. cret. when the former appeared to be slow in action. The province is reported to be quite free from "coko," except for the few cases still under treatment at hospital, and if all new cases are at once segregated as they arise, the disease should be eradicated before long.

Filariasis.—This is very prevalent in Kadavu, but only ten deaths, or 4·36 per cent. of the total mortality, were caused by it. At the hospital twenty-one cases were treated without any fatalities. On the whole the year has been a very healthy one, and no serious outbreak of disease occurred, and it is safe to say that a large number of the deaths were due to gross negligence, ignorance, and obstinate refusal on the part of certain Fijians to seek skilled treatment until they have previously exhausted all native remedies and native quacks.

Provincial Hospital.—This is delightfully situated at the Government station at Vunisea, and it is the only hospital on the island. The admissions and deaths were as follows: Admissions, 685; deaths, 6. Among the patients admitted 949 cases of disease were treated, with six deaths. Besides the patients admitted, there were 1,659 attended to as out-patients. The native staff of the hospital consists of one native medical practitioner (Imanueli Toka) and three dressers, while the outdoor work is done by five servants. Imanueli has done good service, but the dressers have not been satisfactory, owing to various causes. The daily average of persons to be fed has varied from sixty-five in some months to ninety-eight in others. Much inconvenience has been caused throughout the year owing to the great scarcity of water. The reservoir, some two miles distant from the hospital, has been so badly constructed that the level of the water in it above the mouth of the exit-pipe rarely exceeds 1 or 2 in., as the water leaks through the muddy bottom of the "Government reservoir," as the Fijians call it.

Native Town Sanitation.—Two complete tours of sanitary inspection were made during the year. Every native house and kitchen, &c., was carefully inspected, and advice as to drainage of towns, building sites, &c., was freely given. As compared with the past year, it may be said that though great improvement has been shown in respect to the dwelling-houses and the interior of the native towns, yet much remains to be accomplished. The system of native latrines is very poor. These are constructed of native reeds and material as follows: In every town there are two closets—one for the men, and one for the women. These are almost invariably situated on the seashore, at some distance from the town, the men's closet being to the one side and the women's to the other side of the town. Each closet consists of a small raised platform, composed of a number of rafters arranged crosswise, and covered over by a low shelter of native construction, the latter being generally so low that even the natives have to bend their bodies in two in order to enter. The closets are approached by a primitive bridge—usually a coco-nut log—and they are often damaged by the sea, and remain thus until the medical officer goes on his next tour of sanitary inspection. The night-soil, if deposited at low tide, lies on the sand exposed to the flies, &c., for several hours, until the sea carries it off at high tide. The framework of these closets get very soiled, and no attempt is ever made to clean it. The majority of natives, however, prefer to use the bush and scrub around the town as a closet. In order to prevent such an insanitary state of affairs, I have tried to get the natives to clear a space of forty fathoms around each town, but, until my efforts are supported by legislation on the subject, I fear that my intentions will not be carried into effect, as natives only act when compelled to do so.

Free Indians.—There are no settlements of free Indians, and the only Indians in the province are those engaged in store-keeping of petty trading, such as the hawking of tobacco.

There is only one native medical practitioner, and he is attached to the provincial hospital. A second one would be of much service, especially in the outlying districts.

Native Obstetric Nurses.—Vasiti resigned from January 31 in order to get married. Elena followed suit in August, and she was replaced at the end of September by Fine Liku. Elena attended to eighteen cases before her retirement, and Fine has had four cases since her arrival. There has not been any nurse available for duty at the provincial hospital during the whole year, and so very little work has been done in respect to the diseases of women.

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Vaccination.—The native medical practitioner did 185 vaccinations during the year, with very few failures. All the persons vaccinated, with one exception, were Fijians. The vast majority of the children have been vaccinated, and the native practitioner has to travel to the most outlying districts of the province, perhaps some fifty miles (including the return journey), and to remain away from the hospital for at least eight days in order to get subjects for vaccination, hence the reason why he has not been able to do a greater number.

There are eight bakers in Kadavu, all being Chinese, and they have been made to conform to the provisions of the Public Health Ordinance. No prosecutions were undertaken under the Ordinance.

The weather was very dry and much cooler on the whole than in the preceding year. In almost every part of the province complaints have been made of damage done to the food crops by the very dry weather prevalent from May to the end of November especially. Respiratory diseases were less frequently met with, and there was much less influenza than is usual.

For nine months—from February 13 to October 31—the medical officer performed the duties of the stipendiary magistrate in addition to his own.

Report by John Halley, M.D., District Medical Officer, Ba.

Vital Statistics.—Europeans and half-castes, 261, 4 deaths; free Indians (Ba and Tavua), 3,855, 123 births, 11 deaths; indentured Indians (Ba and Tavua), 3,005, 39 deaths; Polynesians, 27, 1 death; Fijians (Ba and Yasawa), 8,737, 320 births, 253 deaths; Fijians (Tavua), 691, 41 births, 18 deaths.

Comparison of births and deaths with two previous years: Fijians (Tavua births and deaths for 1909 and 1910 not known), 1911, births, 22; deaths, 31. Fijians (Ba and Yasawa), births, 1909, 356; 1910, 303; 1911, 295. Deaths, 1909, 295; 1910, 255; 1911, 340.

Diseases.—The principal diseases from which the population suffered were febricula, dysentery, diarrhœa, venereals, rheumatism, yaws, diseases of respiratory tract, diseases of eye, diseases of cellular system and skin, local injuries.

Admissions to the provincial hospital, Nailaga, were 315; deaths, 6; 1,045 persons were treated as out-patients.

Plantation Hospitals.—Rarawai, 1,744 admissions, 29 deaths; Tavua, 366 admissions, 10 deaths; total, 2,110 admissions, 39 deaths. European hospital, 25 admissions, 1 death (suicidal). The year 1912 was an exceptionally healthy one—the figures, both in regard to admissions and deaths, being the lowest on record.

Native Town Sanitation.—Every village in the district of Ba was visited at least twice yearly, and questions affecting the condition existing dealt with on the spot. In a general way the villages are well kept, houses clean and in good repair, drainage satisfactory, latrines in common use, the water-supply by tank, pipe-supply, or from running streams. Duties in this district prevented me visiting the Yasawa group, but reports from native medical practitioner Manasa deal favourably with the general condition of towns.

Plantation Lines and Sanitation.—Every one of the twenty-seven plantations employing indentured labourers was visited and carefully inspected at least twice yearly, and detailed reports sent in to the Department after each half-yearly classification. In every instance the lines, nurseries, latrines, and water supply were found in a highly satisfactory condition.

Indian Settlements.—These are many and scattered over a fifty-mile coastline, and include the isolated humpy, or lean-to, to the settlement of ten to twenty houses. A beginning was made towards definite sanitary improvements by dealing with only such settlements as lay within a three-mile radius from the Rarawai mill and, failing regulations under the Health Ordinance, general cleaning up, clearing of scrub and weeds, felling of trees when obstructing light and air, burning of old houses, walling in of wells and so forth, was undertaken, the village of Wailailai being in particular attended to.

Native Medical Practitioners.—Native medical practitioner Savenaca was assiduous in all his duties—the charge of the provincial hospital, Ba, inspection of all villages in the district, and vaccinations. From reports sent in native medical practitioner Manasa, in charge of the Yasawa group, was keen at work generally and at vaccinations; he had one month's vacation leave during the year.

Native Obstetric Nurse.—Merisiana commenced duty about September, and travelled the Ba district and Yasawa group rounding up female patients for admission to Nailaga hospital, and attending to obstetrical and children's cases as required.

Vaccination.—Native medical practitioner, Ba, 92 successful; 22 unsuccessful; native medical practitioner, Yasawa, 71 successful; 35 unsuccessful; district medical officer, Ba, 73 successful; 17 unsuccessful; total, 236 successful; 64 unsuccessful. I have on more than one occasion during 1912 drawn attention to the numerous failures with certain supplies of lymph; this was the case also in the experience of both native medical practitioners.

General Sanitary Work.—The Local Authority, Ba, was constituted in August, and thereafter monthly meetings of the Health Board took place. Nuisances in general, blocked drains and undrained areas, general clearing-up of yards, attention to latrines around the mill and in residential quarter, were dealt with. A heavy piece of work undertaken by the Colonial Sugar Refining Company was the clearing and deepening of the Yam Alley Creek, some one and a half miles of creek being greatly improved. The Yam Alley drains were entirely renewed and cement drains now carry away down-pipe water. The slaughter-house, butcher's shop, and bakery were regularly inspected, and a list of European and Indian milk-sellers compiled.

The year 1912 was one of the driest known in

this district. Less sickness was observed among all sections of the community than in any previous year.

Report by B. M. Wilson, M.D., District Medical Officer, Levuka.

Vital Statistics.—Population, Lomaiviti: Europeans, 390; Fijians, 5,186; Indians, 150. Comparison with other years: Fijians, 1912, births, 201; deaths, 176; 1911, births, 224; deaths, 275; 1910, births, 248; deaths, 212; 1909, births, 228; deaths, 221. Births and deaths are not available for the information of the district medical officer except in the case of Fijians.

Diseases.—Twenty-one cases of dysentery were admitted to the hospital during the year. There were 4 deaths, 2 of which were children under 2 years of age. During 1911 there were 19 admissions and 5 deaths. A few cases of dysentery occurred at Bureta in the early part of the year. This epidemic in the Bureta district seems to be an annual occurrence. I have inspected the whole area and have been unable to find the cause. The cases last year were chiefly among small children.

Yaws.—Forty-two cases were treated as in-patients and a large number as out-patients at the hospital during 1912. Nearly all these cases were suffering from tertiary lesions. It is very rare for Fijians to submit voluntarily to treatment of secondary lesions.

Tuberculosis.—Nineteen cases of tuberculosis were admitted to hospital and one case died in hospital. Almost all these cases were pulmonary tuberculosis. The above figures are likely to give an erroneous impression of the prevalence of phthisis in Lomaiviti. Early cases are not often seen; if they do come to hospital for medicine they usually decline to remain as in-patients. The treatment of phthisical Fijians in their own towns is quite futile and the majority of the cases in hospital are too advanced to gain anything more than perhaps a slight temporary improvement. They usually leave hospital at their own request or at the urgent entreaty of their friends.

Enteric Fever.—Four cases were admitted to hospital during 1912. All these cases recovered. Only one of these cases arose in Levuka. The others came from Tailevu, Labasa, and Savusavu.

Chicken-pox and Mumps were very prevalent in Levuka and district during the latter half of 1912.

Epidemic Cerebro-spinal Meningitis.—Two cases with one death occurred in hospital. The other case was taken away from hospital and died in her own town. I was unable to prevent this as this disease is not a notifiable disease under the Public Health Ordinance, 1911.

Filariasis accounted for fourteen admissions.

Tinea imbricata.—Ringworm is not common in Lomaiviti and only three cases were admitted to hospital.

Levuka Hospital.—1912, admissions, 221; deaths, 9; 1911, admissions, 272; deaths, 15. There were fewer patients admitted to the native wards in 1912 as compared with 1911. The number of admissions to the European wards shows an increase in 1912 and the average number of days in hospital is decidedly increased. European wards, 1912, number admitted, 42; average number of days in hospital, 18·02; 1911, number of admitted, 37; average number days in hospital, 11·37. Number of out-patients, 1912, 1,464.

Native Town Sanitation.—The towns of Ovalau are well kept and are in a fairly satisfactory sanitary condition. Most of the towns in Lomaiviti, with the exception of those on the island of Moturiki, have a sufficient supply of good water.

Indian Settlements.—The number of Indians on Ovalau is steadily increasing, but they have not, as yet, begun to form settlements of any size.

Native Medical Practitioners.—There are three native medical practitioners in Lomaiviti. Anare Tuidrake, native medical practitioner, Gau, is the most satisfactory. The native medical practitioner, Koro, has not been a good officer.

Native Obstetric Nurses.—Aleci Lawai, native obstetric nurse, Sawaieke, Gau, is the only obstetric nurse in Lomaiviti. Judging from her report the natives do not avail themselves of her services to any great extent.

General Sanitary Work.—The town of Levuka has been kept in a fairly satisfactory sanitary condition. A number of unhealthy buildings have been condemned by the medical officer of health; some of these have been demolished and the others have been repaired and rendered fit for human habitation. The latrine system is primitive, and the service is not at all good. The municipal authorities have difficulties to contend with. Most of the work has to be done by hand labour; wheeled vehicles could be used only to a limited extent. The supply of labour for this work is limited. The quality of the Levuka water supply continues to be satisfactory; all houses not much above sea level receive a constant and abundant supply; most of the houses on elevated sites are very badly supplied with water.

Report by T. R. St. Johnston, District Medical Officer, Lau.

Description of District.—The Lau group consists of some 39 islands (29 being inhabited), scattered through an ocean area of 30,000 square miles. There are four sub-divisions of the group, having a native medical practitioner stationed in each. These are: (*a*) Lomaloma division (the headquarters), consisting of Vanua Balavu, Malata, Susui, Munia, Yavea, Tuvuca, Mango, Cicia, Naitauba, Vatuvara, Katavaga, Cikobia, and Kanacea islands; (*b*) Lakeba division, consisting of Lakeba, Oneata, Nayau, Moce, Komo, Namuka, Kabara, Vulaga, and Ogea islands; (*c*) Matuku division, consisting of Matuku, Moala, Totoya, and Vanua Vatu islands; (*d*) Ono division, consisting of Ono, Doi, and Vatoa islands.

Population.—The estimated population at the end of 1912 amounted to 7,128, and was made up as follows: Lomaloma division: Europeans, 56; half-

castes, 22; Indians, 112; Polynesians, 172; Tongans and Fijians, 1,529; Chinese and others, 8; total, 1,899. Lakeba division: Europeans, 23; half-castes, 10; Indians, 18; Polynesians, 21; Tongans and Fijians, 2,582; Chinese and others, 13; total, 2,667. Matuku division: Europeans, 4; half-castes, 20; Indians, 8; Polynesians, 2; Tongans and Fijians, 1,918; Chinese and others, 1; total, 1,953. Ono division: half-castes, 4; Indians, 2; Polynesians, 8; Tongans and Fijians, 595; total, 609. Totals, Europeans, 83; half-castes, 56; Indians, 140; Polynesians, 203; Tongans and Fijians, 6,624; Chinese and others, 22; grand total, 7,128.

Hospitals.—Central hospitals are now established at Lomaloma, Lakeba, and Matuku; and it is hoped eventually that three more may be established at Moala, Cicia, and Ono.

Diseases.—Lakeba and Matuku hospitals were only opened towards the close of the year, and all the returns of the Lakeba, Matuku, and Ono divisions are therefore relating to out-patients only, or to patients temporarily received in native huts in the native medical practitioner's compounds.

Dysentery.—There was a mild epidemic of dysentery in Lau during the middle of the year, but fortunately not of a severe type, and only two deaths occurred out of 156 cases. Dysentery notices were widely circulated, and village latrines were inspected by myself and the native medical practitioner as far as possible. I am convinced that most of these cases, combined with no less than 1,068 "diseases of the digestive system" (chiefly diarrhœa), though ultimately fly-spread, were in the first place caused by drinking the dregs of the water from the concrete reservoirs, which are universal through Lau. This was a misfortune hardly avoidable, as 1912 was an exceptional year here there being nearly eleven months of continuous drought, and water having to be shipped to those islands which were worst off. One other point is worth mentioning. A favourite habit in Lau, more even than in Fiji generally, is to put aside some cold food to be eaten if one wakes up in the middle of the night, or on returning home from an evening's yaqona entertainment. This cold food, or "Bulasi," is usually left on a plate, half-covered, perhaps, with a leaf, and is an ideal playground and latrine for the last flies before retiring for the night. I have been trying to encourage the use of meat-safes among the people. Most look on them as "smart" furniture, a symbol that a household is advancing in the social world, rather than as an article of any real use or benefit. But there have lately arrived in Lakeba twelve Chinamen, most of them good carpenters, who are now finding a ready sale for meat-safes among the natives.

Tuberculosis.—It is hardly worth giving the figures of this, especially of pulmonary tuberculosis, as probably only about 15 or 20 per cent. of cases in the early stages are actually diagnosed by the native medical practitioners. A large number of coughs, bronchitis, &c., are probably tuberculosis. But of the cases in the later stages, where there is less chance of error, there are 108 cases recorded by the native medical practitioners of Lakeba, Matuku, and Ono, with seven deaths. There was probably really a much higher percentage of deaths from tuberculosis than this. In Lomaloma alone, I know of at least five deaths outside the hospital records, but the relatives nearly always beg to take the patient home if apparently hopeless.

Influenza and Dengue Fever.—Most of the cases recorded by the native medical practitioners as influenza were probably dengue fever; and the dengue fever, as I have observed it in Lau, is very like the "seven-day fever" mentioned by Dr. Joynt in his 1911 report, but seems of a milder type, and is certainly much milder than the dengue I have seen in Suva among newcomers—Europeans and Indians—to the Colony. Probably the Lauans are slowly getting rendered immune to it. It is characterized by severe frontal headache, pain referred to the eye-balls, temperature, and backache. It is often followed by a slight laryngeal cough. But there is hardly ever a rash, no coryza, the pains in the limbs are not severe, and the patient usually feels fit enough to get about again in three days, even if not really well. It is distinctly epidemic, and the numbers recorded are: Lomaloma division: January to March, 30; April to June, 50; July to September, 21; October to December, 12. Lakeba division: January to March, 311; April to June, 254; July to September, 191; October to December, 323. Matuku division: January to March, 122; April to June, 9; July to September, 49; October to December, 68. Ono division: January to March, 6; April to June, 10; July to September, 7; October to December, 22. Totals: January to March, 469; April to June, 323; July to September, 268; October to December, 425. The greatest numbers are from October to March—the mosquito season.

Frambœsia.—Primary yaws in Lau is, I am certain, on the decrease, as isolation and other precautions are yearly being better carried out. Tertiary yaws among the young adults in the form of ulcers accounts for the large number of cases recorded. I hope to try during the year a systematic course of salvarsan treatment, only it will not be an easy matter in Lau, where the islands are so scattered.

Filariasis.—Attacks of filarial fever have been much fewer in Lau this year, attributable chiefly, I think, to the drought, and the consequently lesser number of flies and mosquitoes. The same remarks apply to conjunctivitis and other eye troubles, usually so common here in Lau.

General Health.—The general health of the province has been exceptionally good this year. The people are well off and contented. The hurricane only damaged the north end of the group, and in the rest of Lau the copra crops have been greater than ever. Although the drought severely affected the native food plantations, yet the money from the copra enabled them to buy quantities of rice, bread, biscuits, meats, and other substitutes. The taking of cereal food is on the increase, and is ultimately bound to benefit the people. There are now twenty-four bakers trading in Lau, practically all making good bread; and the little native bakeries that a

few years ago turned out indigestible "pani-cakes" —unleavened masses of flour—have nearly all died out through a natural and healthy competition from the better-class bakeries, which are now in most instances run by white men. The Lauans, too, live largely on fish, coco-nuts, and turtle, and can afford at intervals to buy cattle for beef, so that they are better off in the way of good foods than their brothers in Fiji itself.

Records.—In 1912 I arranged that all the native registrations of births, deaths, and marriages should be sent to me first for recording in my office, and I am thus able to keep in closer touch with the progressive or retrograde movements of the different islands. The native medical practitioners and native stipendiary magistrates have also held inquests on all deaths under one year, and in several instances careless parents have been prosecuted and punished.

Public Buildings.—The new Lomaloma hospital, which has male and female wards, operating-room, out-patient room, waiting-room, and dispensary, was actually opened on March 10 (though I had to take in two emergency cases in February). One hundred and twelve patients were admitted during the nine and a half months. The separate infectious block was opened about May. It has proved most useful and necessary; in fact, another separate one is really wanted for infectious diseases other than dysentery, such as chicken-pox, measles, phthisis, &c. I have also got the natives to put up a good (Fijian) building on a piece of ground given by them, in which yaws cases may be isolated. Lakeba Hospital, not quite so large, with male and female wards and dispensary, was not built until later, and was only opened in December. Provision is made in the 1913 estimates for a water-supply to be laid on. Matuka Hospital, on the same pattern as the Lakeba one, but with no veranda room, was built last, and opened in December. Running water being scarce in Matuku, the hospital is supplied by tanks.

Staff.—The native medical practitioners, with the exception of Inia, Matuku, have done fair work during the year. Jokatama, especially, has done well, with a big district and large population to look after. The dresser and carrier, Lomaloma, is a conscientious and hard-working man. The other native medical practitioners have not got dressers yet. The female nurse, Retieli, has done good work and proved useful.

Obstetric Nurses.—Pasemaca has done well and been of benefit to the district. Naomi (Lakeba Hospital) was transferred to another district at the close of the year. Maritini arrived in Cicia in July. She is slow, but will no doubt be useful when she gets into the way of things.

I send with this the four vaccination books of the province. There has been a fair increase in the numbers vaccinated during the year.

REPORT BY G. H. HUSTLER, M.B., DISTRICT MEDICAL OFFICER, NADI.

Vital Statistics.—The estimated population of the district at the end of 1912 amounted to 7,552, as is shown in the following table: Europeans, 112; births, 2 (17·8 per 1,000); deaths, 0. Fijians, 3,340; 158 births (47·3 per 1,000); deaths, 86 (26 per 1,000). Free Indians, 2,600; births and deaths unknown. Indentured Indians, 1,500; births, 25 (16·6 per 1,000); deaths, 18 (12 per 1,000).

Diseases.—Amongst the European population there has been practically no disease at all during the year, and in all races the district was to a large extent free from epidemic disease.

Measles broke out in the district in June amongst the Indian children living on Miegunyah estate. There were only ten cases, which were isolated in hospital, and the disease did not spread.

Dengue Fever occurred in a very mild form throughout the year amongst the indentured Indians.

Dysentery.—Forty cases were treated in the Indian plantation hospital, with one death. Two or three cases only occurred amongst Europeans, and a few isolated cases amongst Fijians.

Tuberculosis is considerably less prevalent in this district than in most others; this, I consider, is attributable to the dry, healthy climate and the comparative cleanliness of the native towns.

Ankylostomiasis.—Thirty-two cases amongst Indians were treated in hospital, with one death; no cases occurred amongst Fijians.

Framboesia.—Yaws is now being steadily stamped out in this district, there being only about twenty cases amongst children in the thirty-six native towns. All parents refusing to take their children to hospital are being prosecuted under the Yaws Regulation, 1912.

Venereal Diseases.—Twelve cases of syphilis and fifty-one of gonorrhœa were admitted to the plantation hospital, systematic treatment by mercurial injections being employed for the first-mentioned disease.

Respiratory Diseases, chiefly colds and mild bronchitis, occurred in small numbers amongst Fijians and Indians; thirty-one cases amongst Indians being treated in hospital, with two deaths due to phthisis.

Digestive Diseases.—Ninety-eight cases were treated at the Plantation Hospital, with one death.

Eye Diseases.—Forty-two cases, chiefly conjunctivitis, were treated amongst the indentured Indians. Trachoma is practically never seen in this district. The Fijians here are comparatively little affected with eye diseases, this freedom being due largely to the very dry climate and consequent paucity of flies during eight or nine months of the year.

Scabies.—There were thirty-two cases amongst indentured Indians, and a few cases only amongst Fijians.

Tinea Imbricata.—At the mid-year there were about 100 cases of this disease, but there are now considerably fewer, owing to sulphur-fumigation treatment and to the prosecution of those persons who refuse to report themselves and to follow instructions.

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During the year there was an abnormally large number of fatal injuries, chiefly accidental, viz., four Indians and one Fijian accidentally drowned; two Indians and one Fijian suicidal hanging; one Indian burnt; case of assault (murder); and one Indian with fracture of pelvis, due to accidental crushing beneath a truck on the railway line.

There is no provincial hospital in this district, Fijians requiring in-patient hospital treatment being sent either to the Ba provincial hospital at Nailaga or to the Nadroga provincial hospital at Koromumu. There is, however, on the medical station a dispensary for Fijians, to which patients have come during the year for examination and treatment. In all, 1,006 attendances have been registered.

Plantation Hospital.—Admissions, 1,054; deaths, 14. There is one plantation hospital in the medical district of Nadi, viz., at Navakai, with space for 130 patients. There is a resident European superintendent in charge, and the condition of the buildings, water-supply, and the sanitation is satisfactory; and the equipment, though somewhat small and incomplete, is sufficient for present requirements.

Native Town Sanitation.—The sanitary state of the towns is good. They are mostly well placed with regard to drainage and water-supply. The year was an abnormally dry one in this district, and so some of the native towns on the flat, having to depend chiefly on wells, suffered considerable inconvenience through shortage of good water.

Plantation Lines and Sanitation.—The usual half-yearly inspection of all indentured Indian labour, lines, nurseries, water-supplies, kitchens, and latrines was made in June and December. The sanitary and general condition of the lines was satisfactory. All the nurseries are now supplied with fly-proof milk-safes; the water-supply is in each case very good, and the latrines are well kept.

Other Indian Settlements.—The free Indians here are scattered over practically the whole district, and do not congregate in large settlements. Considering the fact that they are allowed to build almost wherever they please they are very healthy. This I attribute largely to the fact that the level of the subsoil-water of this district is comparatively low, and therefore their well-water is so much the less liable to contamination from surface refuse and latrines. Their houses are mostly small and built of native materials, but the people, and especially the children, always appear well fed and fairly clean.

Native Medical Practitioners.—There are normally two native medical practitioners stationed in this district, but during the year there has been only one, viz., Savenaca Soralevu, who is stationed at Nomi, and who visits part of the Nadi medical district and part of the Nadroga medical district. His work has been satisfactorily performed.

Vaccinations performed during the year are as follows: District medical officer, Nadi, 77 successful; 7 unsuccessful; total, 84. Native medical practitioner, Momi, 115 successful; 22 unsuccessful; total, 137.

General Sanitary Work.—The sanitary state of the district is satisfactory. The native towns have been inspected frequently, and instructions given, when necessary, for the weeding of the towns, burning of rubbish and old mats, covering of wells, and supplying latrines with earth-boxes. Free coolie settlements have also been visited from time to time. Improvements have also been effected at the plantation hospital in the matter of water supply, which is now satisfactory. Six lepers were transferred to Makogai on August 14, and orders were given for the burning of the houses vacated by them. Several minor insanitary conditions at the plantation lines were rectified on attention being drawn to them by me. Legal proceedings were taken against two Indians in a case of pollution of drinking water on the Togo estate, and convictions were obtained. There has been nothing special to note with regard to European dwelling and stores.

Report by W. H. Bomford, Acting District Medical Officer, Navua.

Vital Statistics.—It has proved very difficult to obtain any satisfactory figures with regard to the population, and the following are estimated only, with the census of 1911 as basis: Europeans, 120; Fijians, 4,273; Indians, 4,500; others, 210; total, 9,103. The native births and deaths in Namosi province were as follows: 1911, births, 60; deaths, 45; increase, 15. 1912, births, 51; deaths, 44; increase, 7.

Diseases.—Dysentery was by far the largest contributor to the diseases during the year, but fortunately it was, as a rule, of a very mild type. Of the twenty-two deaths which occurred in the plantation hospital from this cause, the greater number were patients debilitated from other diseases, such as phthisis. It was chiefly in evidence during March, May, October, November, and December.

Dengue.—There was a slight epidemic of dengue during the month of April, but no cases proved serious.

Mumps.—Three cases were admitted to hospital during October, but they all came from the same place (Togaleka), and no further cases were reported.

Tuberculosis.—No cases of tuberculosis were seen amongst the native population, but some ten or twelve occurred in the Indians. One European died of pulmonary tuberculosis.

Pemphigus.—Pemphigus was responsible for a number of the hospital units, coinciding with the rainfall.

Plantation Hospital.—The plantation hospital is known as the Tamanua Hospital, and belongs to the Vancouver-Fiji Sugar Company. Patients are chiefly indentured to the Vancouver-Fiji Sugar Company, but many are also admitted from other plantations. Admissions for 1912 were: Company's servants, 1,512; others, 177; total, 1,689. The

general condition of the hospital is excellent, and reflects great credit on the hospital superintendent. During the year the Company's coal hulk, which lies moored off Naitonitoni, was fitted up for patients, and such convalescents as were able to, or fit to, be placed on board her, were placed there under the care of a competent sirdar, with constant visits from the hospital superintendent and the district medical officer. Practically every patient treated there gained weight, and those who did not were all very chronic cases.

Native Town Sanitation.—A complete tour of Namosi and Serua was made. As a general rule the sanitation of the native towns both in Serua and in Namosi has been excellent. A little more care as to not growing any foodstuff in the towns themselves would be advisable; also in the cleansing of drains.

Plantation Lines.—All these have been inspected at frequent times during the year. As a whole, they are very satisfactory. The main lines at Tamanua, belonging to the Vancouver-Fiji Sugar Company, are now supplied with a septic tank, which has proved a great success. In all other lines both sanitation and living rooms are excellent.

Government Indian Settlements are very scattered, and the Indians as a rule have a very considerable space round their houses. The health has been very good, although very little sanitation is in use. This, however, is gradually being improved.

Other Indian Settlements.—Practically the same remarks refer to other Indian settlements. The Indians are scattered so widely over the district that it is impossible to classify any particular part. Very few cases of sickness have been reported from any part.

Native Medical Practitioners.—During the past year the native medical practitioner, Namosi, has also been acting native medical practitioner, Serua. This has made a great deal of travelling necessary on his part. I think that he has done excellent work during the year, considering the distances he has had to cover.

Native Obstetric Nurses.—There is now one of these in both Namosi and Serua. They have now been here for just over six months, and have each attended to about twelve cases. The marked improvement in the children as to both health and cleanliness is very satisfactory.

Vaccination.—Number of cases vaccinated, 114. Only one case failed to take of those which came under my direct notice. A great number of the free Indian children still require vaccination.

General Sanitary Work.—The local authority have sent forward proposals for houses and latrines for approval on two or three occasions. I have made house to house examination of Indian huts, and have endeavoured to get them better ventilated and cleaned. Several breeding-places for mosquitoes were "kerosened." Any complaints made were investigated, and extensive alterations at the Navua Hotel and bakery were advised, and are being or have been carried out. Latrines were erected on several Indian settlements. During April the Government veterinary surgeon inspected the district.

Meteorological Conditions were very variable, July being exceptionally dry; May and December were very wet. The rainfall at Tamanua was 122 in. for the year, as compared with that of Lobau, which was 190, thus showing that Lobau had almost 70 in. more rain than Tamanua.

I may mention that during the year several syphilitic patients were treated at the Tamanua Hospital with salvarsan. Detailed observations were unfortunately not kept, but every case with the exception of two showed marked and rapid improvement. These two were husband and wife, and exhibited apparent immunity to the drug, but afterwards cleared up slowly on KI. and HI. The method used was the intravenous, by direct introduction of the needle into the vein, without incision. To prevent local infiltration, a small amount of normal saline was first let flow, in order to be certain that the needle lay in the lumen of the vein. None of the patients showed any bad after-effects.

REPORT BY E. PRIDEAUX, DISTRICT MEDICAL OFFICER, NADROGA.

Vital Statistics.—Europeans, 100, 1 death; Fijians, 7,341, 341 births, 189 deaths; Indians, 2,400, 130 births, 42 deaths; others, 270, 11 births, 2 deaths; total, 10,111, 482 births, 234 deaths. The Fijian statistics were as follows: Nadroga, 3,215, 170 births, 86 deaths; increase, 84. Colo West, 4,126, 171 births, 103 deaths; increase, 68. Comparison of births and deaths with previous years: Births, 1911, 295; 1912, 341; deaths, 1911, 300; 1912, 189; birth-rate, 1911, 41·2; 1912, 47·1; death-rate per 1,000 living, 1911, 42·3; 1912, 25·0. There were 71 deaths in children under 5 out of a total of 189 amongst Fijians. The large decrease in the death-rate is very satisfactory, and could still further be reduced if the Fijians would take more advantage of medical treatment. There were only 26 deaths stated to have been attended by the district medical officer or native medical practitioners. There were 26 deaths of patients who were stated to have been ill for one day only; no inquiries seem to have been held on these cases.

Diseases (Dysentery).—There were twenty-five cases treated with four deaths. In addition, eleven deaths were reported in the native registers.

Tuberculosis was not very marked. Nine cases were treated in the provincial hospital, and three cases in the plantation hospitals with one death.

Yaws was common amongst the Fijians; eighty cases were treated in the provincial hospital.

Febricula of uncertain origin gave 126 cases amongst the Indians.

Gonorrhœa accounted for 153 cases in the plantation hospitals.

Digestive System.—One hundred and thirty-eight cases were treated in the plantation hospitals and seventeen in the provincial hospital. There were

sixty-nine deaths registered in the native registers from abdominal diseases.

Tinea Imbricata was very common throughout the district. One hundred and eighty-nine cases were treated in the provincial hospital, and 105 patients were discharged cured. Ninety cases were treated in the Natuatuacoko ringworm hospital; only 65 per cent. can be regarded as permanent cures.

Provincial Hospital.—Admissions, 435; deaths, 3; out-patients, 1,149. The three deaths were from dysentery. The small number of deaths is accounted for by the fact that all moribund patients are taken home to their towns to die. There were forty-two operations performed.

Plantation Hospitals.—Admissions, 1,297; deaths, 18. The ratio of admissions to total average daily strength on plantations was 8·7 per cent., and the average daily number in hospital was 3·9 per cent. of the total average daily strength on plantations. There were 119 operations performed; ten of the eighteen deaths occurred in children. Three hospitals were kept open throughout the year, and a fourth was open until the end of April.

Native Town Sanitation.—All towns in Nadroga and the accessible towns in Colo West have been visited by the district medical officer during the year. A visit of inspection was also made to Vatulele. Quarterly inspections of all towns were made by the native medical practitioners. The towns in Colo West were well kept and had very good water supplies. Great improvements have been made in the Nadroga towns, but the water supplies along the coast consist only of shallow open wells. Numerous orders in regard to drainage, latrines, clearing, and general cleanliness have been made, and many improvements effected.

Plantation Lines and Sanitation.—There have been fourteen coolie lines in occupation during the year, and the daily average number of indentured immigrants was 1,200. There were seventy births and thirty deaths. Regular visits were made to the lines, which were well kept. During the dry season most of the estates had some trouble with their water supplies, which are obtained from wells and pumped to the lines by windmills; these have been improved, but are not yet satisfactory. Orders were given for whitewashing and cement drainage. The general health of the immigrants has been very satisfactory, and there have been no complaints.

Indian Settlements.—There are about 1,500 free Indians in the district. There is one settlement at Dua, near Cuvu, where there are 100 Indians, and the rest are scattered about in small settlements throughout the district. These settlements are in a very insanitary condition; few have latrines, and the water supply consists of shallow, open wells, sunk close to their huts. There have been reported sixty births and twelve deaths amongst the free Indians.

Native Medical Practitioners.—The native medical practitioner, Colo West, has made quarterly visits to all towns in Colo West. He has had 400 cases under treatment, and has treated ninety cases of ringworm in the provincial ringworm hospital at Natuatuacoko. The native medical practitioner, Nadroga Hospital, has made inspections and vaccinated in the Cuvu, Sigatoka, Waicoba, and Nokonoko districts. The remaining Nadroga districts are under the care of the native medical practitioner, Momi.

Obstetric Nurses.—Arieta, the native nurse, Nadroga, visited all the towns in Nadroga, and attended thirty-five cases. Litiana was appointed as nurse for Colo West on July 1, and attended fifteen cases during the six months.

Vaccination.—The vaccinations performed were as follows: Successful, 178; unsuccessful, 55; partial, 18; total, 251. Native medical practitioner, Colo West, 126; native medical practitioner, Nadroga, 78; district medical officer, Nadroga, 47; the remainder of those in Nadroga are included in the native medical officer, Nadi's, returns.

General Sanitary Work.—Very little sanitary work has been done during the year as the Local Authority was only appointed in July, and the necessary bylaws were not in force; there was no sanitary inspector. All European and half-caste settlements were inspected, and orders were given for removal of nuisances, and many improvements carried out in regard to clearing and drainage. There is only one bakehouse and one slaughter-house in the district. The milk supply is mainly carried on by free In . and is in need of more supervision.

Meteorological Conditions.—The total rainfall for the year was 62·7 in., as against 82 in. in 1911. The greatest fall for one month was in April, viz., 9·9 in.

Report by J. T. Smalley, District Medical Officer, Ra.

Vital Statistics.—Europeans, 71; births and deaths, *nil;* Fijians, 6,653; births, 230; deaths, 264; Indians, 1,399; births and deaths not known. The half-caste and miscellaneous population varies from 40 to 50. Comparison of births and deaths with two previous years—Births: European, 1911, 2; Fijian, 1910, 252; 1911, 239. Deaths: European, 1911, 1; Fijian, 1910, 362; 1911, 287. Indian statistics are not available.

Diseases.—The following are the main diseases from which the population suffered during the year, with the number of deaths resulting from each, and the period of life at which they occurred: Phthisis, 40 to 50 years, 17 deaths; 20 to 30 years, 6 deaths; 10 to 20 years, 4 deaths; 5 to 1 years, 1 death; total, 28 deaths. Pneumonia, 40 to 50 years, 3 deaths; 20 to 30 years, 4 deaths; 10 to 20 years, 2 deaths; 1 to 5 years, 10 deaths; total, 19 deaths. Diarrhœa (several probably dysentery), 40 to 50 years, 7 deaths; 20 to 30 years, 2 deaths; 10 to 20 years, 2 deaths; 1 to 5 years, 4 deaths; under 1 year, 7 deaths; total 22 deaths. Dysentery, 40 to 50 years, 6 deaths; 20 to 30 years, 3 deaths; 10 to 20 years, 2 deaths; 1 to 5 years, 3 deaths; under 1 year, 2 deaths; total, 16 deaths. Pleurisy, 40 to 50 years, 4 deaths; 20 to 30 years, 8 deaths;

10 to 20 years, 7 deaths; total, 19 deaths. Bronchitis, 40 to 50 years, 11 deaths; 1 to 5 years, 4 deaths; under 1 year, 7 deaths; total 22 deaths (many probably broncho-pneumonia). Of course, filariasis in its many manifestations and framboesia are the main diseases that affect the Fijians, and in 1912 the latter was responsible for 105 out of a total of 409 admissions to the provincial hospital, Ra. A great number of Fijians of this district suffer from tinea imbricata, and 110 were treated at the hospital with sulphur baths, with splendid results. In the early part of the year there were five cases of whooping-cough.

Provincial Hospitals.—There is only one provincial hospital in the district, situated at Nanukuloa. The following deals with the number of admissions, deaths, and out-patients, together with the figures of two previous years: Admissions, 1910, 411; deaths, 27; out-patients, 707; 1911, 508; 25 deaths; out-patients, 614; 1912, 409; deaths, 12; out-patients, 986.

The main diseases admitted were tinea imbricata, 110; yaws, 105; tuberculosis, 24; and cardiac diseases, 10. Tuberculous and cardiac diseases show a marked increase over the figures of 1911. Several cases have come from Colo East for treatment at this hospital. Out of 264 deaths that occurred in 1912 only 12 took place in the hospital. Intestinal diseases claimed 38 deaths during the year, and only two of them occurred in the hospital.

Hospital Buildings.—The European buildings have been repaired to a certain extent, but a great deal more required doing, and will be carried out in 1913. The native houses are in a bad state of repair, and four new ones are needed. As a result of very dry weather in July, August, September, and October the water supply of the hospital failed. On my return from Levuka in October I inspected the reservoir and found it nearly dry.

Plantation Hospitals.—There is only one plantation hospital in the district; it is situated at Penang, and receives patients from the three estates (Penang, Caboni, and Ellington) which employ indentured labour. The following gives the number of admissions and deaths with the figures for the two previous years: Admissions, 1910, 785; deaths, adults, 9; children, 13; total, 22. 1911, 703; deaths, adults, 4; children, 14; total, 18. 1912, 745; deaths, adults, 8; children, 5; total, 13.

The most noticeable feature in connection with the hospital during the year has been the considerable decrease in the mortality amongst the children, despite their increase in number. During the last three years the death-rate amongst the indentured labour and their children has greatly decreased. Main causes of death were: Phthisis, 2; diarrhœa, 2; marasmus, 2; and cerebral softening, 2. No other disease was responsible for more than one death. There were no deaths out of the forty-three cases of dysentery admitted.

Native Town Sanitation.—The staff of this hospital paid fifty-four visits to towns in the district. The state of the town is, on the whole, quite good, comparing favourably with many other districts. The main difficulty has again been the latrines, which are not kept as well as they might be, and, incidentally, many are not much used—the bush still being largely used for the purposes of defecation. The Roko has for some time past been against my system of having, roughly, one latrine for every six to eight people, and says you cannot thereby hold any one person or household responsible for the state of any latrine. For this reason, at the provincial council in November, it was decided that every house was to have its own latrine, and that the occupants of a house were to be held responsible for the state of cleanliness and repair of the latrine belonging to it.

Plantation Lines and Sanitation.—Penang estate: There has been a marked improvement in the manner in which the ground round the lines has been kept during the year. The latrines erected at the end of 1911 have been satisfactory; being composed largely of concrete, they are capable of being kept much cleaner than the old wooden type. The fly-proof line nursery has not been very satisfactory, owing to lack of proper supervision. On the whole, the buildings are kept in a good condition. During the very dry season the well-water was scarcely sufficient for the needs of the people; but such a scarcity has never occurred before and probably will never occur again; but, anyhow, it is proposed to guard against such a contingency by having a new pipe supply. The company's stables are not satisfactory from a sanitary point of view, but the matter is being taken in hand, and before long it is hoped to have the flooring concreted, which will allow of it being flushed out every day. The pollution of the Penang River by the discharges into it during the crushing season of by-products, &c., from the Penang mill has been reported. The company have been ordered to carry out such alterations as will abate the nuisance before the second week in May, 1913.

Caboni Estate.—The state of the lines and the general sanitary conditions of this estate calls for nothing but praise.

Ellington Estate.—The lines on this estate, although satisfactory, are not up to the standard of those on the other two estates. The site is a very good one, and the health of the labour has been excellent.

Indian Settlements.—The general sanitary condition of the free coolie settlements is unsatisfactory, but, despite this, there is very little sickness amongst the people. These settlements—of which there are a large number in Ra—contain, roughly, a little over 800 inhabitants; there is no sanitary inspector.

Native Medical Practitioners.—The native medical practitioner, Nanukuloa, has been changed during the year, Ratu Wilisoni going from Nanukuloa to Bua, and Tomasi Mawi taking his place. Ratu Wilisoni had worked well and took great interest in sanitary matters. Tomasi has, during the short time he has been under me, worked well, but does not take the same interest as Wilisoni did in the appearance of the hospital grounds.

Colonial Medical Reports.—No. 63.—Fiji (*continued*).

Obstetric Nurses.—Akesa, the obstetric nurse, left at the half-year, and her place was taken by Lice. Akesa worked well in the district, but it is not easy to get the people to make use of the services of a nurse during their confinements. The nurses, however, do good in that they teach the women to be clean in their person and in their homes, and endeavour to teach them how to feed their children —a very difficult and thankless task. Lice, the new native obstetric nurse, has worked well.

Vaccination.—One hundred and thirty-eight primary and fourteen secondary vaccinations were performed during the year. Of this number sixty-six were vaccinated in two places only, the remainder in three or four.

Penang Gaol.—The prisoners' cells are roomy, and have sufficient ventilation; they have been kept in a clean condition. The constabulary quarters is a modern wooden building; each individual room is of good size and well lighted. The latrines have not been satisfactory.

Criminal Abortion.—A considerable amount of criminal abortion takes place amongst the Fijians. Inquiries have been instituted in several suspicious cases, but it is impossible to get at the truth. Before any increase in the population of this district can take place, it is essential that the people suffering from intestinal and respiratory diseases should be brought into hospital, mainly because many of them are young people. Out of thirty-eight deaths from intestinal diseases twenty occurred in people under 20 years of age, and out of sixty-nine deaths from diseases of the respiratory system thirty-five occurred in people under the same age.

Report by P. Laurence Edward, Veterinary Surgeon, Suva, Inspector of Stock.

Inspection of Stock in Suva.—During the year the following number of stock were examined at the port of Suva. These animals were imported from Tonga, Somoa, New South Wales, Victoria, and South Australia, and were all allowed to land: Horses, 19; cattle, 101; sheep, 222; pigs, 66; dogs, 13; cat, 1; donkey, 1.

Inspection of Stock, Taviuni and Navua.—I visited Taviuni, and while there inspected about 5,000 head of cattle, and advised the destruction of ten head as tuberculous. The stock on this island are owned by Europeans and have always been well looked after, and are practically free from tuberculosis.

I visited Navua and inspected about 775 head, and advised the destruction of eighteen head as being clinically tuberculous. These cattle were owned by Indians, who refused to kill them, and, as there is no power to compel an owner to destroy diseased animals, the matter was left in *statu quo*. The cattle in this district are very poor, weedy mongrel animals, and, if systematically inspected, would show a very high percentage of tuberculosis.

Twenty-five visits were made to the dairies around Suva.

Inspection of Slaughter-houses and Butchers' Shops.—Twenty visits were made to the slaughter-houses (two in number). These are in the same condition as they were last year. Seventy-two visits were made to the butchers' shops (two in number), and the premises and meat inspected.

One notice was issued. No diseased meat was seized, but several portions of carcases were trimmed, as parts were badly bruised.

One hundred visits were made to the livery stables (four in number). These are in the same condition as last year, and are very unsatisfactory. I do not see how any improvement can be made until there is a sewerage system in Suva. I think the proprietors endeavour to keep them as clean as possible under the circumstances.

Veterinary Surgeon.

An outbreak of a contagious disease resembling glanders in mules was stamped out this year. The outbreak was in the Rewa province; nineteen mules died or were destroyed. Up to the present time there has been no recurrence of the disease.

The tuberculin test has been applied to eighty-four head of cattle this year, and eight reacted (9½ per cent.). I do not, however, put any value on these figures, as the cattle were picked working bullocks or cows, and the test was applied is a condition of the sale. It is obvious that no vendor would agree to the test unless he felt certain the cattle were healthy.

During the year I have attended to the Government stock in and around Suva, and also to the Central Road Board horses; their health during the year has been good. Two horses, the property of the Public Works Department, have died; and one, the property of the Agricultural Department.

During the year I have attended to numerous animals owned by private individuals, and the fees earned were £203 0s. 6d.

Colonial Medical Reports.—No. 64.—British Guiana.

MEDICAL REPORT FOR THE YEAR 1912-1913.

By E. D. ROWLAND.

Acting Surgeon General.

Public Hospital, Georgetown.

This institution has accommodation for 295 males and 238 females.

9,481 patients were admitted during the year, and with the 444 patients remaining in hospital on April 1, 1912, make a total of 9,925 patients treated.

The number of out-patients treated was 33,731, a decrease of 11,227 on the previous year.

There were 1,157 deaths. This gives a death-rate of 11·6 per cent. of the total number treated.

Of the total 241, or 20·0 per cent., died within twenty-four hours, and no fewer than 412, or 35·6 per cent., died within seventy-two hours of admission.

During the year the largest number of typhoid cases recorded were treated. There being no fewer than 194 cases with 44 deaths, giving a death-rate of 22·6 per cent.

Five nurses and six servants developed the disease, arising probably from contact with the sick.

There is no doubt that Georgetown is the centre of this disease, and unless some radical change is made in the sanitary conditions, more especially by the adoption of some modern plan of dealing with cess-pits, typhoid fever must increase and be a standing menace to the health of the city and colony.

During the year there were 308 cases of pneumonia treated, and 129 deaths; with a high mortality of 41·8 per cent.

The deaths amongst children under 5 years of age were 213, or 18·4 per cent. of the total deaths. This is very excessive and is to a large extent due to malnutrition consequent on improper feeding.

There were 638 deliveries in the Maternity Ward with 33 deaths. Of these deaths 5 were due to septic conditions, 4 to eclampsia, 1 to peritonitis following rupture of uterus, and the remainder to diseases not connected with parturition.

The number of operations (major) performed during the year were 920.

Public Hospital, New Amsterdam.

This institution has accommodation for 96 males and 54 females. There were 2,853 patients admitted, and with 154 remaining on April 1, 1912, make a total of 3,007 patients treated. The number of out-patients treated was 21,434.

There were 365 deaths, which give a death-rate of 12·1 per cent. of the cases treated. Of the total deaths, 32, or about 8·7 per cent., died within twelve hours of admission, and 37, or 10·1 per cent., within twenty-four hours of admission.

There were 96 births in the Maternity Ward.

Public Hospital, Suddie.

This institution has accommodation for 54 males and 26 females. There were 1,327 patients admitted, and with the 69 remaining on April 1, 1912, make a total of 1,396 patients treated. The number of out-patients treated was 5,485.

There were 155 deaths, which give a death-rate of 11·1 per cent. of the cases treated. Of the total deaths 66, or 42·5 per cent., died within seventy-two hours of admission.

There were 26 births, of which 7 were still-born.

Public Hospital, Bartica.

This institution has accommodation for 24 males and 11 females. There were 265 patients admitted and with the 10 remaining on April 1, 1912, make a total of 275 treated. The number of out-patients treated during the year was 1,196.

There were 26 deaths, which give a death-rate of 9·4 per cent. of the cases treated. Of the total deaths 10 died within seventy-two hours of admission.

There were 10 births during the year.

Public Hospital, Morawhanna, and Arakaka Ward.

The hospital at Morawhanna has accommodation for 14 males and 11 females, and the Arakaka Ward for 12 males. There were 818 patients treated and 51 deaths, which give a death-rate of 6·2 per cent. of the cases treated. Of the total deaths 16 died within twenty-four hours of admission. There were 3,891 out-patients treated.

Lunatic Asylum.

There were 466 males and 301 females in the asylum on April 1, 1912. During the year 95 males and 58 females were admitted, 43 males and 24 females were discharged, and 84 males and 52 females died. The percentage of mortality on the total number of inmates was 14·7.

The noticeable feature of these figures is the high death-rate for the year. This institution, as a rule, has a mortality of from 7 to 8 per cent. of its total number. This last year it rose to as high as 14·7, and, as is pointed out by the Medical Superintendent, it was found, after careful and prolonged inquiry, to be due to the impossibility of obtaining ground provisions, these having to be replaced by rice which affected the health of the old people very adversely.

The following statement shows the work done at this institution by the attendants and inmates:—

Return of Diseases and Deaths in 1913 in the Georgetown Hospital, and Berbice, Suddie, Bartica, and N.W.D. Hospitals.

British Guiana.

GENERAL DISEASES.

	Admissions	Deaths	Total Cases Treated
Alcoholism	29	—	—
Anæmia	134	2	—
Anthrax	—	—	—
Beriberi	—	—	—
Bilharziosis	—	—	—
Blackwater Fever	3	1	—
Chicken-pox	62	—	—
Cholera	—	—	—
Choleraic Diarrhœa	—	—	—
Congenital Malformation	—	—	—
Debility	67	14	—
Delirium Tremens	14	—	—
Dengue	—	—	—
Diabetes Mellitus	1	—	—
Diabetes Insipidus	1	—	—
Diphtheria	2	—	—
Dysentery	414	115	—
Enteric Fever	204	42	—
Erysipelas	7	—	—
Febricula	—	—	—
Filariasis	—	—	—
Gonorrhœa	211	1	—
Gout	—	—	—
Hydrophobia	—	—	—
Influenza	174	—	—
Kala-Azar	—	—	—
Leprosy	—	—	—
(*a*) Nodular	1	—	—
(*b*) Anæsthetic	4	—	—
(*c*) Mixed	—	—	—
Malarial Fever—	46	3	—
(*a*) Intermittent	1,367	55	—
Quotidian	—	—	—
Tertian	—	—	—
Quartan	—	—	—
Irregular	—	—	—
Type undiagnosed	—	—	—
(*b*) Remittent	16	1	—
(*c*) Pernicious	38	13	—
(*d*) Malarial Cachexia	21	1	—
Malta Fever	—	—	—
Measles	—	—	—
Mumps	8	—	8
New Growths—	—	—	—
Non-malignant	51	2	—
Malignant	55	13	—
Old Age	39	7	—
Other Diseases	—	—	—
Pellagra	—	—	—
Plague	—	—	—
Pyæmia	11	9	—
Rachitis	—	—	—
Rheumatic Fever	1	—	—
Rheumatism	346	2	—
Rheumatoid Arthritis	—	—	—
Scarlet Fever	—	—	—
Scurvy	1	—	—
Septicæmia	48	42	—
Sleeping Sickness	—	—	—
Sloughing Phagedæna	—	—	—
Small-pox	—	—	—
Syphilis	45	2	—
(*a*) Primary	13	—	—
(*b*) Secondary	37	—	—
(*c*) Tertiary	96	9	—
(*d*) Congenital	18	9	—
Tetanus	25	13	—
Trypanosoma Fever	—	—	—
Tubercle—	40	13	—
(*a*) Phthisis Pulmonalis	—	—	—
(*b*) Tuberculosis of Glands	—	—	—
(*c*) Lupus	—	—	—
General Diseases—*continued.*			
(*d*) Tabes Mesenterica	—	—	—
(*e*) Tuberculous Disease of Bones	—	—	—
Other Tubercular Diseases	—	—	—
Varicella	—	—	—
Whooping-cough	6	1	6
Yaws	45	2	—
Yellow Fever	—	—	—

LOCAL DISEASES.

	Admissions	Deaths	Total Cases Treated
Diseases of the—			
Cellular Tissue	753	21	—
Circulatory System	251	72	—
(*a*) Valvular Disease of Heart	—	—	—
(*b*) Other Diseases	—	—	—
Digestive System—	1,425	181	—
(*a*) Diarrhœa	—	—	—
(*b*) Hill Diarrhœa	—	—	—
(*c*) Hepatitis	—	—	—
Congestion of Liver	—	—	—
(*d*) Abscess of Liver	—	—	—
(*e*) Tropical Liver	—	—	—
(*f*) Jaundice, Catarrhal	—	—	—
(*g*) Cirrhosis of Liver	—	—	—
(*h*) Acute Yellow Atrophy	—	—	—
(*i*) Sprue	—	—	—
(*j*) Other Diseases	—	—	—
Ear	29	—	—
Eye	277	—	—
Generative System—	—	—	—
Male Organs	480	5	—
Female Organs	1,916	77	—
Lymphatic System	136	—	—
Mental Diseases	181	4	—
Nervous System	254	50	—
Nose	19	—	—
Organs of Locomotion	219	3	—
Respiratory System	1,877	503	—
Skin—	644	4	—
(*a*) Scabies	—	—	—
(*b*) Ringworm	—	—	—
(*c*) Tinea Imbricata	—	—	—
(*d*) Favus	—	—	—
(*e*) Eczema	—	—	—
(*f*) Other Diseases	—	—	—
Urinary System	784	217	—
Injuries, General, Local—	683	24	—
(*a*) Siriasis (Heatstroke)	—	—	—
(*b*) Sunstroke (Heat Prostration)	—	—	—
(*c*) Other Injuries	—	—	—
Parasites—	563	52	—
Ascaris lumbricoides	—	—	—
Oxyuris vermicularis	—	—	—
Dochmius duodenalis, or Ankylostoma duodenale	—	—	—
Filaria medinensis (Guinea-worm)	—	—	—
Tape-worm	—	—	—
Poisons—	18	—	—
Snake-bites	—	—	—
Corrosive Acids	—	—	—
Metallic Poisons	—	—	—
Vegetable Alkaloids	—	—	—
Nature Unknown	—	—	—
Other Poisons	—	—	—
Surgical Operations—	6,065	49	—
Amputations, Major	—	—	—
,, Minor	—	—	—
Other Operations	—	—	—
Eye	—	—	—
(*a*) Cataract	—	—	—
(*b*) Iridectomy	—	—	—
(*c*) Other Eye Operations	—	—	—

Butchery, hides, &c., and labour value	$881.02
Piggery, yield of pork and labour value	731.45
Bakery, labour value	284.00
Kitchen, labour value	425.00
Parching room	163.00
Laundry	2,424.50
Tailor's shop	584.94
Sewing room	630.64
Shoemaker's shop	205.01
Printer's shop	100.00
Other trades and employment ...	2,880.00
Wood-cutting	1,162.00
Coffins and funerals	353.88
Ground provisions	48.16
Weeding, trench digging, &c. ...	700.00
	$11,573.60

Leper Asylum.

On April 1, 1912, there were 306 males and 134 females in the asylum. During the year 73 males and 21 females were admitted, and on March 31, 1913, there were 266 males and 121 females in the asylum. There were 114 deaths, 83 males and 31 females. The percentage of mortality on total number of inmates was 21·3.

Similarly as at the Lunatic Asylum, the death-rate of this institution was adversely affected by the prolonged drought rendering it impossible to obtain ground provisions, and so necessitating the patients being fed on rice, and the mortality rose to as high as 21·3 per cent. of the total number.

The farm was kept in good order, but the yield from it was adversely affected by the drought.

The majority of the inmates keep their cottages and grounds neat and tidy. They are given small plots of ground in which during their spare time they are allowed to grow vegetables, and these are either used by themselves or sold to the store for consumption within the asylum.

Public Dispensaries.

Georgetown.

There are three dispensaries in the city: No. 1 at the Police Station, Broad Street; No. 2 at the Alms House; No. 3 at the Public Hospital.

There are seven Country Dispensaries, situated as follows:—

(1) *Demerara River.*—At Akyma.

(2) *Berbice River.*—At Ida Sabina.

(3) *Upper Pomeroon.*—District extends from the Tapacooma Lake to and inclusive of Urua.

(4) *Lower Pomeroon.*—The district extends from but exclusive of Urua, to the mouth of the Pomeroon River, and includes the Wakapoa Creek and its tributaries.

(5) *Moruca River.*—The dispenser resides at Acqueero and the district extends from the mouth of the Moruca River up to Kamwatta, including all the tributaries and settlements.

The dispensers in charge are provided with corials for the purpose of paying periodical visits to the different grants, homesteads and missions.

(6) *Potaro.*—11½ miles from Potaro Landing and provided with six beds for the reception of urgent cases.

(7) *Albouystown.*

The following table shows the number of persons treated:—

Dispensary	Paying patients	Police patients	Paupers	Total
No. 1 ...	781	—	2,243	3,024
Albouystown ...	1,377	—	1,953	3,330
No. 2 ...	931	—	5,574	6,505
No. 3 ...	528	—	5,795	6,323
Demerara River ...	221	54	657	932
Berbice River ...	444	—	605	1,049
Upper Pomeroon ...	103	—	640	743
Lower Pomeroon ...	486	13	1,220	1,719
Moruca	12	—	1,271	1,283
	4,883	67	19,958	24,908

Prison Hospitals.

The following table shows the number of prisoners admitted and the number of deaths in these hospitals during the year:—

Institution	Admitted to Hospital			Died in Hospital
	M.	F.	T.	M.
H.M. Penal Settlement ...	108	—	108	5
Georgetown	103	19	122	—
New Amsterdam	24	6	30	2
Suddie	23	4	27	—
Total	258	29	287	7

Sugar Estates.

The office of Medical Inspector was abolished as from April 1, 1912.

At the close of the year there were 37 estates hospitals with a total of 2,369 beds.

35,628 patients were treated in the estates hospitals, being a decrease of 6,416 on the previous year. There were 854 deaths, as against 1,172 for the previous year, which gives a death-rate of 2·4 per cent. of the cases treated.

The year 1912-13 was a very healthy one on the estates. The long drought no doubt aided much in this result, which was specially noticeable as following after five unhealthy years.

The population, birth and death-rates for all immigrants on the estates are as follows for the last three years:—

Year	Population	Birth-rate	Death-rate	Infantile mortality
1910-11 ...	62,197	24·3	30·8	215
1911-12 ...	63,945	28·1	24·8	178
1912-13 ...	66,134	34·3	17·5	138

The death-rate of indentured immigrants for the last three years is as follows:—

Year	Death-rate
1910-11	18·2
1911-12	17·3
1912-13	13·3

Colonial Medical Reports.—No. 64.—British Guiana (*contd.*).

THE population, birth and death-rates for all immigrants off the sugar estates, viz., in the towns and villages for the year 1912-13 are as follows:—

Population	Birth-rate	Death-rate	Infantile mortality
64,812 ...	31·4 ...	30·2 ...	175

The diminution in the number of cases of malaria and the number of deaths from this cause which began in 1906-07 still continues. This is without doubt the effect of quinine distribution. In 1906-07 the prophylactic measure was adopted on eleven estates; this gradually spread until now quinine is used prophylactically on all the thirty-seven estates.

During this period the number of malarial fever cases treated in estates hospitals has been as follows: 1906-07, 33,748; 1907-08, 26,930; 1908-09, 28,181; 1909-10, 27,301; 1910-11, 21,063; 1911-12, 15,028; 1912-13, 7,384.

It is interesting to report that the decrease in the number of cases of infantile convulsions mentioned in my report for last year still continues. In 1909-10 there were 195 cases with 57 deaths; in 1910-11, 138 cases and 29 deaths; in 1911-12, 100 cases and 23 deaths; and in 1912-13, 70 cases with 13 deaths. This reduction is, I am sure, due entirely to the systematic giving of quinine to the children.

VACCINATION.

Glycerinated lymph is imported for the use of the public vaccinators, to whom it is supplied free of charge. There were 890 successful vaccinations during the year.

HEALTH OF THE COLONY.

It is satisfactory to report that the colony has been free from such dangerous, infectious, or contagious diseases as plague, yellow fever, and smallpox.

The death-rate of the whole colony was 29·2 per 1,000, as against 31·7 per 1,000 for the previous year; the birth-rate was 33·1 per 1,000, as against 28·8 for the previous year. This is a considerable improvement on the figures of the last few years.

Pneumonia still claims a large number. At the Public Hospital, Georgetown, 308 cases were treated with a death-rate of 41·8 per cent.; of these 31 per cent. died within twenty-four hours, and 49·6 per cent. within seventy-two hours of admission.

Enteric Fever.—The Resident Surgeon, Public Hospital, Georgetown, calls attention to the large increase for the year; there were 194 cases with 44 deaths, against 108 cases with 37 deaths for the previous year.

On February 24, 1912, notification of enteric fever was made compulsory with the result of at once showing how widespread the disease was throughout the colony.

For the year ending March 31, 1913, there were 395 cases in the County of Demerara distributed as follows: In Georgetown, 294; East Coast, 38; West Coast, 1; East Bank, 54; West Bank, 8.

There were 39 cases in the County of Berbice, divided up as follows: In New Amsterdam, 11; East Coast, 20; Berbice River, 4; West Coast, 4.

In the County of Essequebo there were 8 cases only.

There are no recorded cases from the Interior, neither from the gold fields nor from the balata or timber grants.

The death-rate in the Interior during the year has not been noticeably higher and the labourers returning thence bring no word of any special disease.

The death-rate for the financial year 1912-13 is interesting, being for Georgetown, where the larger number is treated in the Public Hospital, 16 per cent. In the country, 30·4 per cent. And the whole colony 20·8 per cent.

Notification and deaths per month:—

		Whole Colony		Rainfall
		Cases	Deaths	Botanic Gardens
April,	1912 ...	42 ...	5 ...	6·26 in.
May,	,, ...	44 ...	16 ...	9·08 ,,
June,	,, ...	45 ...	3 ...	8·21 ,,
July,	,, ...	40 ...	12 ...	11·24 ,,
August	,, ...	41 ...	9 ...	8·17 ,,
September,	,, ...	19 ...	7 ...	1·5 ,,
October,	,, ...	17 ...	4 ...	1·89 ,,
November,	,, ...	19 ...	5 ...	4·03 ,,
December,	,, ...	10 ...	3 ...	16·45 ,,
January,	1913 ...	20 ...	8 ...	18·18 ,,
February,	,, ...	64 ...	5 ...	2·41 ,,
March,	,, ...	81 ...	15 ...	7·54 ,,
		442	92	94·96 in.

Social Condition.

The vast majority of cases occur among the labouring classes, fairly divided as to sex, and, as is usual, with a high percentage rate amongst those between the ages of 10 and 30.

Careful inquiry as to the cause of the spread of enteric leads us to believe that personal contact is the important factor in this colony. Association with cases of this disease in small, dirty, ill-ventilated tenement rooms, built in yards overcrowded with midden pits, is more than amply sufficient to account for the spread of this disease. Were it not for the natural sanitation, affected by the breeze and sun, Georgetown would be as hideous as some of the cities of the middle ages when affected with plague.

The other common factors found elsewhere, such as infected milk, flies, and so on, have been shown locally to have a small influence, but every endeavour to trace cases comes back to personal contact, more or less immediate, with a previous case.

To show the increase of the disease I am not able to give actual figures of cases, but from the Registrar-General's report, the following figures are taken of the deaths that are registered. These will in-

dicate very clearly the steady increase that is going on:—

Deaths in the Colony from Enteric Fever from Registrar-General's Annual Reports (1884-1912).

	In whole Colony			Certified by medical men
	M.	F.	T.	
1884	5	5	10	—
1885	5	5	10	—
1886	1	—	1	—
1887	1	—	1	—
1888	1	—	1	—
1889	5	4	9	2 certified
1890	9	12	21	16 "
1891	6	2	8	All
1892	6	9	15	All
1893	9	5	14	5 certified
1894	4	4	8	All
1895	2	5	7	All
1896	8	5	13	All
1897	2	4	6	All
1898	3	8	11	All
1899	8	8	16	All
1900	—	2	2	All
1901	4	3	7	All
1902	1	2	3	All
1903	1	1	2	—
1904	4	2	6	4 certified
1905	3	1	4	All
1906	5	9	14	13 certified
1907	4	4	8	All
1908	12	14	26	25 certified
1909	20	13	33	30 "
1910	25	32	57	54 "
1911	29	47	76	All
1912	50	43	93	84 certified
Totals	233	249	482	

In 1883 the Resident Surgeon of the Public Hospital, New Amsterdam, recorded three cases of enteric fever in that hospital.

If the death-rate is estimated at being about 20 per cent. all the time, a fairly accurate estimate of the number of cases can be arrived at.

There is some evidence to show that country people coming to town take the disease away with them to their homes in the villages.

The mortality amongst children under 1 year, it is to be regretted, still continues far in excess of what it should be. In 1910 there were 1,954 deaths, or 235 per 1,000; in 1911 there were 1,865 deaths, or 229 per 1,000. In 1912 there were 1,879 deaths, or 190 per 1,000 births. The mean rate for the last five years was 225 per 1,000.

During the year tuberculosis was the cause of 6·4 per cent. of the total mortality of the colony as against 7·3 per cent. for the previous year, and in Georgetown 9 per cent. as against 8·6 per cent. for the previous year.

The Society for the Prevention and Treatment of Tuberculosis has continued its good work during the year. I know, from being in close touch with the working of this Society, that the scope of its work is being gradually extended, but the want of funds stands in the way. Its operations have now been extended by the appointment of a "lady visitor," who visits the cases under treatment, gives advice as to the means to be taken to prevent the spread of infection to others, and endeavours to persuade those afflicted to take advantage of the Tuberculosis Ward at the Public Hospital, Georgetown. This disease has likewise been made notifiable. From what we know of this disease, the excellent work that is being done by the Society for the Prevention and Treatment of Tuberculosis can only be looked upon as a palliative.

The work also being now done by the Town Council is merely preliminary to proper systematic efforts to stamp out the disease. A vigorous enforcement of the present Town Council By-laws, amending them from time to time as may be found necessary, is urgently needed, and no real prevention of the disease can be looked forward to until the people have been educated up to the necessities of living and sleeping in clean, well-ventilated rooms; not only must the rooms have their sanitary proper number of inhabitants, but the lots must also not have more than the proper number of inhabitants per square foot.

The struggle to prevent the disease is well-nigh hopeless under the present conditions of housing the poor. The Honourable Dr. Godfrey attended a Conference in Trinidad in March, 1913, and as a result of the deliberations of the Conference the following resolutions, moved by Dr. Cecil Wall (Great Britain), were unanimously passed:—

"Whereas it has been proved conclusively to this Conference that tuberculosis exists in the West Indies to an alarming extent, be it resolved that this Conference is of opinion that it is desirable that measures for the administrative control of tuberculosis in the colonies and countries represented at this Conference should include: (1) Notification; (2) housing reform; (3) the establishment of tuberculosis dispensaries and other machinery for the detection, prevention and treatment of the disease."

Dr. Wall, in moving the resolution, said that after the long discussions which have been held during the past week, it was unnecessary for him to say more in favour of the resolution. He felt certain that the delegates, one and all, were convinced that those measures were absolutely necessary in the efforts to stamp out tuberculosis from the community. Other motions would be brought forward dealing with matters of smaller detail, but those general principles seemed to be of such outstanding importance that he had been asked, as representative of the United Kingdom, to formally propose their adoption by the Conference.

M. le Medicin-Major Dr. Noc (Martinique) seconded the resolution.

Dr. Godfrey (British Guiana) moved:—

"That tuberculosis associations be started in West Indian Colonies where they do not now exist."

Dr. Godfrey, in moving the resolution, said that they had heard a good deal of these associations, and of the work that had been done in the past, and in proposing the resolution he did not think he could do better than advise the colonies to do what

British Guiana had done, and that is, to establish tuberculosis associations on the same lines as the Trinidad Association.

Dr. Hutson (Barbados), in seconding the resolution, said he had been much impressed with the work which the Trinidad Association had done, and he hoped that before very long they would have similar institutions throughout the West Indian Islands.

Dr. McDonald (Kingston City Council, Jamaica) moved:—

"That it be a recommendation from this Conference, that measures should be taken in the colonies and countries represented here to stamp out bovine tuberculosis and to prevent its importation."

Dr. McDonald, in moving the resolution, said he had little to say with regard to the motion, except that it had been proved that bovine tuberculosis did exist in the West Indies. Its present extent seemed to be slight, so that it should be a matter of little financial encumbrance to any Government to stamp out the disease, and its prevention was a matter not associated with any great financial output.

Mr. Saunders, veterinary surgeon (Imperial Department of Agriculture for the West Indies), seconded and said he had great pleasure in identifying himself therewith, as a member of the sister profession.

Dr. Duke (Leeward Islands) moved:—

"That in the opinion of this Conference it seems desirable that all West Indian Colonies, not at present teaching the elements of sanitation and hygiene in their schools, should have such subjects added to their codes at the earliest possible date."

Dr. Tucker (Bermuda) seconded.

Dr. Ross (Jamaica) moved:—

"That this Conference is of opinion that the endeavour to combat disease would be effectually aided by the adoption of efficient registration of births, deaths and marriages in places where at present it does not exist."

Dr. Hatton (Windward Islands) seconded.

It is very gratifying to know that the large majority of the recommendations have already been adopted in this colony. I desire to draw special attention to the recommendation with regard to "housing." This, in my opinion, is one of the most important, more especially in the towns of Georgetown and New Amsterdam, and I trust that special steps will be taken by the municipalities to deal with this side of the question in seeing: That all houses, more especially those let out as tenements, are properly and efficiently ventilated; that overcrowding is not allowed; that houses considered unfit for human habitation by the Health Officer be condemned.

Malarial Fever and Anti-malarial Measures.

In the Supplementary Report dated November 16, 1911, the number of cases of malarial fever treated in each estate hospital for each of the five years—1906-07, 1907-08, 1908-09, 1909-10, 1910-11—was shown separately. The total number of cases treated in 1906-07 was 33,748, in 1911-12 they had fallen to 15,169, and in 1912-13 to 7,384. This plainly shows what can be accomplished by anti-malarial measures, which, on the estates, consist of:—

Abolition of mosquito breeding grounds, including the screening of tanks, barrels and other receptacles for storing drinking water, cleaning the yards of old tins, bottles, &c., and keeping the drains and trenches clean and free of grass, so as to allow the small fish to get at the mosquito larvæ.

The free distribution of quinine to the resident labourers and especially to the children.

In the city of Georgetown, the Health Officer has instituted a vigorous campaign against mosquitoes, which, I am sure, will be followed by good results. The fight must be a continuous one, and with the assistance and co-operation of those that suffer, not only from the diseases carried by mosquitoes, but the pain produced by their bites, we shall win in the end.

I very much regret to have to record year after year in my annual reports, that the town of New Amsterdam has done nothing; it is not to their credit that the authorities should so persistently refuse to undertake anti-malarial measures.

The Government still continues the sale of quinine at the various post offices throughout the colony. All prisoners, members of the police force and their families, the boys at the industrial schools at Onderneeming and the orphan asylum, and attendants of Government medical institutions are supplied with quinine free. The reports from the medical officers of the districts all continue to confirm the high value to be placed on the systematic administration of quinine. It has now become not uncommon for labourers to demand it as a necessity.

A spleen census of all children on the sugar estates is taken every half-year.

Drinking Water.—The water supply generally remains about the same. On one or two estates concrete reservoirs have been built and some attempt made to improve the impurity of the water.

Anchylostomiasis.—On the sugar estates the measures which have now for some time been advocated by this department have been continued.

(i) The erection of latrines.

(ii) The systematic examination of all newly arrived immigrants and of all persons suffering from anæmia or showing the least sign of being infected with the anchylostome parasite.

(iii) The treatment and constant observation of all known infected cases.

In this connection it is pleasing to report that every estate is now supplied with latrines. There has been a very marked diminution of the number of cases, particularly of those severe cases which were so common a few years ago. It has also been found practical and advisable to treat the milder infected cases as out-patients.

The introduction every year of a large number of anchylostome-infected East Indian immigrants is a very serious factor in preventing not only much better results, but also the eradication of the disease.

Quarantine.

During the year there was plague in Trinidad and Porto Rico, and small-pox in Grenada.

The precautions permitted by the Quarantine Regulations were enforced and I am pleased to say there was no case of infection. Similar precautions were taken against Venezuela for plague, yellow fever and small-pox during the whole year.

Forty-four ships were visited by the health officers and seven vessels were fumigated by the Clayton machine.

Persons were placed in the Quarantine Station on two occasions, once in July and once in August.

The Quarantine Station has been inspected every three months and the various disinfecting machines steamed and tried.

Subsidized Nurse Midwives in Districts.

During the year sixteen women qualified as nurse-midwives. Six students received subsidies amounting to $157 to assist in maintaining themselves whilst undergoing training at the Public Hospital, Georgetown. The examination for these certificates is very much more difficult than formerly. In addition to certificates, sign-plates are now given to those women who are certified by Government examination. Midwives' outfits are obtained from the Medical Supply Association and supplied without charge to certain nurse-midwives to enable them to be in a position to properly perform their duties.

The scheme started in July, 1908, for providing an outdoor maternity department has worked very satisfactorily and is being largely taken advantage of by poor women who do not, for one reason or another, care to go to the Public Hospital. For the year 1909-10, 70 cases were attended in their own homes, and 1,172 visits paid. For 1910-11, 134 cases were attended and 2,872 visits paid. For 1911-12, 170 cases were attended and 4,208 visits paid. For 1912-13, 256 cases have been delivered and attended to at their own homes, and 5,723 visits paid.

The work of the outdoor midwives is supervised by one of the divisional nurses, but the work has so grown, and is still growing, that the time is approaching when it will be necessary to have a skilled nurse in charge of this most important department.

Bacteriological Department.

The report of the Bacteriologist shows the varied but important work done during the year. The assistance rendered by the bacteriologists, not only to the staff of the public hospitals, but to private medical practitioners, in assisting in the diagnosis of difficult and doubtful cases, is well known, and fully appreciated. The total number of specimens dealt was 3,144.

During the month of April the Bacteriologist and Assistant Bacteriologist were specially employed in visiting the villages during the drought to advise on the supply and purification of water.

Special reports have been issued as follows:—

Report on condensed milks.

Second report on the Nastin treatment of leprosy.

Report on typhoid bacilli in milk.

Report on mosquito breeding-places in Fort William Frederick.

Report on experiment with crude carbolic acid as a larvicide.

Report on mosquito breeding-places around the Police Barracks and Thomas lands.

Report on the vats and tanks of the Public Hospital, Georgetown.

Annual report of the Bacteriological Department, 1911-12.

Two half-yearly reports to the Tropical Diseases Research Fund Committee, London.

The following papers have been contributed to medical publications:—

Rain as a Drinking-water Supply in British Guiana.

The Treatment of Leprosy by Nastin.

A Review of the Milk Question in British Guiana.

Experiments with Crude Carbolic Acid in British Guiana.

Lung Lesion in Leprosy.

A Simple Process for the Combined Clarification, Decolorization and Sterilization of Peaty Waters.

Drinking-water Supplies.

Studies in Enteric Fever.

The *Bacillus violaceous* in the Water and Milk Supply of British Guiana.

The total number of specimens examined were 3,144, covering the following items: Sputum for bacilli tuberculosis; leprosy; tissues for section; identification mosquitoes; blood for Widal test; blood for blood count; blood for malaria; pathological fluid, pus, &c.; varia; urine; milk for analysis; fæces; water for analysis; diphtheria; blood for filaria.

The number of *post-mortem* examinations made is 794. A large number of these were made by the medical officers of the Hospital. Thirteen were performed under instructions from the Coroner.

The specimens in the Pathological Museum have now been almost completely labelled. Many have been discarded and replaced by other better and more illustrative ones. Twenty-five new specimens have been added.

The Röntgen-ray apparatus has continued in satisfactory working order during the year. The apparatus was used more than two hundred times.

K. S. Wise,
Government Bacteriologist.

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MEDICAL OFFICER OF HEALTH.

Port of Georgetown.

Forty-four ships were visited.

Quarantine for plague was imposed against Trinidad from April 1 to August 8, against Porto Rico from July 27 to August 6, and against Venezuela during the whole year.

Quarantine for yellow fever was imposed against Venezuela for the whole year.

Quarantine for small-pox was enforced against Grenada from March 6 till March 31, and against Venezuela during the whole year.

Seven vessels were fumigated during the year in each case by the Clayton Machine.

Persons were placed in the Quarantine Station on two occasions, once in July and once in August.

The Quarantine Station has been inspected every three months and the various disinfecting machines steamed and tried.

K. S. WISE,
Medical Officer of Health of the Port of Georgetown.

PUBLIC HOSPITAL, GEORGETOWN.

Water Supply and Dietary.—Lamaha water is used for bathing and washing, and rain water stored in large tanks and vats for drinking, cooking, and medicinal purposes. The total storage capacity is 207,400 gallons.

The highest number of males in hospital on any one day was 312 on June 26, 1912, and of females the highest number was 220 on October 27, 1912.

The highest total number of patients in hospital on any one day was 500 on June 26, 1912.

The lowest number of males was 237 on January 15, 1913, and of females 155 on December 30, 1912.

The lowest total number was 389 on January 15, 1913.

As usual, the death-rate of those who come to hospital too late for all human aid is high, as shown by the following table:—

Died within 12 hours of admission				87	or	7·5 per cent.
,,	24	,,	,,	241	,,	20·8 ,,
,,	48	,,	,,	330	,,	28·5 ,,
,,	72	,,	,,	412	,,	35·6 ,,

Table showing the number of deaths occurring within seventy-two hours of admission for the last five years:—

	Males	Females	Total	Percentage
1908-09 ...	297 ...	155 ...	452 ...	39·03
1909-10 ...	299 ...	198 ...	497 ...	40·1
1910-11 ...	339 ...	187 ...	526 ...	30·02
1911-12 ...	327 ...	184 ...	511 ...	40·39
1912-13 ...	245 ...	167 ...	412 ...	35·6

Of the 241 cases that died within twenty-four hours of admission, 40 were deaths from pneumonia.

There remained in hospital on April 1, 1912, 262 males and 182 females, giving a total of 444.

There were admitted during the year ending March 31, 1913, 5,338 males and 4,143 females, a total of 9,481. Of these admissions 258 were unallotted immigrants, 33 indentured immigrants from sugar estates, and 987 immigrants from places other than sugar estates; 58 were Chinese.

There died in Hospital: Males, 673; females, 484; total, 1,157.

This gives a percentage of 12·01 males, 11·1 females, and 11·6 on the total number of cases treated.

The average daily number of patients was: Males, 272; females, 181; total, 453.

The deaths of children under one year were: Males, 88; females, 77; total, 165.

The deaths of children from 1 to 5 years were: Males, 23; females, 25; total, 48.

This makes a total of 213 deaths in children under 5 years of age, or 18·4 of our total death-rate.

During the year a weekly consultation was held in the Out-patient Department for the purpose of instructing mothers in the care and management of their children.

It is gratifying to note that these consultations have been largely attended and much appreciated.

There were sent to the Lunatic Asylum 61 males, 39 females, total, 100; Alms House, 4 males, 5 females, total 9.

There were 638 deliveries in the Maternity Ward with 33 deaths. There were 67 stillbirths and 64 abortions.

There remained in hospital on March 31, 1913, 285 males and 188 females, giving a total of 473.

The outdoor patients for the year were 14,282 males, and 19,449 females, a total of 33,731.

The chief diseases treated were:—

Malaria	658 cases	...	23 deaths		
Phthisis	366	,,	...	151	,,
Pneumonia	308	,,	...	129	,,
Dysentery	228	,,	...	82	,,
Diarrhœa	227	,,	...	10	,,
Typhoid fever ...	194	,,	...	44	,,
Kidney disease ...	366	,,	...	126	,,
Anchylostomiasis ...	102	,,	...	6	,,
Diphtheria	2	,,	...	0	,,

There were admitted into the Phthisical Ward 146 males and 84 females, giving a total of 230.

There died in this ward during the year 37 males and 32 females, or a total of 69. There were discharged 77 males and 32 females, or a total of 109.

The death-rate from pneumonia for the year was 41·8.

Of those who died of pneumonia, 64 out of 129 cases died within seventy-two hours of admission, showing that about 50 per cent. of our pneumonia cases come too late to benefit by hospital treatment.

The number of cases of typhoid fever admitted during the year was 194, the largest number yet recorded.

Of these 194 cases, 44 died, giving a death-rate of 22·6 per cent. Typhoid fever has now been made notifiable and declared by Ordinance to be a dangerous infectious disease. It is, however, satisfactory to note that although the number of cases is

the highest for this year, the death-rate is the lowest. Of the 194 cases, 49 were from the country districts, and 145 from Georgetown.

A. T. Ozzard,
Acting Resident Surgeon.

Public Hospital, New Amsterdam.

The buildings and grounds are in fairly good order. There is a bathroom and lavatory to each ward. The pail system is employed, and the excreta is removed daily by the Town Council.

The water supply is of two kinds, viz.: Creek water for bathing and laundry work, and rain water which is stored in tanks for drinking and cooking purposes. Our storage capacity is 34,500 gallons.

There are 150 beds in the hospital. The conduct of the patients has been, on the whole, satisfactory.

The highest number resident was on June 26, 1912, when there were 107 males and 74 females; total, 181. The lowest number resident was on December 7, 1912, when there were 56 males and 35 females; total, 91. The daily average resident was: Males, 78; females, 48; total, 126. There were in hospital on April 1, 1912, 100 males and 54 females; total, 154.

There were admitted in hospital for the year ending March 31, 1913, 1,737 males and 1,116 females; total, 2,853. Thus there were treated in hospital during the year 1,837 males and 1,170 females; total, 3,007.

There died in hospital 229 males and 136 females; total, 365; being a death-rate of 12·1 per cent. Of these 32 died within twelve hours, and 37 within twenty-four hours of admission. There remained in hospital on March 31, 1913, 66 males and 47 females; total, 113.

There were 96 births during the year. Of this number 9 were stillbirths.

The out-patients for the year were: 8,983 males and 12,451 females; total, 21,434.

The chief diseases treated were:—

Malarial fever ...	322 cases	...	26 deaths
Syphilis	40 ,,	...	2 ,,
Phthisis	23 ,,	...	12 ,,
Anchylostomiasis ...	11 ,,	...	6 ,,
Disease of heart ...	40 ,,	...	10 ,,
Pneumonia ...	126 ,,	...	45 ,,
Diarrhœa	160 ,,	...	42 ,,
Dysentery	100 ,,	...	21 ,,
Disease of liver ...	16 ,,	...	9 ,,
Disease of kidney ...	149 ,,	...	57 ,,

J. H. Conyers,
Resident Surgeon.

Public Hospital, Suddie.

The Steward's quarters within the Hospital Compound were by means of a few alterations converted into a house for the Assistant Resident Surgeon. The Steward now resides in quarters outside of the Hospital.

The grounds within the Hospital Compound have been kept clean, but need constant attention, and our staff of porters is but a small one.

The sanitary arrangements are fairly satisfactory. The contents of the soil-buckets are dumped into trenches in the ground to the south of the Hospital, and no nuisance is caused thereby so long as the trenching system is properly supervised. The drainage is fairly good.

The Water Supply consists of rain-water collected from the roofage of the Hospital and is stored in three large iron tanks, two of these having a capacity of 36,000 gallons, and the other 25,000 gallons.

The tanks are fairly mosquito proof.

The water is occasionally treated with chlorinated lime for purification purposes and kerosene oil at times is poured on the surface of the water as an additional security against mosquito breeding.

The accommodation for patients consists of four wards:—

No. 1 Ward	(males)	containing	26 beds.
,, 2 ,,	,,	,,	14 ,,
,, 3 ,,	,,	,,	14 ,,
,, 4 ,,	(females)	,,	26 ,,
			80

There are also four small rooms for paying patients.

Unfortunately, as yet there is no separate ward for children, and no maternity ward.

The greatest number in hospital on any one day was 85 on January 27, 1913.

The chief diseases treated were:—

Malarial fever	114 cases	...	8 deaths
Influenza and pneumonia	92 ,,	...	35 ,,
Dysentery...	53 ,,	...	6 ,,
Diarrhœa	46 ,,	...	8 ,,
Anchylostomiasis ...	64 ,,	...	9 ,,
Tuberculosis	36 ,,	...	11 ,,
Diseases of kidney ...	47 ,,	...	15 ,,

Of the 155 deaths for the year, 66 died within seventy-two hours of admission.

The daily average number in hospital was 65·9. There were 26 births in hospital, of which 7 were still-born. There were 5,485 out-patients treated during the year.

A. T. Ozzard.

Bartica Hospital.

A few minor repairs were done to buildings, which are now in fair condition. Drainage and sanitary arrangements good. Water supply has been abundant and good.

Accommodation: Male ward, 24; female ward, 11; total, 35.

The greatest number of patients in hospital on any one day was 14 on May 19, 1912; for several days in November, 1912, and March, 1913, there were no patients in hospital.

The number of patients in hospital on April 1, 1912, was 8 males and 2 females. The number of patients admitted during the year was 163 males and 102 females. Patients discharged during the

year numbered 150 males and 91 females. Died during the year, 17 males and 9 females.

Patients remaining on March 31, 1913, 4 males and 4 females.

Of those who died:—

4 died within 12 hours of admission.				
1	,,	24	,,	,,
2	,,	48	,,	,,
3	,,	72	,,	,,

The death-rate on the total treated was 9·4.

There were 10 births in hospital during the year.

The number of out-patients treated during the year was 518 males and 678 females; total, 1,196.

The chief diseases treated were:—

Malarial fever	46 cases	...	3 deaths
Pulmonary tuberculosis ...	4 ,,	...	3 ,,
Anchylostomiasis	2 ,,	...	— ,,
Diseases of the brain ...	1 ,,	...	— ,,
Diseases of the heart ...	4 ,,	...	2 ,,
Pneumonia	22 ,,	...	9 ,,
Diarrhœa	6 ,,	...	2 ,,
Dysentery	25 ,,	...	4 ,,
Liver diseases	2 ,,	...	— ,,
Kidney diseases	6 ,,	...	— ,,
Other diseases	157 ,,	...	3 ,,
	275		26

I. H. Ross,
Resident Surgeon.

Public Hospital, Morawhanna.

The accommodation remains the same as in the previous year, namely, for 14 male and 11 female patients. At the Arakaka Dispensary also the accommodation has been the same as in the previous year, namely, for 12 patients.

The total number of admissions during the year under review was: 535 males and 273 females.

From the previous year there remained in hospital 10 males.

The number of deaths during the year under review was: 33 males, 18 females.

The chief diseases treated during the same period were: Malarial fever, anchylostomiasis, pneumonia, and dysentery.

The death-rate on the total number treated was: Males, 6·05; females, 6·6.

Of those that died within twelve hours of admission: Males 6, females 2; 5 males and 3 females died within twenty-four hours; 5 males and 4 females within forty-eight hours of admission; of those that died within seventy-two hours: Males, 4; females, 2.

There were 3,891 cases treated as out-door patients during the year.

The daily average number of in-patients treated during the year—11, as against 13 in the previous year.

Public Hospital, Morawhanna.—The building is in good condition. Some minor repairs were carried out during the year under review. The nurses' and servants' quarters were kept in good condition during the year.

Hospital Compound, Morawhanna.—This has been maintained in good order and condition during the year.

The Village of Morawhanna.—The streets have been kept in a fairly satisfactory condition. The drainage is fairly satisfactory. The health of the inhabitants has been good.

The system of sewage disposal consists of closets and trenches that are tide-flushed. The pail system is confined to the Government reserve.

Arakaka Dispensary.—The building is in good condition. The compound has been kept clean and in good condition during the year. The district: Regular visits have been made during the period under review. The health of the people was fairly satisfactory.

Malarial fever was prevalent during the year.

Quinine has been regularly supplied at St. Bede's Mission, also other medicines were supplied free to the Mission to be distributed amongst the sick in this portion of the district.

Quinine has been regularly and systematically supplied to every police station in this district.

C. H. Downer,
Acting Resident Surgeon.

Public Lunatic Asylum, Berbice.

The usual numerous repairs to the buildings were carried out by our staff of artisans.

D Block was painted inside and out, and the latrines in Victoria Block were repaired and covered with lead.

The buildings, with the exception of the Administrative Block, are in good order.

The grounds have been kept in fair order, and constant attention is given to them and to the earth drains to keep them free from grass. The roads require relaying with burnt earth, but only a little can be done owing to the insufficient quantity of material provided. Four large wooden bridges, including the one at the main gate, have been replaced by concrete culverts and burnt earth surfaces, considerably improving the appearance of the grounds.

Sanitary Arrangements and Drainage.—These continued to be the same as on previous years. A good start was made in building three long concrete drains to carry off slop water from the bath-rooms of D and F Blocks and Medical Superintendent's quarters; much still remains to be done in this direction, and efforts will be continued until all earth drains are concreted.

Water Supply and Dietary.—The rain-water in the tanks and vats attached to the buildings and the creek-water from the waterworks have proved sufficient for the actual needs of the institution, in spite of the long drought; two or three of the vats, which became empty, were filled with creek-water which was treated with alum and chlorinated lime, yielding a very good and clear water for drinking purposes.

The dietary of the attendants and patients suffered a good deal from sameness owing to the

impossibility of obtaining the required quantities of ground provisions during the long drought, necessitating the use of rice for months; this apparently induced a low state of nutrition, which reflected itself in the increased death-rate during the year, specially amongst the old and feeble patients during the second quarter.

Average number daily resident during the year: Males, 456; females, 286. Average stay of those who were discharged: Males, 246·71 days; females, 75·54 days. Average stay of those who died: Males, 2,798·09 days; females, 1,651·86 days. Average stay of those remaining was: Males, 1,492·44 days; females, 824·32 days. The number of deaths was: Males, 84; females, 52. The percentage of deaths upon the total number treated was: Males, 14·9; females, 14·4. Total, 14·7. The number of those discharged was: Males, 43; females, 24.

The chief diseases treated were: Chronic Bright's disease, senile decay, colitis, diarrhœa, lobar pneumonia, pulmonary tuberculosis and chronic nephritis, besides the usual forms of insanity. The usual dose of quinine was administered weekly to every attendant and patient during the third quarter of the calendar year with satisfactory results.

There were 79 casualties, none being of a serious nature, and most of them being caused by bites and falls during fits.

Q. B. De Freitas,
Medical Superintendent.

Public Leper Asylum, Mahaica, E.C., Demerara.

Condition of Buildings and Grounds.—General repairs and painting throughout of all the cottages to the eastern side of the North Block, painting inside and outside the female attendants' quarters, inmates' kitchen, fire station, and the male infirmary have been done by the Public Works Department. Many of the cottages to the south in the male asylum are in bad repairs.

The grounds have been kept in fair order considering the limited number of inmates who are able to work. The main roads are in good condition, but a supply of road material is needed for all the roads.

Sanitary Arrangements and Drainage.—The pail system continues in use and the excreta are buried. The drainage has been satisfactory except in very bad weather, but the source of trouble has been adjusted. The main trenches have been kept clear of grass and weeds, and are flushed out daily at high tide. The work of concreting has begun with some small drains.

Water Supply.—The artesian well supplies water for laundry and sanitary purposes. The male bath-room is supplied by water from the Mahaica Creek. Except in very dry weather, rain water is used at the female asylum bath-room.

Rain water collected from the larger buildings and cottages is stored in large tanks and vats and used for drinking, cooking and medicinal purposes. The total storage is 117,467 gallons.

A fire brigade has been instituted during the year under review, comprised of inmates and attendants, and practices have been held. In the absence of a regular instructor, the brigade is under charge of an ex-policeman inmate.

The conduct of the whole asylum has been very satisfactory, and I am pleased to record that a number of both male and female inmates have undertaken voluntarily the responsibility of assisting the staff to maintain discipline and order. The effect is very gratifying.

Both male and female inmates who are able to perform some duty have been employed as usual, and have satisfactorily filled all the subordinate departments of the institution. Their labour value is of assistance to the asylum, and the benefit of suitable occupation is also very wholesome to the individual.

General Remarks.

Treatment.—In view of the unfavourable reports that have been from time to time made by experienced workers as to the value of nastin in the treatment of leprosy, nastin is not now supplied for routine treatment at the asylum. I may remark here that of the cases (4) discharged as cured after treatment by nastin, one, an East Indian woman, has not since been heard of, but the other three are as follows: P. D., male, black Creole, aged about 48 years, admitted August 11, 1908; nodular leprosy; discharged September 17, 1910; re-admitted March 9, 1911, anæsthetic leprosy and ulceration; died May 5, 1912. E. L., male, black Creole, aged 32, admitted February 1, 1909; nodular leprosy; discharged June 2, 1910; re-admitted May 16, 1912, well-marked nodular leprosy. W. C., female, black Creole, aged 10, admitted October 6, 1908, nodular leprosy; discharged September 30, 1910; re-admitted March 6, 1913, well-marked nodular leprosy. Both these latter cases are fairly strong inmates, especially the girl; no ulcer has appeared as yet.

It is fair to state that in all the above cases the treatment by nastin was discontinued on discharge from the asylum. P. D., a pauper, advanced in years, and without means for proper support, evidence of the disease appeared six months after discharge. E. L., a groom, returned at once to his work and haunts; the conditions of life with this class of worker must be reckoned with. The disease in this instance showed outward manifestation eighteen months after discharge. In the case of the girl, she was transferred to the orphan asylum, where she remained apparently healthy until some relation obtained her discharge about August, 1912, and she was then taken to live with them in Essequebo. She stayed there about six months. In February, 1913, she was admitted to the Alms House. W. C.'s circumstances in Essequebo must have been poor and unfavourable to good health; her disease showed outward signs twenty-seven months after treatment.

Colonial Medical Reports.—No. 64.—British Guiana (*contd.*).

During the year Government Bacteriologist, Dr. Wise, supplied us with three strains of Leprosy Bacilli extract by Dr. Bayon, of the Lister Institute of Preventive Medicine. Eleven nodular cases were selected for experimental treatment as follows:—

Males 7: East Indians, 2; East Indians, Creole, 2; mixed, 2; Portuguese, 1. Females 4: Black Creole, 2; mixed Creole, 2.

The injections were made every third day, the cases carefully watched, and the temperature taken frequently. There was no clinical effect in any of the cases, all the bacterial extracts appeared inert, and the treatment was discontinued after twenty injections.

Iodine in solution has been much recommended and largely in use in hospital practice for wounds and ulcers. A 2 per cent. solution of iodine has been tried in the asylum for painting the large chronic indolent ulcers prevalent with the nodular cases. The results, though satisfactory in some cases, have not come up to our expectation.

All ulcers are personally inspected and in most cases seen weekly. Very extensive ulcerations are not common and the number of ulcers has decreased greatly.

There have been three births during the year. The infants were all removed immediately at birth from their mothers. The children have been carefully examined and all found healthy. Two have been sent to the orphan asylum. One has since died of pneumonia, and the other two are in good health.

The following have been the causes of death during the year:—

	Cases		Per cent
Exhaustion (due to leprosy) including acute exacerbations	4		
Chronic infiltration, 15 cases, or 13 per cent. of total deaths	15		
Gangrene	3		
Chronic ulceration, 18 cases, or 15 per cent. of total deaths	18	...	48
Septicæmia	3		
General debility, 12 cases, or 10 per cent. of total deaths	12		
Muco-enteritis	25	...	22
Pulmonary tuberculosis	8	...	7
Bright's disease	6	...	6
Heart disease	5	...	4
Cerebral meningitis 1, anæmia 1, cerebral apoplexy 4, malarial intermittent fever 1, granuloma 2, shock 1, hanging 1, diarrhœa 1, dysentery 1, cirrhosis of liver 1	14	...	13
			100

From the above it will be seen that next to the direct result of leprosy, the largest mortality was due to muco-enteritis.

This form of complication (ulceration chiefly of the large intestines), which is so frequently met with in advanced cases in the asylum, would appear to be due to the direct result of the *Lepra Bacilli*, and which may be aggravated in a large measure by climatic conditions as sudden extreme changes of weather, dampness, &c. Other minor causes may also contribute, such as a proper supply of fresh vegetables.

The highest total number of inmates was 450 (May 17, 1912).

The lowest total number of inmates was 381 (February 20, 1913).

The average daily number resident during the year was: Males, 277; females, 126.

The stay of those who died was: From thirteen hours to thirty years.

The number of deaths was: Males, 83; females, 31.

The death-rate per cent. of the total number of inmates was: Males, 21·9; females, 20. Total, 21·3.

The total number of patients treated in hospital was: Males, 206; females, 107.

The total number of outdoor patients was: Males, 468; females, 400.

FRED. T. WILLS,
Medical Superintendent.

SKELDON MEDICAL DISTRICT, SPRINGLANDS.

The sanitary condition and general health on the estates were fairly good.

Drainage, yard, and ranges are in order.

On Plantation Skeldon the majority of cases treated in hospital were fever-free skin diseases, such as small ulcers, chigoes, scabies, and other pustules.

Ankylostomiasis was by no means frequent; the few cases detected were promptly treated until recovery. Malarial fever is very much diminished. Quinine distribution to labourers not patients in hospital, as also to children on the estate, is regularly carried out.

Latrines are adequate and kept clean. Barrels in the yard are screened, and no rubbish is allowed to accumulate.

The villages are fairly healthy. The majority of the cottages and huts are situated in open pastures and built far apart, giving free access to daylight and air. Latrines, however, are conspicuous by their absence.

The drinking water supply is either non-existent or deplorably unfit.

E. H. GEWAND, G.M.O.

PORT MOURANT, BERBICE.

Estates and Villages.

The general health has been indifferent, although malarial fever has been considerably less in the district throughout the year. There has been a good deal of influenza, intestinal complaints, bronchial catarrh, and bronchitis; whooping-cough and measles have occurred in more or less scattered cases all through the year.

The prevailing diseases have been bronchial affections, influenza, and intestinal cases. Influenza has been more serious than usual, and three

or four deaths have directly resulted from it, and in many cases it has appeared to be the cause of the two other classes of complaints mentioned. Malarial fever has been considerably less both on the estates and in the villages. Quinine has been given for general use at times on the estates, but it is not used systematically in the villages.

The conditions of the season, drought at the time of the usual rice crop, when many places lost their crop, or as at Albion cutting at a later time in the water, probably explains this diminution; the high cold winds alternating with hot sunshine and no wind probably explains to a certain extent the increase of influenza, bronchial, and intestinal cases. Typhoid and paratyphoid have been less than in the last two or three years.

The prevailing diseases above mentioned to which the young and the old are specially liable have been the cause of increased mortality among them; premature births and the resulting weak infants have been above the average and have increased the mortality.

Rickets has decidedly increased. Formerly it was very rare, but now it is not uncommon; with the growing rice industry cattle for milking purposes are getting fewer, and the difficulty of getting cow's milk is increasing. The people frequently tell me that they can only get condensed milk.

Estates.

On both estates there has been some increase in hospital admissions and deaths; the increase of admissions is due almost entirely to the indifferent class of this year's coolies, among whom A.D. infection, liability to skin diseases, and general poor condition of the system have been very marked.

In spite of every precaution, as besides the ordinary monthly medical inspection, the manager inspects the new coolies every week, and overseers and drivers are particularly warned to look after them. At Albion 468 and at Port Mourant 375 cases have been admitted for skin diseases and small sores, the great majority of these cases being new coolies. At Albion 260 and at Port Mourant 71 cases of mostly small wounds have been admitted; 51 cases at Albion and 24 at Port Mourant of chigoes have occurred as in-patients; both of these two classes of cases have been entirely recently indentured coolies. The free and older indentured coolies look after and prevent these small affections. He looks after the house better, whilst with the new coolies the estates have to lime and otherwise clean their houses at times, and the new coolie often appears to be glad of an opportunity to get into the hospital. I think to a certain extent underlying the liability for skin diseases is a scorbutic tendency due to the little consumption of green vegetables among the new coolies. In the periods of drought green vegetables are very scarce, and what little there is of a high price. Recently we tried to get a supply to make a vegetable soup for the hospital, but could not get it, and then had to fall back on limes as a lemonade, extra milk or potatoes, whilst the morning ration was given to some outside; the free coolie often grows vegetables for his own use, and varies his diet more.

Ankylostomiasis and A. D. infection cases treated at Albion were 288 with no death, at Port Mourant 141 with no death. A good many more, either fresh or recurrent cases, were treated on both estates but not recorded, as they are often admitted for some other complaint, which is entered as the diagnosis. It has been particularly bad among the new coolies on arrival. Nearly all the pregnant new women were cases of chronic ankylostomiasis and required treatment for months, and they, with some of the others, I am afraid, will never be up to much.

I am glad to say, however, that the new coolies now show a decided improvement generally.

Both yards are in good condition, and drainage is good. Latrines are present, and ranges kept in good order.

Water Supply.—From the Canje Creek and stored in ponds there has been a good supply.

The sanitary condition, drainage, and water supply of the villages are much in the same condition as last year and show little advance.

Rose Hall Village has been kept well drained; in this village, crowded condition of the houses in parts, presence of cattle about the houses, absence of latrines, and unscreened water barrels deserve and have, I believe, the special attention of the Council.

C. P. Kennard.

New Amsterdam, Berbice.

The general health has been good. Malarial fever, ankylostomiasis, pneumonia, and bronchitis have been the chief diseases. The mortality has not been excessive.

Outside the estates there is little attempt at sanitation. The water supply is mostly from unscreened barrels, supplemented by ponds and trenches.

Walter S. Barnes, M.D.

Mara.

The general health has been fair.

There has been a marked diminution in the number of malarial cases, due, I have no little doubt, to the regular administration of quinine, and also in the number of parasitic skin diseases. I regret, however, that I have again to report on the number of cases of pneumonia admitted and the high mortality of this disease.

The water supply is excellent.

The latrines are in good order, but there have been many cases of ankylostomiasis treated in hospital lately.

Arthur Matthey.

Fort Wellington.

The general health was good. On the two sugar estates there was a great rise in the birth-rate. The

prevailing diseases were malarial fevers, intestinal and respiratory affections, ulcers, and parasitic skin ailments.

There were 5,571 examinations made for the detection of ankylostome infection. In a considerable number it was found. The mortality on the estates was less than during the previous year. In the district generally it is not, so far as known to me, above the average. The sanitary condition remains practically the same, and in the larger villages leaves much to be desired. The water supply was the same as previously.

Vaccination was kept up.

I. K. Reid.

Mahaicony.

The general health of the villagers has been good during most part of the year.

Malarial fever has been the prevailing disease. During May, June, and July bowel complaints were prevalent.

The sanitation is not good. The water supply is mainly derived from the creeks, trenches, and ponds. In the dry weather water was scarce and bad.

P. MacAdam.

Mahaica, East Coast.

The health of the inhabitants of the villages, as well as the estate (Cane Grove, *cum annexis*, Melville) was generally good. No epidemics were experienced.

The chief diseases treated were lesions of the intestinal and respiratory tracts, *i.e.*, diarrhœa, dysentery, pneumonia, and bronchitis.

The number of cases of malarial fever were fewer, and of a less malignant type than formerly. The sanitary arrangements in the villages are very primitive.

On Plantation Cane Grove a new lot of latrines were erected upon a different and improved site. The cowpens were also removed farther away from the estate cottages.

In Mahaica village there are very few vats or tanks for the conservancy of rain water, and the inhabitants are largely dependent upon the generosity of the proprietor of Plantation Springhall for their water supply.

The drainage generally of the villages is good, with the exception of a part of Plantation Cambridge and Tranquility Hall. The latter, I imagine, furnishes one of the best—or worst—breeding places for mosquitoes in the colony. These two places mentioned are not, however, under the control of the Village Council.

M. H. C. Irving.

Belfield.

The health on the estates has been extremely good, and in every way shows a marked and great improvement on former years. There have been fewer cases of a serious nature, and if easily preventable ones, such as chigoes, sores, ground itch, be excluded, our hospital returns would have been reduced by over 30 per cent.

There have been a few sporadic cases of enteric fever, the origin of which it is hard, if not impossible, to trace.

On all the estates a good sanitary condition is maintained. The yards are kept clear of rubbish and pots and pans, and all utensils that can harbour mosquitoes are rigidly excluded. The water supply is safely guarded, and latrines are used on all.

Another year's experience, if this were needed, has only confirmed the prophylactic action of quinine. It is distributed regularly to the labourers, and in the case of children a regular roll is kept to see that each child gets its dose.

All these, *i.e.*, the good sanitary condition and the regular use of quinine, combined with the dry weather, have rendered the year under report the healthiest for a long time.

The same may be said of the villages. It is remarkable the health our Creole population maintain, while it is a matter of regret that they, especially the children, cannot get the advantages that those living on estates obtain. If this were only possible, I am sure there will in a short time be a large increase to our population.

There is every effort made in the corporated villages to maintain, as far as their means will allow, as good a sanitary condition as is possible, but there is a large population living on other lands that own no allegiance to any sanitary authority, and live under conditions which should not be allowed.

C. F. Castor.

Buxton, East Coast.

General health of estates good, especially during latter half of year.

Prevailing Disease.—Fever, influenza, parasitic diseases, and lung affections.

Sanitary condition considerably improved.

Mortality, &c.—For the first time for the past five years the birth-rate is in excess of the death-rate on nearly all the estates.

The usual giving of quinine, thymol, and care of pregnant women is carried out.

The general health of villages seems to have been very good.

Prevailing Diseases.—Fevers, bowel and lung complaints.

Sanitary Condition.—Buxton Village was under water for over three weeks in January, 1913. Pigs, ducks, and carrion crows are the principal sanitary officers in the villages.

W. J. von Winckler.

Ogle Front.

The general health on the estates has been very good.

The prevailing diseases were dysentery, influenza, lung affections, parasitic skin diseases, and malarial fever.

The number of cases of malarial fever were enormously less during the year.

The two estates having indentured immigrants in this district are Plantation Ogle and Plantation Success. During the financial year under review the number of cases of malarial fever treated in hospital at Plantation Ogle were 86, with one death, and at Plantation Success 108 and no death. Whilst for the preceding year there were at Plantation Ogle 434 cases treated in hospital with two deaths, and at Plantation Success 305 cases with five deaths.

One of the chief causes of this reduction was undoubtedly the regular distribution of quinine, as a preventative, to all residents on these estates.

The sanitary condition has again been improved by the erection of a special pump driven by wind for a better drinking water supply.

The water is conducted by pipes from an ordinary trench containing Lamaha water into two large concrete basins sunk in the ground. Here it is treated by the sulphate of aluminium and chloride of lime process, and after a time is pumped into an iron tank raised some feet above the ground. From this tank it flows by a pipe to what corresponds with a standpipe, and from which it is drawn for use.

The drains in the yards of the two estates already mentioned have received a good deal of attention, and the grounds around the dwellings have been sloped and levelled.

The general health of the inhabitants of the villages has been fairly good.

The prevailing diseases were malarial fevers, diarrhœa, influenza, lung affections, and Bright's disease.

The sanitary conditions of the villages has shown no improvement during the year.

R. Carter.

River View, East Bank, Demerara.

The death-rate for the year under report, 15·8 per 1,000, is satisfactory. At Providence and Peter's Hall the death-rate was below 12 per 1,000.

The birth-rate, which had remained low in 1911-1912 on account of an unusually small number of births at Diamond, now shows the considerable rise from 29·5 to 37·2 per 1,000. The latter figure is inflated by Diamond having made up for its deficiency of the previous year, its birth-rate reaching 43·9, the highest on the four estates. Thus, even when allowance is made for this casual inflation, the birth-rate is seen to be more than double the death-rate.

I attribute the lowness of the death-rate in large part to cosmic causes.

The health of the labouring poor on this torrid river bank is powerfully influenced by the moisture of its atmosphere. The greater and more persistent the humidity, the higher the sickness rate and mortality.

Conversely, the drier the air the healthier the people, and the longer this dryness continues, the more beneficial its action. The year under report was a dry one, and it followed a year of drought. An unusually low mortality was therefore to be expected.

Under the climatic and other circumstances of these estates, no drought, however prolonged, will of itself reduce the mortality to 16 per 1,000—not to speak of the less than 12 per 1,000 at Providence and Peter's Hall. In order to arrive at such a figure it is necessary to carry out suitable measures for the cure and prevention of disease, and especially of those diseases which have the largest influence over the sickness rate and mortality.

The most important of these are malarial fever and ankylostomiasis.

Malaria.—The distribution of quinine has been so extended as to take in the entire East Indian population of the four estates, the adults of the south nigger yard at Diamond having come into line with the rest on April 1, 1913. As a result of this general use of quinine, not only has the number of cases of malarial fever been greatly diminished, but there has also been a steady reduction in the number of enlarged spleens.

Ankylostomiasis.—With a very limited staff of workers, whose time is principally occupied with the ordinary medical work of the estates, it has not been found practicable to attend to all the infected coolies on these estates in the short period of a year.

Of the 1,620 persons found infected, about two-thirds have been entirely cleared of the parasite.

The 477 remaining under treatment have been on the thymol lists for a considerable time, and are being rapidly taken off. In a few months these yards will be completely rid of ankylostomes.

Of 342 persons examined at Herstelling nigger yard 146 were found infected, and are now under treatment.

Peter's Hall and the south nigger yard at Diamond have not yet been dealt with. Only 170 from the former estate and 160 from the latter nigger yard who were found with ova whilst in hospital were put on the thymol list when discharged. Seventy-six of the Peter's Hall cases have been cleared of the worms and taken off the list. The others remain under treatment. As soon as possible these two yards will be taken in hand systematically.

Among the coolies fifty-three cases of typhoid fever occurred in the nigger yards of Houston, Peter's Hall, Providence, Farm, and Diamond. Three of them ended fatally.

In proportion to population the coolies suffered most at Houston, and least at Diamond.

A diminishing tendency from Houston is observed. the frequency with which the disease occurred on the estates being in direct ratio to proximity to Georgetown.

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It would therefore appear that Georgetown is the centre from which typhoid fever is imported into the nigger yards on the East Bank, the infection spreading in them subsequently to a greater or less extent.

Watching the progress of the disease in this district during the past few years, it has appeared to me that prolonged dry weather favours, while long-continued heavy rain hinders the spread of the infection. If this observation is correct, it helps to explain the great prevalence of this fever during the past two exceptionally dry years; and it leads one to expect that in years of heavier and more continuous rainfall the epidemic will abate.

A satisfactory feature of the year's statistics is the low infantile mortality of 103 per 1,000 births. This is the more remarkable that many coolie infants are born puny, asthenic, and ill-prepared to meet the dangers incidental to infancy in surroundings of poverty and malaria.

Like the general mortality of the estates, the death-rate among the infants was favourably affected by the dryness of the year. In wet years the infants suffer more. But a very important factor in this connection is the correct attitude of the mothers as regards the feeding of their infants. The unspoilt coolie mother is beyond praise for her devoted care in rearing her infant at the breast. It is an inspiring sight to see her, even in the throes of sickness and suffering, continue to supply it with its only perfect food. Her reward is the preservation of her child from that plague of bottle-fed infants, *entero-colitis*.

In the villages many, perhaps most, of the infants are bottle-fed almost from their birth. The result is a very high death-rate among them, largely due to entero-colitis.

Many of these deaths could be entirely prevented by the simple process of restricting the infants to their natural diet until the period of dentition.

An enormous waste of infant life goes on every year in these villages, an exception being made last year, when cosmic conditions were unusually favourable to health.

The responsibility for the excessive mortality shown lies on the mothers. They can decrease or increase that mortality according as they conform to or disregard the primary duty of nursing their infants. Perverted notions about infant feeding prevail widely among the women, and dull their sense of obligation towards their helpless infants in a matter of supreme importance.

J. E. A. Ferguson, G.M.O.

Belle Vue District.

General health of inhabitants has been fairly good. Mortality has been about the usual average.

The principal diseases treated were: Malarial fever and pneumonia. Two cases of enteric fever and several cases of blackwater fever were treated.

Sanitary condition and water supply of estates are good. That of the villages is very fair.

W. G. Boase.

Leonora.

The year has been a healthy one. Malarial fever was, as usual, the most common disease, but the number of cases was less than in previous years. As a consequence convulsions in children were less frequent. The other prevalent diseases were bowel troubles and pulmonary affections, chiefly pneumonia. Ankylostome infection is not common on the estate, especially Leonora proper, due largely to the very efficient latrine system.

Quinine continued to be administered systematically on the estates, and no doubt contributed to the malarial diminution, but the villagers who are not so treated also enjoyed this immunity, so that quinine alone was not responsible for the happy result. To the long stretches of dry weather following on the heels of the prolonged drought of the previous year must be attributed to a large extent the general good health.

The mortality appeared to be less and the births higher than usual. During the year under consideration the deaths numbered 185 and births 396, both including the estates. The death- and birth-rates of the estates calculated on the last Census returns were 23 and 41 per 1,000 respectively. The numbers of stillbirths, chiefly coolies, and deaths of infants under a year, are still too high.

The sanitation on the estates where there is a resident staff is good, and the water supply conserved. In the villages there is room for improvement.

F. A. Neal.

Tuschen, West Coast, Demerara.

Estates.

Uitvlugt upheld its reputation and maintained a high standard of efficiency. It is not only a pleasure, but a duty to compliment its authorities on the pains taken to safeguard the health of their employees.

De Kinderen has again advanced, and much credit is due to the manager for the improvements made in the surroundings of the immigrants and at the estate hospital, and for his readiness to co-operate and carry out the wishes of the medical inspector.

Tuschen, off the indentured list and practically abandoned as a sugar estate, lacks the means to keep up with De Kinderen and Uitvlugt, and earlier in the year showed a tendency to drift back, but towards the close a marked improvement was made, and praise must be given to the acting manager and the attorney.

Vergenoegen and Philadelphia, abandoned, are about as unsatisfactory as regards sanitation as they could possibly be. The houses and ranges are dirty and squalid, as often as not overcrowded, in not a

few cases unfit for human habitation, the drinking water supply none too easy of access, only fit for cattle, and dubious at that; the drainage partially choked, the side dams and house lots overgrown with sour grass, and with no latrine accommodation, the dumping ground of filth indescribable, bridges out of repair and dangerous, no attempt to ameliorate, the aspect thoroughly disheartening—an object lesson of what should not be.

In *Leguan* the same more or less applies to Success, Maryville, Enterprise, and Blenheim. Yet, and withal, the health of the residents generally has been good, and, in fact, surprisingly so.

The chief sources of illness were malarial fevers, pulmonary and bowel complaints, ankylostomiasis, and the usual cutaneous diseases. With regard to fevers and ankylostome infection there was, however, not only a marked numerical reduction, but a considerably diminished severity, and no fatality is recorded from either. There was some whooping-cough off and on during the year, and occasional cases of paratyphoid came under notice, not to be wondered at if we accept the findings of specialists "that at least 14 per cent. of recoveries from this disease continue to harbour the germs and remain a constant menace to the community." Yaws is by no means uncommon amongst the children at the lower end of the West Coast beyond Mora, but it is difficult to persuade the parents to permit benefit by salvarsan treatment.

With regard to Tuschen, however, it must be taken into very full consideration that the estate authorities kindly permit the admission of pauper, poverty, and emergency cases unable to bear the risk of the journey to the Public Hospital, Georgetown, or the Alms House, the majority of these picked off the public road in a moribund condition. The death-rate is obviously, therefore, inordinately high. In this particular instance no less than 11 of 15 fatalities were such cases, and having no connection whatever with the estate, but were admitted under Poor Law Board or police necessities. Tuschen, as the last hospital on the coast, may be in more senses than one regarded as *terminal*—that it is of some public and official service must be apparent.

The birth-rate on the three estates as compared with the mortality appear to me particularly satisfactory.

The Sanitary Conditions.—The yards and drains at Uitvlugt and De Kinderen are kept clean, well weeded, and clear of rubbish. The ranges were frequently whitewashed, the floors disinfected, and maintained in satisfactory order and repair. The latrine accommodation received attention, is in order, adequate, well used, valued and valuable. Tuschen, towards the close of the year, improved conditions generally and to a marked extent.

The water supply from the Bœraserie conservancy may be—probably is—exceptionally good, but it is bad at the best. With source open to contamination, the necessarily grave objections are obvious.

All the estate hospitals were kept clean and satisfactory and adequately supplied.

Departmental instructions re daily free issue of quinine, the screening of all water-barrels, the abolition of pots and pans and miscellaneous receptacles, and the clearance of high grass and superfluous vegetation in the vicinity of the ranges have again been rigidly adhered to at Uitvlugt and De Kinderen, and, as far as possible, recently "honestly attempted" at Tuschen. The value of the systematic administration of quinine has again been evidenced in the comparative results of the Half-Year Spleen Censuses taken at Uitvlugt.

The general health of the villages was fairly good, perhaps surprisingly so, considering the adverse sanitary conditions that prevail, and the poverty and negligence that undoubtedly exist. The social status is in many instances lamentable, and prejudicious to the individual, the offspring, and the State. Locally work is scarce save at certain periods of the year, and what there is the East Indian mostly secures at a rate that the black scorns to accept, amongst whom thrift plays little or no part, and there is no attempt at self-help. They want everything done for them, free medical attendance is expected, and as often as not rudely demanded as a right. Sickness and confinements are seldom if ever provided for, as is the case amongst many of the very poor at home. Illegitimate children are begot, the parentage dubious, the support non-available, true affection can scarce be expected, and infantile mortality under such conditions must obviously be higher than it should be. It is probably the duty of the State to assist to relieve sickness, but to afford gratuitous relief on demand in all cases may be dangerous to public interests, and actually tend to encourage conditions that it is most undesirable should exist.

The chief diseases met with were intermittent and remittent fevers, lung affections, intestinal complaints, and minor cutaneous ailments. Here again, as on the estates, work in the rice-fields was no unimportant factor in causation.

There were a few sporadic cases of paratyphoid. Measles and whooping-cough were prevalent at times during the year.

The mortality was apparently rather less than usual, and certainly not excessive.

The sanitary conditions throughout are, as I have previously stated, very far from satisfactory; little or no proper pride is taken in home surroundings. The East Indian is chiefly concerned with his cow and his rice; amongst the blacks, the bread-winner, if not a loafer, is away in the gold-fields or the balata bush, or engaged in his small farm aback, and his hardly earned wage, often large if from the bush, is "bust" in reckless extravagance, the home is left squalid, no attempt is made to furnish it, or weed around it; and though expecting everything to be done for them, they regard extraneous efforts to improve as an advantage being taken of their liberties.

The house lots and side dams are not as they should be, and it is the exception to find proper drainage attended to.

The water supply is deficient, defective, and

generally about as unsatisfactory as it can be; no attempt is made to protect its purity. Like other things, the majority seem to expect it to be found for them—in the rainy seasons obtained from dirty roofs and gutters, and collected in miscellaneous and none too clean receptacles placed round the houses, as often as not containing larvæ, and dangerous to the community; at other periods of the year from open trenches or mud-holes, open to any any every pollution. Here again the thoughtlessness and apathy of the people is painfully in evidence. Wrong is perpetrated openly daily, and the coolies are bad offenders; they drive their cattle out in the early hours of the morning, and care not a jot where they go to—naturally the first sweet water trench. Men and children bathe in the supply they drink from, and women wash foul clothing in the same. At Tuschen the majority of the poorer class derive their supply from a pond-trench, weeded and preserved at my own expense, but scarcely a day passes without the annoyance of having to find fault with somebody for a most palpable disregard of cleanliness.

Latrine accommodation is practically non-existent. Nature is relieved at will, and slops emptied promiscuously. Children are permitted to expose themselves openly, and decency has no pride of place.

The drainage generally requires more attention than is paid to it. Parts of Vergenoegen and Philadelphia, Good Hope and Ruby on the West Coast, and Waterloo, and other villages in Leguan are particularly unsatisfactory. Overcrowding is more or less general, and is a serious matter.

Tuschen Estate Hospital has served a special purpose, and but for it I do not know what we should have done with the emergency pauper and poverty sick unable to bear the journey on to the Public Hospital or Alms House in Georgetown. The advantage of such an institution to the Government in a terminal district like this, where such cases are brought from wide areas, far beyond our own limits, should not be lost sight of.

P. M. Earle,
Government Medical Officer.

Wakenaam.

There is but one estate in this district, viz., Plantation Marionville, the general health of which has been good.

The prevailing diseases have been influenza, dysentery, malarial fever, syphilis, chronic rheumatism, bronchitis, bronchial catarrh, pneumonia, asthma, diarrhœa, gonorrhœa, ankylostomiasis and ankylostome infection, ground itch, chigoes, ulcers, scabies.

The number of cases of skin diseases is still high, but compared with previous years some improvement has been effected.

The mortality rate continues to show a downward tendency, despite the fact that the resident population has increased. 951 cases were treated, with 13 deaths.

The sanitary condition is fairly good, and drainage is quite satisfactory. The latrines are used and kept in good sanitary condition. The water supply is as good as it has ever been, but there is much room for improvement here.

The general health of the villages has been fairly good. The principal diseases treated have been: Influenza, pneumonia, Bright's disease, diarrhœa, syphilis.

The sanitary condition and drainage are not as satisfactory as could be desired, and the same remark applies to the water supply and latrine accommodation; this latter is mostly conspicuous by its absence. Steps are being taken to remedy this state of things.

J. Sholto Douglas, G.M.O.

Suddie.

The general health on the one sugar estate in this district, Plantation Golden Fleece, has been fairly good.

There was an epidemic of influenza during December, 1912, and the following months of this year.

The prevailing diseases were: Malarial fevers, influenza, pneumonia, bronchitis, ankylostomiasis, dysentery, diarrhœa, syphilis, and the usual run of ulcers and parasitic skin affections.

The sanitary condition and drainage were fairly satisfactory.

The water supply consists of a large concrete tank capable of holding about 70,000 gallons of water fed from the roofage of the buildings, as well as open trenches running through the yards and fed from the Capoey Lake aback.

The general health of the villages has been about the average.

The chief diseases were: Malarial fevers, influenza, pneumonia, ankylostomiasis, filariasis, syphilis, dysentery, diarrhœa, and a few cases of enteric fever. The mortality, so far as one can judge, was not higher than usual.

The sanitary condition and drainage, as usual, leave much to be desired. Undoubtedly in some of the villages considerable efforts are being made to improve the surroundings of the lots. The water supply remains in the same unsatisfactory condition. Most of the villages obtain their water from open trenches liable to fouling of all kinds. The most pressing needs in the villages are a pure water supply, proper latrine accommodation (over draining trenches where possible), and anti-mosquito measures generally.

A. T. Ozzard.

Anna Regina.

In the Anna Regina Hospital there were treated 1,056 cases with 17 deaths. In the Hampton Court Hospital there were treated 734 cases with 14 deaths.

At Anna Regina the principal diseases treated were malarial fevers (289), influenza (129), pul-

monary affections (52), ankylostomiasis (35), dysentery and diarrhœa (53), and the usual cutaneous affections. Of the deaths, 7 died within twenty-four hours and 4 within seventy-two hours.

The resident population on this estate is about 1,251, including the annexe, Reliance. The births were 64 and the deaths 27.

At Hampton Court the principal diseases treated were malarial fevers, influenza, pulmonary affections, dysentery, and diarrhœa, ankylostomiasis, and the usual skin diseases. Of the deaths, 6 died within twenty-four hours.

The population on this estate is given as 1,205; births were 60 and the deaths 10 for the year. The general health has been very fair.

There has been a falling off in the cases of malarial fevers, due, I take it, to systematic quininization and also the very dry weather. Severe cases of malarial fever have been very few indeed; as a rule, the majority recover in a day or two, and the temperature or, I should say the amount of fever, is very slight. In the two hospitals there were 26 cases of pneumonia with 5 deaths. Pulmonary tuberculosis would appear to be very rare, only 2 at Anna Regina and 1 at Hampton Court. In the villages it is also very rare—almost unknown to me. No case of enteric fever has come under my notice. There has been a marked diminution in cases of ankylostomiasis. The sanitary condition of the estates continues to improve. The drainage at Anna Regina (indentured yard) has been greatly facilitated, a new koker having been erected. The hospital on this estate has been lately thoroughly distempered and presents a very pleasing appearance. The free yard has also a koker put in, which will effectually drain it in the wet weather. My thanks are due to the estate authorities for their ready co-operation in all measures conducive to the health and well-being of the immigrants.

The general health of the villagers appears to have been good during the dry weather. During the rainy season there was much sickness, especially influenza and bronchial affections, including many cases of pneumonia, the last being fairly common. With the exception of influenza, which appears to have beecome endemic, there has been no epidemic disease. Infantile convulsions continue to account for most deaths among children; in the hospitals, however, recovery is the rule. Diarrhœal disease among the children has not been excessive. With the exception of Queenstown, and perhaps Daniel's Town, the sanitary condition of the villages is still unsatisfactory. Queenstown is well laid out and the drainage generally good, the streets are clean, and the different lots and homesteads are also kept clean and neat.

Daniel's Town is also fairly well laid out, and the drainage is good. The villages Henrietta and Richmond have been declared sanitary districts, and general improvements in their condition are taking place.

J. Teixeira.

Colonial Medical Reports.—No. 65.—Municipality of Colombo.

MEDICAL REPORT FOR THE YEAR 1912.

By W. MARSHALL PHILIP,

Medical Officer of Health.

Meteorology.

For the first time for a considerable number of years there was a marked improvement in the rainfall, which totalled during the year 101·14 in., as against the average for forty-three years of 88·23 in. This average is made up of Fort and Observatory records, corrected to 4 ft. above ground level, as in the case of the 1912 record, and was, together with the other data given in the Appendix, kindly furnished by Mr. Bamford of the Observatory.

Topography.

The total area of the town, including the eastward and Wellawatta extensions, is 8,676 acres, or $13\frac{1}{2}$ square miles. The eastward extension, which was included in 1910, covers an area of 1,593 acres, and had in 1912 a mean population of 11,286; while the Wellawatta extension, which was included in 1912, covers an area of 620 acres, and had a mean population of 7,499. These two extensions, therefore, represent an aggregate area of 2,213 acres, with a population of 18,785, *i.e.*, equal to nearly half the population of Galle.

The town is roughly spindle-shaped, being 8 miles long as the crow flies from north to south, and $2\frac{3}{4}$ miles wide from east to west at its broadest part. Within this area there are 115 miles of public streets, in addition to many miles of private roads and lanes. The difficulty of transit, due to the long, narrow shape of the town, is increased by the manner in which it is intersected by the lake, and by the numerous large swamps which cut into it from the east, and is still further increased by the great deficiency of public streets. One of the principal wants of Colombo is a more complete scheme of public roads, the absence of which to serve as a guide for the development of the town, especially in the matter of buildings, is in a large measure responsible for its present irregular, inconvenient, and insanitary disposition. Until street lines have been laid down for the whole of the undeveloped parts, no check can be put upon this insanitary development, which is going on so rapidly at present.

Colonial Medical Reports.—No. 65.—Municipality of Colombo (*continued*).

Viewed from a height, such as the top of one of the tall buildings in the Fort, there is extraordinarily little evidence of the 38,667 dwellings which shelter the quarter million of inhabitants in the town. This is due to the great luxuriance of the vegetation here, and especially to the enormous numbers of coco-nut trees which tower above and obscure the buildings. A great deal of Colombo, especially in the residential quarters, is literally choked with vegetation, which acts as a great obstruction to the ventilating action of the breezes, rendering whole streets of houses hot, stuffy, and muggy. The principal offender in this respect is undoubtedly the coco-nut palm, which, while it gives comparatively little shade, when thickly planted, very effectually shuts out the breezes.

It would be greatly to the benefit of the town if some control could be exercised over the growth of vegetation, especially in proximity of dwellings, and a beginning might with advantage be made in the case of coco-nut palms, which might be prohibited within, say, 100 ft. of each side of a public road. This would enable the breezes to sweep down the streets and ventilate the houses. As matters stand at present there are many streets which, when viewed from the end, appear as little more than a narrow slit between dense masses of coco-nut palms. The proposed measure would undoubtedly be unpopular, but then so are most sanitary reforms until the benefit of them has had time to be realized.

The suffocating effect produced by the overgrowth of vegetation in Colombo is accentuated by the fact that most of the town is low-lying and flat, especially in the southern part, which is the chief residential district. In the northern, and to a less extent in the eastern parts, there are a number of low hills and ridges, the highest point being Elie House reservoir, which is 90 ft. above mean sea-level. The large swamps which eut in from the east and run up to the bases of these hills become biennially flooded and converted into large sheets of open water, as the result of overflow from the Kelani River. Notwithstanding the regular occurrence of these floods, there are many dwellings which have been erected below flood level, and which are in consequence damp and unfit for human habitation. The proposed building by-laws will make the erection of such dwellings illegal, but the existing low-lying dwellings must also be dealt with, the remedy in most cases being demolition, followed by drainage and filling. If the owners are unable to drain and fill up the land to the required level, then the land must remain unbuilt upon.

Vital Statistics: General.

"Vital statistics form the basis of sanitary reform, especially in regard to legislation."—*Newsholme.*)

If, therefore, legislation is to follow the most effective lines, it must be based upon a correct interpretation of these statistics; but a careful examination shows that a correct interpretation of the Colombo statistics is dependent upon a thorough knowledge and a due appreciation of the influence of the various local conditions, both past and present, which have affected, and in many cases still affect, the sanitary state and health of the town. As these do not appear to be generally recognized here, it may be of interest to mention a few of the chief of these conditions, and of their bearing upon the health of the town as indicated by the vital statistics.

Colombo, like all old-established towns, has to a large extent been developed upon what are now recognized to be unsanitary lines. Not for over a hundred years—not, in fact, since the days of the Dutch up till the present time—has any effective legal control in the matter of the erection of buildings been granted by the legislature to the sanitary authorities. The result, as was inevitable, has been that landowners have from time immemorial gone on erecting buildings practically where they chose, and how they chose, and being either ignorant or heedless of the sanitary requirements as regards air space, lighting, ventilation, drainage, access for cleansing, and such-like, the town has become progressively more and more insanitary. During recent years, when something of the nature of a building boom has been going on consequent upon the abnormal influx of people, as shown by the phenomenal intercensal increase during the recent decade (32½ per cent.), this insanitary development has been unusually active, much of it having, moreover, been carried on in defiance of the warnings of the Council's officers, who have been powerless to prevent it owing to the lack of effective legal control.

It is important to consider the effect which this has had upon the sanitary state and health of the town. Overcrowding of the land with improperly designed buildings has necessarily led to great interference with the ventilation, lighting, and drainage of the dwellings, and this, as is well known, is invariably associated with a high mortality from lung diseases. Not only so, but, as the mischief has been cumulative, so should one expect the evil effects also to be cumulative, and that such has been the case is shown by the vital statistics, for the mortality from the pulmonary group of diseases has been steadily rising since as far back as reliable statistics go, viz., 1897. This is particularly marked in the case of one of this group, viz., pneumonia, on account of its being less amenable than almost any other infectious disease to direct preventive measures, such as disinfection, isolation, and cleansing. Phthisis, however, which is another member of this group, although it steadily increased up till 1909, has during the last three years shown a marked tendency towards improvement—an improvement which it is interesting to note coincides with the adoption in 1909 of disinfection of phthisis-infected houses. Whether this improvement is the direct result of this measure it is, of course, too early to say, and whether it will be maintained is very doubtful, unless legal powers are granted to enforce the important preventive

measures of isolation of infected cases and the improvement of the housing conditions.

The vital statistics, therefore, although of late satisfactory so far as they go in respect of phthisis, clearly indicate the necessity in respect of pulmonary diseases generally, for the granting of legal powers to control the erection of new buildings, to improve existing buildings, and to enforce isolation of advanced cases of phthisis, if any very material or permanent improvement is to be secured.

It should be remembered that these pulmonary diseases are responsible for a very large proportion (nearly a third) of the total deaths in Colombo, and that, therefore, until a check has been put upon them, it is unlikely that there will be any very material improvement in the general death-rate; on the contrary, as the erection of insanitary dwellings continues to go on apace, and the town is becoming more and more congested, one might fairly expect the general death-rate to have gone on rising. That it has not done so of late years is due to the fact that the death-rates from most of the other principal causes have been steadily decreasing for a number of years, notwithstanding the persistence of many adverse conditions.

The other principal causes of deaths referred to are the "diarrhœal" and the "fever" groups of diseases, which, although they also are to some extent associated with insanitary housing conditions, are more particularly associated with filth conditions, and therefore afford a better indication of the state of the town in regard to ordinary sanitary matters, such as municipal and domestic cleansing, in respect of which one has not infrequently seen it publicly stated that practically no improvement has been effected. Upon what grounds such statements are based it is difficult to understand; they are certainly not supported by the facts disclosed by the vital statistics, nor are they in accordance with the experience of those who are in the best position to judge of such matters. As an illustration of this improvement, take the case of the "diarrhœa" group of diseases, under which heading are included dysentery, diarrhœa, and enteritis, all of which are essentially "filth diseases."

Decrease of Diarrhœal Diseases.—The statistics show that the mortality from this group, although it had been steadily rising up till 1906, has since then been steadily decreasing, the lowest rate on record having been reached in the year now under review.

Decrease of Fevers.—So also in the case of the "fever" group (most of which is probably enteric), the mortality from this group has for a considerable number of years been more or less steadily decreasing, the lowest death-rate on record having been reached in the year now under review.

The improvement in the mortality from these causes has, as stated, gone on notwithstanding the persistence, and indeed progressive increase of many powerfully adverse conditions, to which reference will now be made.

Adverse Conditions.—It is well known that the incidence of diseases, such as diarrhœa, enteritis, dysentery, and enteric fever, is very closely associated with the manner in which the waste of the population is dealt with, *i.e.*, the night-soil, the sewage, and the other domestic and trade rubbish. It is also closely associated with the food supply as regards its liability to contamination.

Bucket Latrines.—What, then, are the conditions in respect of these in Colombo? First, as regards the night-soil, the great bulk of this is still dealt with in so-called dry-earth latrines, the vast majority of which, especially in the poorer and more crowded parts of the town, are kept, and always will be kept, in a most insanitary condition. They are not in reality dry-earth latrines at all, for the reason that the coir dust supplied as a covering is seldom used by the people, in spite of innumerable warnings and even prosecutions on that account. These latrines, therefore, form a very great source of danger as regards the diseases mentioned, and as the population has been very rapidly increasing, so has the amount of, and therefore the possible danger associated with, this class of waste been increasing. The actual danger from this source is, however, in a measure dependent upon the manner in which the work of removal is done, and this has undoubtedly been improved since the contract system was abolished and the work was taken in hand by the Works engineer at the end of 1910. By far the greater part of the danger is, however, associated with the manner in which the householders themselves perform their duty in using the covering supplied, and in maintaining their latrines in a cleanly condition, and in these respects there has been little improvement There is, under the conditions which obtain here, obviously no proper solution of this problem, except the adoption of the water-carriage system, and the immediate removal of this class of waste in a cleanly manner, and although many millions of rupees have already been spent for this purpose in sewering the town, practically no benefit has as yet been derived from this work by the town at large, owing to the lack of legal powers to compel householders to adopt this system.

Drainage.—The same remarks apply to the disposal of the liquid waste, *i.e.*, the sewage. In spite of the great growth of the population, and the increase in the water supply, and the consequently great increase in the output of sewage, it is for the most part still disposed of by turning it either direct on to the ground in close proximity to the dwellings, or into open and frequently unbuilt drains, many of which serve no purpose beyond conducting it from the house where it is produced to some other spot, which is often adjacent to other houses, where it creates a nuisance and is a source of constant complaint from the residents and of trouble to the Council's staff. Here again there is obviously no proper remedy except to compel the house-owners to connect their drains to the underground sewers, and this, as stated, there is no legal power to enforce.

It is expected that such powers will before long be granted; but that does not alter the fact that, until the underground system has actually replaced these bucket latrines and sewage-carrying open

drains we have in Colombo a state of affairs which has been becoming progressively more favourable to the incidence of filth diseases *pari passu* with the growth of the population.

Disposal of Rubbish.—Next take the case of domestic and trade refuse: the only point to which reference need be made in the present connection is that, although matters have been greatly improved, it is still unsatisfactory in that the destructor at Mansergh Avenue is insufficient for the rapidly growing needs of the town, and there are still a number of insanitary fly-breeding tips either within or in close proximity of the town.

Food Supply.—Lastly, take the case of the food supply as an instance of the adverse conditions which exist here. It stands to reason that as the infection of all these filth diseases must gain access by the alimentary canal, the purity of the food supply is of the first importance. Apart from the obvious risk of infection by flies to which food is exposed in houses surrounded by insanitary bucket latrines and sewage-carrying open drains, the conditions under which it is exposed in the public markets are very unsatisfactory, as these markets are for the most part hopelessly out of date, and cannot be maintained in a sanitary condition.

Public Markets.—Why should not our markets be put into an up-to-date condition? It is not for the want of money derived from that source, for, as the annual statements of revenue and expenditure show, only a fraction of the revenue derived from public markets has in the past been expended upon them, the balance having apparently been utilized for other purposes. During 1912, for example, although a revenue of Rs. 52,081·05 was derived from public markets, only some Rs. 30,243·93 in all was expended upon them, including salaries of staff, maintenance, and an unusually large amount for construction work. During the last three years the aggregate revenue from markets has exceeded the aggregate expenditure by Rs. 46,607. This is not, in my opinion, sound policy, since to utilize public markets as a source of general revenue is equivalent to putting a tax upon food. They should, I think, be merely self-supporting, and if it is found that after making due provision for putting them into an up-to-date condition, and maintaining them so, there is a substantial balance, then the stall rents should be reduced. This should have the much-needed effect of reducing the price of foodstuffs in Colombo. If it does not do so, then the market prices should be fixed by regulation. In dealing with the financial aspect of the question, one may appear to have diverged somewhat from the point in connection with which it was introduced, viz., the present insanitary condition of the public markets; but the two subjects are so closely associated that they cannot be dealt with apart.

The proposed new Food and Drugs Act will, if adopted, greatly increase the sanitary control over the food supply, but we are handicapped by the want of sufficient staff. The ordinary householder here requires so much keeping up to the mark in the matter of domestic cleanliness that, unless the sanitary inspectors spend the bulk of their time in inspecting private premises, the sanitary condition of these rapidly degenerates. In addition to this they have so many other duties to attend to in connection with infectious diseases, bakeries, laundries, and such like that they have very little time to give to food inspection unless they neglect some of their other work which, as experience has shown, would immediately result in our being inundated with complaints, for every householder here appears to think that it is the duty of the Public Health Department to devote the whole of its time to his own particular grievance, no matter how trivial it may be.

I have repeatedly urged the necessity for appointing a Food Inspector, but so far my recommendations have not been acted upon.

Improvements Effected.—In view of the existence of all these conditions, which are favourable to a high mortality from filth diseases, it seems reasonable to suppose that the steady decrease in the mortality from these diseases shown by the statistics has been due to the improvements which have been effected in other directions in the sanitary state of the town. A few of the chief of these improvements will now be mentioned.

Scavenging.—That a very great improvement has been effected in the carrying out of the work of scavenging, both as regards the cleansing of private premises and of public streets, is apparent to anyone who can compare the state of affairs, say, ten years ago (prior to which I cannot speak from personal experience) with what exists now. Ten years ago there was no systematic inspection of private premises, most of the time of the sanitary inspectors being then occupied with duties which had nothing whatever to do with sanitation, such as collection of general revenue, revision of voters' lists, and such-like. Upon their being relieved of these non-sanitary duties, a system of routine inspection of all private premises in the town was instituted and has since been carried on. The effect of this was gradually to improve the state of cleanliness in which private premises were maintained. Much difficulty was, however, at first experienced owing to the fact that the scavenging of the public streets, and consequently the removal of rubbish put out by householders, was in the hands of a contractor, whose sole aim appeared to be to save as much as he possibly could on his contract which he had undertaken at an impossibly low figure. It was found impossible to make him abide by any time-table, or to do his work properly, with the result that householders complained that it was no use putting out their rubbish. It was not, however, until the beginning of 1905 that the Council decided to abolish the contract system, and to have the work carried out departmentally under the Works Department, at whose hands it has since been gradually undergoing a process of complete reorganization.

The improvement thus effected in the public scavenging greatly facilitated the work of making the householders keep their premises clean, as they

began to learn that their rubbish if put out would be removed. The next step was for the Works Department to arrange for a proper scavening time-table, and to require householders to put out their rubbish in an approved type of sanitary dustbins at fixed hours. From January 1, 1908, copies of the time-table and regulations printed in the vernacular were posted in the streets, served on householders, and announced by beat of tom-tom, and as the engineer stated in his report, the results of this far exceeded expectations. The rapid increase in the quantity of rubbish put out from private premises for removal was enormous.

Referring to the extraordinary increase in the amount of rubbish removed, the engineer remarked in his report that "this means that the inspection of private premises must have been greatly improved, and the standard of cleanliness raised, for so large an increased quantity of rubbish to have been put out for removal by the Council's carts."

The reduction in the death-rate from diarrhœal diseases and fevers would appear to support the same conclusion.

Food Trades.—Not only has the greater cleanliness of private premises contributed towards this improvement in the death-rate from these filth diseases, but a great improvement has been effected in respect of dairies and bakeries, as well as in the condition of eating-houses. The cleanliness of the public markets, difficult although they are to keep clean, has also been much improved as the result of a certain amount of structural improvement, combined with a reorganization of the staff and the introduction of a much more thorough system of inspection.

Milk Supply.—The improvement in the milk supply is one of the most satisfactory features of the work of this department, the amount of adulteration having been reduced from 72 per cent. of samples examined in 1907 to 12½ per cent. in 1912.

Special Measures.—Next, take the case of the work done with special reference to fevers. Ten years ago there was practically no notification of enteric fever, although the death-rate from fevers was then very much higher than it is now. Since that time notification has been insisted upon, every case being visited and inquired into; a special gang of coolies is employed to clean up and disinfect premises where enteric cases have occurred; each case which is not under the care of a qualified medical man is visited daily throughout the illness, disinfectants are supplied, instructions, both verbal and printed, are given, and a special covered latrine bucket with cyllin solution in it is supplied; in cases where the isolation is had, the patient is removed to the enteric hospital; and within recent years the protective measure of inoculation has been urged; all milk vendors are medically examined, and their blood is also examined bacteriologically, with a view to the detection of enteric carriers, before registration is granted.

There are many more directions in which work has been carried on with a view to improving the sanitary conditions here, but the above will perhaps suffice to indicate what has been and still is being done.

There is every reason to believe that when the Legislature has granted the legal powers required (1) to compel householders to abolish their insanitary latrines and sewage-carrying open drains, (2) to control the erection of new buildings and improve the state of the existing ones, and (3) to enforce segregation of advanced cases of phthisis, there will be a great further improvement in the death-rate of Colombo, which, although already one of the healthiest of the large towns in the tropical East, should become far more so than it is at present.

Population.—The estimated mean total population in 1912 was 227,062.

Births.

The total number of births registered in Colombo during 1912 was 5,195, representing a birth-rate of 22·9 per 1,000, which is slightly below the average. It is quite certain, however, that the recorded birth-rate is not a true measure of the fertility of the population, and that many births of children of Colombo parents escape registration in the town owing to the custom which prevails amongst the indigenous races whereby prospective mothers migrate prior to confinement to the homes of their parents. The extent to which this custom must affect the recorded birth-rate may be surmised from the fact that at the Census, out of a total female population of 81,599 enumerated in the town, of whom about half were at child-bearing ages, 13,697 gave their place of birth as the Colombo District, *i.e.*, outside the town, from which one may fairly deduce that the homes of the parents of many thousands of Colombo women are still in these extra-urban districts, and that therefore there must be a great deal of migration to these districts for confinement purposes. In fact, it is common knowledge that this is so. Children born under these circumstances would naturally be registered in these extra-urban districts prior to their being brought into Colombo by their mothers, and consequently the record of their births is lost to the Colombo statistics.

This has an important bearing upon the infant death-rate of Colombo. It is, of course, assumed that such of these children as survive until the mothers' return to Colombo are brought here, and should they die in Colombo their deaths are registered here.

As the infant death-rate is generally accepted as the best test of the sanitary condition of any place, it is important that the true rate should be known; but this cannot be ascertained unless steps are taken to ensure that all children born of Colombo parents in extra-urban districts, and who are subsequently brought into Colombo before they are a year old, are registered in Colombo, and that, on the other hand, all children born in Colombo of non-resident parents, and who are removed from the town before they are a year old, are excluded from the Colombo registers.

Colonial Medical Reports.—No. 65.—Municipality of Colombo (*continued*).

DEATHS: GENERAL.

Total deaths registered, 6,636; crude death-rate, 29·2 per 1,000; average crude death-rate for ten previous years, 33·0 per 1,000; death-rate corrected for hospital deaths, 26·8; death-rate further corrected for age and sex, 31·5.

(*a*) *Correction for Hospital Deaths.*

The hospitals in Colombo attract a large number of sick persons, not only from the town, but also from all parts of the island, especially from the adjoining rural districts. During 1912 there were 542 deaths amongst these non-residents in the hospitals, and it is the deduction on this account which reduces the death-rate from 29·2 to 26·8. The rates of the individual races are very differently affected by this correction, the most extreme example being in the case of the Europeans. Out of a total of sixty-four European death records in Colombo during 1912, twenty-seven, *i.e.*, 42 per cent., were non-residents of the town, who came here sick and died in the hospitals, their death-rate being reduced by this correction from 20·3 to 11·8 per 1,000. On the other hand, a large proportion of the Europeans who are taken seriously ill go home to Europe, if they are well enough to travel and can afford the expense. Unfortunately, there is no record of the number of such, or of the number who die out of Colombo, so that the compensating correction cannot be made, and the true European death-rate cannot be ascertained.

The race next to the Europeans which is most affected by the correction for hospital deaths is the Sinhalese, whose death-rate is thus reduced from 32·0 to 27·7. This is mainly due to the great use which the large suburban Sinhalese population make of the Colombo hospitals.

The correction is least in the case of the Moors and the Malays, neither of whom appear to make much use of the hospitals. They are both very conservative races, and cling tenaciously to their established customs.

In addition to the death-rates of non-residents which occur in hospitals, a number occur in the town generally in the case of persons who have come sick from the rural districts in search of medical advice, or in order to be with relations, or for other reasons. As an off-set, however, against the increase of the Colombo deaths caused in this manner, a number of town residents leave the town when sick and die in the rural districts. There is no record of such in either case, so that it is not possible to make corrections, but it is not improbable that they more or less balance each other, so that the death-rate may not be materially affected one way or the other.

(*b*) *Correction for Age and Sex.*

In the Colombo population as a whole there is, when compared with the standard (*i.e.*, the population of Ceylon), a deficit of females, and of children and old people; but women, children, and old people have normally a higher rate of mortality than males and middle-aged people in Ceylon, so that the age and sex constitution of the Colombo population is favourable to a low rate of mortality, and a correction must therefore be made to neutralize this effect before the death-rate of Colombo can be compared properly with the death-rate of other places (which must, of course, be similarly corrected). This correction raises the Colombo death-rate during 1912 from 26·8, to which it was reduced by the correction for hospital deaths to 31·5 per 1,000, which is the nearest approach to the true death-rate that can at present be obtained.

The age and sex constitution of the several races in Colombo differs markedly, so that the correction on this account will affect the various races differently. In the case of the Sinhalese it is very slight, but in the case of Europeans, Tamils, and others, it is considerable. There are thus great difficulties in the way of ascertaining the true death-rates of these migratory races—in fact, it is at present quite impossible to do so. Take the case of the Europeans, for example—not only is it usual to send children away either to England or up-country, but a large proportion of them remain away until they are grown up and are ready to enter business or to take up a profession. Then, again, it is the custom for the adults to retire and leave the island at the age of 55 or under. Thus the population is constantly being depleted of a large proportion of its children and old people, both of which classes have normally high rates of mortality. On the other hand, the European population is being constantly augmented by the influx of young adults, most of whom have been passed as medically fit before they were allowed to come to the island, all of which tends, quite irrespective of the health conditions here, to produce a lower rate of mortality than would otherwise prevail.

The foregoing will show that there are many points of interest in connection with the death-rates in Colombo, and that great caution must be observed in instituting comparisons between the rates of different races or places. Notwithstanding this, however, it is probable that the influence of the age and sex factor does not greatly vary from year to year, so that a useful comparison may be made of the rate of a race in one year with the rate of the same race in previous years, and the same applies when comparing wards.

The race with the lowest death-rate in 1912 was the Europeans, whose crude rate was 20·3, compared with their average of 29·4. Their rate, exclusive of the deaths in hospitals of non-residents of the town, was only 11·7 per 1,000; but, as previously explained, this does not represent their true death-rate. The race with the highest corrected death-rate was the Malays.

PRINCIPAL CAUSES OF DEATHS: GENERAL.

The principal causes of deaths amongst the population, as a whole, and indeed in every race except

the Europeans, were as usual the pulmonary diseases, chief amongst which was pneumonia, which during the last two years has, as the result of the decrease in phthisis, taken the first place as the cause of mortality. The decrease of the phthisis death-rate since 1909 is a noteworthy feature of the statistics, and it is hoped that it may continue to improve.

During 1912 pneumonia caused 13·8 per cent. of the total deaths in Colombo, phthisis caused 10·5 per cent., diarrhœa and enteritis 9·6 per cent., dysentery 4·0 per cent., bronchitis 3·6 per cent., and enteric fever 3·5 per cent.

Europeans as usual suffered most from enteric fever, which, although less than half the average, was still responsible for 13·5 per cent. of their total deaths. Their next greatest cause of death was diarrhœa, which caused 5·4 per cent. As usual, comparatively few of their deaths were caused by pulmonary diseases; hut their statistics in this respect are not trustworthy, as most Europeans who are attacked by phthisis go to Europe; and there is no record of the number of such or of their deaths. The European pneumonia rate is, however, comparatively low, and that is a disease which operates too rapidly to permit of those who are stricken escaping from the island. It may therefore he that their true phthisis rate is also genuinely low, compared with other races. It is a significant fact that about a quarter of the total recorded European deaths are usually due to diseases, the infection of which gains entrance with their food supply. This is probahly in a large measure due to their heing more susceptihle to these diseases than are other races; hut, on the other hand, one knows from what one has seen that there is an extraordinary lack of supervision over the kitchen in many of the bachelor establishments, and it is young hachelors who suffer most. There is, therefore, every reason why Europeans should exercise strictest precautions in all matters connected with their food supply, and the maintenance of their health in a condition which will enahle them to resist attacks hy these food-horne diseases.

Tamils, in addition to suffering more severely in 1912 from pneumonia, had a higher mortality than any other race from diarrhœal diseases. This is no douht due to the fact that more poverty exists among them, and they live, as a class, under more unfavourahle conditions than any other race.

They had as usual a relatively low mortality from enteric fever, which is probably due to most of them having already had the disease during their childhood in India, where enteric fever is said to be exceedingly prevalent.

The Moors, like the Tamils in Colombo, had as usual a low death-rate from enteric, but whether the same explanation holds good in their case is douhtful. It may he that many of their children suffer from this disease in a mild form which thus escapes recognition and notification, or they may have a certain degree of natural immunity to the disease.

On the other hand, their religion requires them to be more particular about the source and preparation of their food than any other race, and this may, and probahly does, confer a certain amount of protection upon them.

The Malays, who are much less strict Muhammadans, had as usual a higher fever rate (probahly mostly enteric) than any other race except Europeans; hut it is satisfactory to note that, like the Europeans, they showed a great improvement in this respect in 1912. The principal cause of deaths amongst both the Burghers and the Sinhalese was as usual pulmonary diseases, chief amongst which was pneumonia. In considering these principal causes of deaths one must he careful to avoid making the mistake of assuming that because a certain disease is the principal cause of deaths amongst one race, whereas it is not the principal cause in another race, that therefore the first race suffered more than the second race from that disease. Such may be, hut is not by any means necessarily the case. Take the case of pneumonia as an example: although 12·3 per cent. of the total Burgher deaths and only 11·9 per cent. of the total Moor deaths were due to this cause, the Moors nevertheless suffered more severely from this disease in proportion to their population than did the Burghers, for whereas 3·07 per 1,000 of the Moors died of pneumonia, only 2·81 per 1,000 of the Burghers died of this disease. The rates for each race expressed as a percentage of their total deaths are only of value as a means of expressing which disease each race has suffered most from during the particular period dealt with, and must not be used for comparing the mortality amongst different races or even amongst the same race at different periods of time, or in different localities. They are very useful rates, hut their legitimate uses are strictly limited, as stated above.

Infant Mortality.

Deaths, 1,554; death-rate per 1,000 recorded births, 299; average rate for the preceding ten years, 333; decrease, 34 per 1,000. That the true infant mortality in Colomho is probably a good deal lower than it appears from the statistics had already been explained in Section 5. The following table shows the average infant death-rate for each race since 1908, and also the rates for the years 1911 and 1912:—

	Average 1908-11	1911	1912
Europeans	159	182	22
Burghers	200	218	186
Sinhalese	290	286	284
Tamils	436	413	381
Moors	410	423	382
Malays	304	291	289
Others	441	408	354

A large proportion of the Tamils, Moors, and others heing poor are compelled to live in densely crowded, unhealthy areas, their infants being thus exposed to conditions which are always associated with a high rate of mortality. Many of the mothers are, moreover, ignorant and careless, and especially in the case of the Tamils, many of them have to work when they should be attending to their children. In the case of the Moors, it is largely a case of mishandling of the infants, many of whom are injured by hand-feeding instead of breast-

feeding. Sanitary dwellings for the poor are very urgently required in Colombo, and until this undoubtedly very difficult problem is solved there can be little material improvement in the infant death-rate.

The principal causes of infant deaths expressed as a rate per 1,000 recorded births amongst the population generally were as follows: Convulsions (91), debility (45), diarrhœal diseases (37), pneumonia (34).

The Moors, Tamils, and Malays each had a very high infant death-rate from "convulsions," which is a sure indication of improper feeding, most of these deaths being no doubt the result of digestive troubles. It is most unfortunate in this connection that the use of condensed milk, much of which is quite unsuitable for infants, appears to be rapidly spreading amongst the poorer classes, who have not got the education necessary to warn them against the dangers to their children entailed by this form of feeding. Breast-feeding is said to be rapidly being displaced, especially among the Moors, by hand-feeding, and as condensed milks are being imported in enormous and yearly increasing quantities, and are being assiduously thrust before the public, much of it is taking the place of breast milk or fresh cow's milk, to the great detriment and loss of life of the infants.

Pulmonary Diseases.

Under this heading are included phthisis, pneumonia, and bronchitis.

The only races which showed improvement were the Europeans, the Tamils, and the Moors.

Phthisis.—Deaths, 713. Every race except the Malays and others shows an improvement. The Malay rate, on the contrary, shows the large increase of 1·21 per 1,000. The Europeans show the greatest improvement, viz., 1·66, but this is misleading, for, as previously stated, comparatively few phthisis-stricken Europeans remain in Ceylon. They are generally sent home, and such of their deaths as occur there are lost to the Colombo statistics. They are such a small population, however, that their statistical variations do not materially affect the general rates.

The improvement in the death-rate from phthisis amongst the general population, which began in 1910, has since been maintained, the 1912 rate being, with the exception of 1910, which was practically the same, the lowest recorded for nine years. In this connection it may be recalled that regular visitation and disinfection of phthisis-infected houses was first commenced in July, 1909. The details in regard to this disease are given in the statements in the Appendix.

Pneumonia.—Deaths, 886. The high level at which the pneumonia death-rate keeps is an indication of the destruction of life, which is going on as the result of a large section of the population being compelled to live in overcrowded and, therefore, unhealthy, areas and dwellings, and which the Council's staff is powerless to improve owing in the first place to the absence of legal powers, and, in the second place, to the great difficulty and cost involved in the improvement of such areas.

Exclusive of the mixed class of aliens included under the heading of Others, the race which as usual suffered most from "pneumonia" was the Tamils. The Europeans suffered comparatively little from this disease, as they live for the most part in the more sanitary quarters of the town, and seldom adopt the unhealthy custom of shutting up their bedroom windows at night.

Every race except the Europeans had a death-rate from pneumonia in excess of the average, the greatest increase being observed in the cases of the Others and the Malays.

Bronchitis.—Deaths, 222. It is possible that a considerable proportion of the mortality ascribed to bronchitis is in reality due to the more specific causes of phthisis and pneumonia.

Diarrhœal Diseases.

Deaths, 927. This group includes diarrhœa, enteritis, and dysentery, the two former of which are considered below under one heading, and include also the various forms of colitis, as there is no proper line of demarcation between them.

The death-rate from this group of diseases in 1912 was the lowest on record. Every race participated in the improvement, the most marked being the case of the Europeans, whose rate corrected for deaths of non-residents was only 0·95. The Moors and others showed the least improvement.

Diarrhœa and Enteritis.—Deaths, 655. Every race showed a marked improvement in the mortality from this cause, the greatest improvement being in the case of Burghers.

Dysentery.—Deaths, 272. Every race except the Others showed improvement. The Europeans had, for them, the extraordinarily low corrected rate of 0·32 per 1,000, only one European resident of Colombo having died of this disease during the year.

Fevers.

Deaths, 330. Under this heading are included enteric, remittent, intermittent, and simple continued fever. The death-rate in 1912 was the lowest on record. Every race showed improvement, the most marked being in the case of the Malays, followed by the Europeans. The least improvement was in the case of the Tamils, who, however, have normally a low fever rate compared with other races. The correction for non-residents reduces the European rate from 2·86 to 1·58.

Enteric Fever.—Total cases reported, 621. Of these 475 were from the town, 49 from extra urban districts, 6 from the Port, and 91 were of untraced origin. The very high case mortality shows that a large number of mild, non-fatal cases probably amongst the children escape notification. This applies most to the Moors and the Tamils, as the statement in the Appendix shows.

The statistics annexed show that the largest number of cases occurred at the 20—25 age-period amongst males, and at the 15—20 age-period amongst females. The number affected rapidly

decreases after the age of 30, especially in the case of females.

Infectious Diseases Notification.

The notifiable infectious diseases are plague, cholera, small-pox, chicken-pox, measles, scarlet fever, diphtheria, acute or choleraic diarrhœa, enteric fever, simple continued fever of seven days' duration or over, and since January 1, 1910, phthisis.

The total number of these diseases reported and dealt with during 1912 was 2,529, which is a decrease of 540 compared with 1911.

The complete absence of both cholera and small-pox, and the great reduction in enteric fever in 1912, are the most noteworthy features of these statistics. The increase in the number of cases of phthisis reported during 1912, compared with 1910, is entirely due to improvement in notification, the death-rates from this cause having been practically identical during these two years.

Food.

The fact that over 1,000 deaths occur every year in Colombo from diseases the infection of which gains entrance with the food is, one would imagine, sufficient justification for incurring special expenditure with a view to improving matters in this respect, and yet, although this has been insisted upon in these reports year after year, nothing has been done. The arrangements for the inspection of food are exactly the same as they were twenty years ago, inasmuch as there is no special staff for food inspection, which has to be carried out as hitherto by the sanitary inspectors, who have a multiplicity of other duties to perform, and so cannot give the time or attention to it which the importance of this work demands.

This is not creditable to a town the port of which, in point of tonnage of vessels calling, is third in the British Empire and seventh in the whole world, and which has become a favourite port of call for pleasure seekers. The town can quite well afford to maintain a staff of special food inspectors, and ought to do so. The nucleus of such a staff should be begun, as has repeatedly been urged, by the appointment of a trained food inspector, who could in time train other men to work under him. Really capable and reliable food inspectors are not easily obtainable, and a suitable salary should be offered to attract a good man.

Milk.—A still further improvement took place during 1912 in the quality of the milk offered for sale in Colombo. Out of 1,200 samples examined only 150, or 12½ per cent., were below the standard, as against 17 per cent. in 1910, and 72 per cent. in 1907. Hitherto it has not been possible to obtain more than a chemical examination of milk, but during 1912 Dr. Hirst began a bacteriological examination, and found that, although as was shown by the milk collected in one dairy, it is possible to produce milk here of a very high degree of purity (only ten organisms per c.c. being found), in others there was the grossest contamination, as many as 20,000,000 organisms per c.c. and much filth being found. The *Bacillus tuberculosis* has never yet been found in a milk sample here. In fact, so far as is known, tuberculosis does not exist amongst the cattle here. This is no doubt due to the fact that the cattle live practically in the open air—the sheds being invariably open on one and generally on all sides. It is expected that when the new Food and Drugs Act comes into operation a still further improvement will be effected by establishing, in addition to the chemical standard now in force, a bacteriological standard of purity. It is only by doing so that the dairymen can be compelled to adopt more modern methods of handling the milk, such as straining and cooling, for it is only by the bacteriological examination that carelessness in these respects can be detected. The health of householders is guarded as much as possible at present by frequent inspections of the dairies, by frequent sampling for chemical examination, and by medical and bacteriological examination of all the milk vendors prior to registration, with a view to the detection of persons suffering from contagious and infectious diseases, and of "carriers" of enteric fever.

Bread.—There is nothing new to record in connection with the bread supply, which has not so far been found to be adulterated in Colombo, although much of it is of inferior quality owing to the use of cheap flours and inferior yeasts.

Tinned Foodstuffs.—It is expected that when the new Food and Drugs Act comes into force considerable improvements will in time be effected in respect of tinned foodstuffs—especially as regards tinned milk, the use of which is unfortunately, greatly on the increase, and much of which is of greatly impoverished quality. This is a matter of the highest importance in connection with the infant mortality, as has already been pointed out under that heading.

Water.

Town Water.—During the year 164 samples of town water were examined chemically by the City analyst, all of which were found satisfactory. The chemical examination, although most useful as a rough test, is not nearly so delicate as the bacteriological tests, which were begun systematically on March 30. Ninety samples were collected and examined by Dr. Hirst, who subjected them to an unusually complete series of tests. The result of these bacteriological tests was to disclose evidence of occasional fæcal contamination in the town mains, in one case the pollution being definitely traced to a fractured main. This is probably the usual source of these pollutions, and may in some cases be due to the breaking up of the streets and subsidence due to the pumping operations carried on by the drainage works; but as there is no information on the point available in this office, nor as to the frequency with which these faults in the mains occur, or where they occur, I have asked the waterworks engineer to kindly inform me immediately a fault in the mains is discovered by his staff, in order that the water may be examined, and the extent and degree of danger, if any, of the pollution may be ascertained.

Colonial Medical Reports.—No. 65.—Municipality of Colombo (*continued*).

Although Dr. Hirst has not yet completed his investigations, he considers that the results so far obtained justify the conclusion that the main supply from Labugama is on the whole bacteriologically satisfactory. It will no doubt be improved, and the minor degrees of contamination due to the droppings of wild animals and decaying vegetation will be eliminated when the Jewell system of filtration has been completed.

Wells.—There are two classes of wells in Colombo, viz., (*a*) private wells, and (*b*) public bathing wells.

At the public bathing wells a variable charge is made by the owner for the use of the water.

All the wells in Colombo are technically "shallow" wells, and when one considers the foul nature of the soil in which a large proportion of them are sunk, it is not surprising that out of the sixty-six samples examined chemically during the year, fifty-one, or 77 per cent., were condemned as unfit for human consumption. Unfortunately for them, the people in their ignorance cling to these foul wells, which they like owing to the coolness and clearness of the water which they contain, and one cannot convince them that the most dangerous of waters are often very bright, sparkling, and pleasant tasting. The work of closure of the worst of the private wells was continued, thirty-three having been closed during the year. No public bathing wells have so far been closed owing to the great demand which this would throw upon the town supply, and it was considered that until there was sufficient town water available to ensure an ample and permanent source for bathing purposes it would be inadvisable to close these public wells. Such of them as were found to be badly polluted have from time to time been treated with permanganate. The bacteriologist has undertaken an examination of the water of these public wells, and it is proposed now that sufficient town water is available to gradually close those which are polluted, beginning with the worst.

There is the more justification for this in view of the fact that the Council has now established a number of excellent public bathing places in connection with the new water-carriage public latrines, and these are very largely taken advantage of.

Aerated Waters.—Great difficulty is experienced here in obtaining soda water free from copper; even some of the best firms from time to time experience this. The quantity of copper present is, as a rule, small, but there should be none at all, as its presence is due to defective machinery. An improvement has been effected in this respect by the substitution of block tin pipes and block tin lining to the fittings instead of having brass exposed to the solvent action of the water charged with CO_2 under pressure. Apart from the occasional presence of copper there is little fault to be found with the purity of the water, as the manufacturers all use town water. Some of them have at times to be checked in the matter of filters, the crudest forms of which they sometimes adopt. When the Jewell system of filtration has been installed on the town system there should be no necessity for further filtration. It has occasionally happened that individual bottles of tonic and other sweetened waters have been found to contain dead flies, but this is very exceptional and is due to carelessness in the factory—especially as regards the protection of the syrup from flies. The best factories now provide fly-proofed syrup rooms.

Public Markets.

There is little improvement to record in the state of the public markets, except as regards Dean's Road, where the old fish stalls have been replaced by a new fish market, which is a great improvement on the old arrangement. If the Colombo markets generally are to be put into an up-to-date condition, a great deal more money than it has hitherto been customary to spend upon them must be allotted for this purpose.

Slaughter-house.

Apart from the lack of proper means of disposing of the drainage, the sanitary condition of the slaughter-house was maintained in a fairly satisfactory condition; but there are a number of improvements required. The City sanitation engineer is dealing with the drainage problem, and it is hoped that a workable scheme for improving matters in this respect will shortly be devised. The slaughter sheds require to be crow-proofed, the floors and drains require repairing, and the buffalo remaining shed requires to be provided with a permanent roof. There are a few other minor matters which require attention, and in respect of which it has been asked that provision should be made. It is highly desirable that a cooling room should be established and its use enforced.

Compared with 1911, there was an increase of 1,660 in the number of cattle, and of 5,256 in the number of sheep and goats slaughtered. There was, however, a decrease of 89 in the number of pigs slaughtered, but whether this is due to a lessened consumption of pork, or to an increase in the amount of illicit slaughter, I am unable to say.

Registered Trades.

Dairies.—There were thirty-eight dairies on the register at the beginning of the year, nine of which were discontinued, while ten new registrations were granted, leaving thirty-nine on the register at the end of the year.

During the year the Colombo Ladies' League, which was started at the instance of Lady Clifford, offered a number of medals and prizes for the best-kept dairies and bakeries. Committees of ladies

were appointed for the purpose of inspecting and judging the premises of competitors, and the medals and prizes were awarded at the end of the year as the result of these inspections. The effect of this was to set up a beneficial rivalry amongst the competitors, which it is hoped will be maintained.

The advantage of this work does not, however, end here, for it has the effect of bringing the best-kept places to the public notice in a way which cannot be done officially, and this in turn brings the tradesmen an encouraging increase of trade. It is sincerely hoped that the Ladies' League will continue this most useful work.

An advance in the matter of dairies, which was undertaken by this department during the year, was the examination for enteric "carriers" by the bacteriologist, of the blood of all milk vendors prior to granting registration. No "carriers" have so far been discovered.

Bakeries.—There were fifty-six bakeries on the register at the beginning of the year, eight of which were discontinued, while eleven new registrations were granted, leaving fifty-nine on the register at the end of the year.

There are still a number of bakeries in most unsuitable situations, but it is difficult to get them removed, although it is clearly in the best interests of the public health that such places should, after a reasonable period of grace, be closed. The decision on such matters should be based entirely upon sanitary grounds. It may at times seem hard upon individual bakers, who have carried on their trade for a number of years in a certain locality, and have so acquired a local trade connection, to be turned out; but many of these places have, since the bakeries were started, become overcrowded with buildings and otherwise insanitary, as the result of the uncontrolled and improper development of the locality, and the standard now set for bakeries is undoubtedly much higher than it used to be; but this is in my opinion no proper reason for allowing these insanitary bakeries to remain indefinitely as a menace to the public health. The sword must fall sooner or later, and the sooner the better for the public health.

Laundries.—Apart from the fact that the work of getting the floors and walls of the laundries cemented and the provision of separate dwelling and working rooms has been continued, there is no improvement to record in regard to laundries. It is a most difficult problem. Recently, however, the question of providing a sufficient number of Municipal dhobi *khanas* to serve those who wash in the lake has been and is still under consideration, and it is hoped that a scheme will ultimately be evolved which will make it possible to put a stop once and for all to washing clothes in the sewage contaminated lake.

The difficulty of supervision, and of getting improvements effected, is greatly increased by the fact that dhobies having practically no stock in trade are constantly changing their houses. During 1912, for instance, ninety-eight were discontinued, while 110 were granted registration for new houses. There were 285 dhobies' houses on the register at the end of the year.

Eating-houses.—It is only by constant inspection and, where neglect is found, by prosecution, that eating-houses, especially the small ones, can be kept in anything like a satisfactory condition. The mess in which they are sometimes found is often the fault of the customers, who are careless and dirty, throwing scraps of food upon the floor, spitting, &c., and the keepers and their inadequate staff of servants are so busy attending to them that they neglect to keep the place clean. This is especially the case in the poorer and more crowded parts of the town. There are, however, a number of very well-conducted eating-houses.

Like the dhobies, the eating-house keepers are constantly changing their places of business. During 1912, 102 were discontinued, while 118 new registrations were granted, leaving 303 on the register at the end of the year.

Aerated Water Factories.—There were fifteen of these on the register at the end of the year, ten being in Slave Island alone. Some of them are very well kept, while others are a constant source of trouble to this department. Just as in the case of most other trades, it is the petty trader who gives most trouble, and requires the greatest amount of attention from the sanitary staff.

Cemeteries.

The Council's staff control only so much of the cemeteries as has not been handed over to the Episcopalians and the Roman Catholics. A good deal of improvement has been effected in the appearance of the General Cemetery by the construction of the lych-gate and by the work of the garden staff. It is hoped that in time this may become one of the most beautiful spots in Colombo, as it ought to be.

Work Statements.

Sanitary Inspectors (fourteen men and one woman inspector).—It is the duty of sanitary inspectors to be constantly finding fault with and getting those punished who do not comply with the sanitary laws. Therefore, the more energetic and fearless an inspector is in carrying out his duty the greater is the number of persons against whom he has to proceed. It is thus obviously impossible for a good sanitary inspector to escape making enemies, especially in a place such as Colombo, where a very large section of the population is not only grossly careless in sanitary matters, but resents being compelled to observe the sanitary regulations. As everyone knows, the very first weapon which is generally used here by an enemy is the false charge, and it is not therefore surprising that not a year passes without the sanitary inspectors as a class being assailed with charges of blackmailing and other misconduct. The result of this is that a well-nigh intolerable atmosphere of suspicion and distrust has arisen around these men, making it

extremely difficult for even an honest man to carry out his duty without the risk of being made the subject of attack. How far this distruct is justified it is exceedingly difficult to say, but personally I think the inspectors as a class are a much maligned body. Nevertheless, the feeling undoubtedly exists. That being so, it is hard to understand why one of the most effective means of checking the inspectors, viz., a chief sanitary inspector, has been denied this department, in spite of my repeated requests that such an officer should be appointed. This is, I should think, almost the only town of importance in the world which does not employ a chief sanitary inspector, and I must again repeat my request that such an officer be appointed. Not only is it most depressing for the staff to have to work in an atmosphere of suspicion and distrust, but, if matters are allowed to continue as at present, it will become impossible to get good men to come forward as candidates for inspectorships. Nothing but a grave concern for the future of this department would have induced me to bring up this most distasteful subject; but I feel that it is only fair to the men under me that their side of the case should be represented.

During the year 69,493 inspections were paid; 3,604 notices were served; 33 wells and 25 cesspits were closed; 567 houses were disinfected (exclusive of the 1,031 disinfected by the sub-inspectors); 4,465 prosecutions were entered, of which 3,827 were convicted, 410 were pending, and 232, or 5 per cent., were discharged or withdrawn; fines aggregating Rs. 33,052 were imposed, representing an average fine of Rs. 8·63 per conviction, which is almost exactly the same as in 1911. Of the prosecutions, the vast majority were as usual for filthy premises.

Sub-inspectors.—The work of the sub-inspectors is confined ordinarily to inquiring into and taking action in respect of enteric fever and phthisis, but their services have at frequent intervals to be requisitioned to act for sanitary inspectors, there being no Relief Sanitary Inspector.[1] During the year they carried out the disinfection of 531 fever and 419 phthisis-infected houses, and 81 houses infected by other diseases, making in all 1,031 houses disinfected by them.

Cleansing Gang.—During the year 812 filthy premises were cleaned out by the Public Health Department cleansing gang, 240 of those being premises where enteric fever had occurred.

Insect Prevention Gang.—2,957 premises were visited during the year, in 573 of which mosquito breeding places were found and abolished. Twenty-five prosecutions were entered in this connection, and twenty-four convictions were obtained. 104 pools were oiled.

This gang has since been handed over to Major James, I.M.S., who is conducting a stegomyia survey, and is organizing this work on a much more comprehensive and effective scale than has hitherto been possible.

Disinfecting Station.—The Equifex steam disinfector worked satisfactorily, 145 loads comprising 3,785 articles being dealt with during the year.

Municipal Free Dispensary, Slave Island.

The staff attached to this, which is so far the only municipal dispensary in the town, consists of a medical officer, an apothecary, two lady health visitors, and one midwife. The medical officer attends to the patients who call at the dispensary, and also visits such cases in their houses as are reported by the health visitors to be unable to attend. He also visits confinement cases at the request of the midwife. The efforts of the staff are directed as far as possible with a view to preventing infant mortality. In addition to paying systematic visits to all houses in the poor quarters, the health visitors are required to visit every house in which a birth occurs in their district, and to inquire into and give advice in regard to infant feeding. For this purpose a weekly return of all births registered in the ward is sent from the office to the dispensary, and in cases where hand feeding is found inquiries are made as to the nature of the feeding, and advice is given. Such cases are visited on an average four times. 131 cases of hand-feeding were thus detected and visited during 1912.

Although the infant mortality in this ward showed some signs of improvements during 1910 and 1911, *i.e.*, the first two years during which this dispensary has been in operation, it is disappointing to find that in 1912 it was again high, being, in fact, one of the highest infant death-rates in the town. Upon inquiring into this it was found that out of a total of 180 infant deaths in this ward during the year, no less than 77, *i.e.*, 42 per cent., were due to convulsions, no other single cause having been responsible for more than 18 deaths. It was further found that of these 77 deaths 21 occurred during the first and 20 during the second week of life, making in all 41 deaths, *i.e.*, 52 per cent. within the first month of life. As births do not, according to the present law, require to be registered before six weeks from date of birth, it follows that over half of the children born may die before this department hears of them.

This state of affairs has been dealt with in England, under the Notification of Births Act, 1907, by making it compulsory for the father, or in his absence by any person attending upon the mother at the time of or within six hours after the birth, to give the medical officer of health written notice of the birth within thirty-six hours of its occurrence; such notice being in addition to, and not in substitution of, the usual registration.

Municipal Midwives.

Six hundred and seventy-seven cases, representing 690 births, were attended by the six municipal midwives during 1912, there having been thirteen multiple births. Amongst the children born there

[1] Since writing the above a Relief Inspector has been sanctioned by the Council.

were thirty-nine stillbirths and thirteen deaths within ten days of birth, representing a death-rate (exclusive of stillbirths) of 1·93 per cent., which is considerably below the 1911 rates.

Municipal Enteric Hospital.

The medical officer of this institution reports that during the year 184 cases were treated, with 45 deaths, representing a case mortality of 24·4 per cent. The corresponding figures for 1911 were 354 cases with 77 deaths, representing a case mortality of 21·7 per cent.

Reference has been made in previous reports to the consistently high mortality amongst the cases sent from the female hospitals, and it has been suggested that some investigation by the authorities concerned is desirable. No information has, however, been so far received on the subject in this department.

As it was found impossible to obtain trained nurses for the enteric hospital, there being a very great scarcity of these in the town, two probationers were taken on, and are being trained under the matron. This system, although not so satisfactory as having trained nurses, works fairly well.

The health of the staff was well maintained during the year, none of them having contracted enteric fever.

Municipal Bacteriological Laboratory.

Dr. Hirst in his report gives an interesting account of the work which he has carried out during the year. The securing of the necessary appliances and stocks, most of which had to be obtained from Europe, occupied the greater part of the first half of the year; but by the end of the year the amount of work undertaken had reached the maximum which could conveniently be carried on in such a small laboratory. The present crowded state of the laboratory affords ample evidence of this, and it is advisable that provision should at once be made for extending the accommodation, and giving Dr. Hirst some assistants. As matters at present stand he has got no one who can in any way relieve him or act for him should a rush of work come, or should he become sick, or go on leave.

The work undertaken during the year included routine examination of the town water; examination of the water in the public bathing wells; examination of the milk supply; an investigation into the effect of the sewage effluent from the treatment works upon the river, and into the survival of pathogenic organisms in the sewage sludge; an investigation into the rat question with special reference to rat plague and rat leprosy, neither of which were, however, found; a collection and classification of ectoparasites on rats, in which connection it is noteworthy that the common plague flea was not found; an examination of all milk vendors with a view to the detection of enteric "carriers," none of which were, however, found; an investigation of the problem of whether fæcal organisms ingested by fly larvæ breeding in the trenches at Narahenpita survive through the stage of pupa and imago and can so be carried to the town, but so far no definite conclusion has been arrived at on this point, the investigation of which is hampered by considerable practical difficulties.

Early in May the work of inoculating municipal employés (free of charge) against enteric fever was with the consent of the Council begun, and sixty-eight injections were thus administered.

Colonial Medical Reports.—No. 66.—Shanghai Health Department.

ANNUAL REPORT FOR THE YEAR 1913.

By ARTHUR STANLEY, M.D., B.S.Lond., D.P.H.

Health Officer's Report.

Notwithstanding the almost complete absence of deaths from choleraic diarrhœa such as was so marked a feature of the previous year the death-rate remains at about the same level. When it is noted that 135 of the 307 deaths recorded among foreign residents were Japanese, and that 21 of these were due to beriberi, a disease which rarely affects non-Asiatics, care must be taken when comparing death-rates calculated since the great increase in the Japanese population and those obtaining in earlier years; that is to say, higher death-rates may now be expected, and these do not necessarily indicate that local conditions as regards health are not so good for the non-Asiatic community. Apart from this, however, the incidence of small-pox, typhoid fever, dysentery, tuberculosis, and scarlet fever were abnormally high, and their prevention calls for special attention.

As regards scarlet fever, in no country has any marked impression been made on its incidence by ordinary sanitary measures. In England it remains almost as common as measles, and natural immunity, the result of this prevalence, has produced a mild type of the disease. As the infection is almost entirely personal, in addition to the ordinary public sanitary measures, there is required for its adequate prevention a high general intelligence on the part of the community. If this want of success is met with in countries having all the benefits of modern sanitation and education, what can be expected in a community such as Shanghai made up of so many elements? An unfortunate factor also is the extreme virulence of the infection met with in China—scarlet fever in Shanghai is more than four times as deadly as it is in England; and there is no indication of a decrease in virulence.

Colonial Medical Reports.—No. 66.—Shanghai Health Department (*continued*).

As regards tuberculosis, the greatest health problem of the day in all countries, it will soon become possible to build more solid preventive measures on the foundations at present being laid among the Chinese which are mostly of an educational nature. That lung tuberculosis is excessively prevalent among the Chinese is very evident; and no scheme which does not include the Chinese community within its scope can have any permanent hope of success. A tuberculosis hospital has been put forward in this report for some years past as a desirable health requirement. Such a hospital will, besides providing a haven for tuberculous foreigners who are unable to go to sanatoria at home, serve as a centre for the organization of other measures which in a few years may develop into an adequate scheme for fighting the disease.

As regards small-pox, vaccination affords a means of prevention which is easy of application and for all practical purposes complete in its object. Foreigners still die of the disease as a result of the neglect of this obvious precaution. The Health Office has attacked the disease at its origin, namely, among the Chinese, by providing free vaccination at its sixteen sub-district offices during the proper season, that is to say, from October to December; and such a scheme is bound to be a benefit to all sections of the community. 13,000 such vaccinations during the year under review, mostly infants and young children, constitute a record in the history of preventive medical work in Shanghai, and also speaks well for the intelligence of the Chinese community in taking advantage of the measure.

As regards dysentery, typhoid fever, and that important group of bowel troubles including also cholera, sprue, &c., the preventive measures are almost entirely in the hands of the householder. The importance of sterilized food is gradually being recognized at home, and the need for such precautions is far greater in China, where the probability of food infection is much greater. When one recalls to memory the ghostly procession that yearly departs this life in Shanghai or goes home physically wrecked from these causes, it is extraordinary that more attention is not given to this important matter by the public generally. Every case of diarrhœa of any kind occurring in a household should be the special concern of those in charge of the messing arrangements, and should, with the assistance of the Health Office, be probed to the bottom. If the public would worry less about smells, which are the necessary concomitant of life in the Orient and never do anyone any real harm, and give more attention to the sterilization of food, it would be calculated to prevent untold suffering and ill-health. The measures necessary will be found simply put in the Public Health Notice, so that there is little excuse for the fine carelessness and trusting to luck which characterizes the average household. Life is interesting and delightful mainly because of its uncertainties, but it would not be so unless the certainties were respected. That the consumption of sterilized food will prevent cholera, typhoid, dysentery, sprue, and allied conditions is certain, and, being so, the simple rules of the Public Health Notice as regards food should be carefully followed until they become a sort of religious ritual.

There is, in China, no sanitary subject which better repays careful study than that of the disposal of refuse. No city in the world is probably so favourably served as Shanghai is in the disposal of all kinds of refuse. When it is remembered that 150,000 tons of ashes and kitchen refuse have to be removed yearly from houses within the Settlement and decently disposed of, it will be seen that this is a matter which is of considerable importance to the community. As long as everything goes well little heed is taken; but if any part of the organization were to break down even for a few days the public would be seriously incommoded. As a result of special attention to this subject a philosophy of garbage has been developed which has led to greatly improved methods. The earliest improvement was made in 1905, when the horse carts were replaced by Chinese wheelbarrows, a mode of conveyance which, though archaic, has the advantage of being able to penetrate practically anywhere. This led to the stopping of dumping refuse on the roads. Besides being an advantage from the point of view of both sanitation and general efficiency, this change reduced the cost of transport to the shoots to one-fourth. In the old days it was the custom to throw kitchen refuse out on the alleyway or road—this had to be swept up; an obvious waste of municipal labour. Various forms of refuse receptacles were accordingly tried, until finally a cement bin with iron lid and door was designed and fixed at suitable points in the alleys. The occurrence of plague helped along the scheme as it became necessary to keep rats away from house refuse, which is their main food supply. While these new garbage bins were rat-proof they were also fly-proof, and helped to minimize the fly nuisance. As a result of these measures the same number of coolies, who in the old days swept up the alleys and dumped the sweepings on the roads for the garbage carts to take to the shoots, were able to do the whole business of collecting the garbage from the new bins and conveying it to the shoots in barrows. Another example of economy combined, as it usually is, with increased efficiency. Having collected the garbage, it has to be disposed of decently and in order. In the old days it was all taken away by boats and dumped along the sides of the Soochow Creek, as may be seen by the unsightly heaps on either side of the Soochow Creek between Ferry Road and Jessfield, not to mention a considerable portion dumped in the creek itself, a practice which, even at the present time, it seems impossible to entirely prevent. As a result of careful organization the greater part of the daily mountain of house refuse is now actually a source of profit, being sold to country boatmen, who buy it for agricultural purposes—an ideal method of disposal, and one in accordance with the economy of Nature. Of the remainder, what cannot be used for filling and

raising purposes has still to be dumped. Regarding the latter, however, a demand has been educated for the stuff after it has lain two or three years in the lap of Nature, where it becomes purified and may be used for all kinds of filling and raising purposes. The natural purification of garbage is a most interesting subject, and one of considerable importance to the community. It has been found that the nuisance from flies and smell quickly disappears. The process of oxidation is so rapid that a heap of garbage becomes so hot that it cannot be touched with the hand, while the heap itself frequently ignites spontaneously and smoulders away into ashes. The main destruction of organic matter is effected in one year, and after two years only a trace of free ammonia is appreciable, although some heat remains in big heaps. After three years the purification is complete. Below the ground water level (say 3 ft. to 6 ft. below the usual level of the ground) no such rapid purification takes place, as immersion in water arrests combustion. The nitrogenous content of fresh garbage makes it a useful manure, which is increased in value by the quantity of ash (plant food) it contains, while its texture tends to make any soil mixed with it light and porous. The demand for agricultural purposes is thus readily explained. It is, in fact, the cheapest manure available, the average selling price at the shoots being 5 cents a ton. The cost of ultimate disposal of refuse, which in 1907 was 7.3 cents a ton, has been diminished annually, until during the year under record it was approximately 1 cent a ton. The cost of collection and disposal was 4½d. a ton compared with 9s. the cost of London refuse. And it is probable that the ensuing year may actually show a profit. It may be noted that this economy has gone hand in hand with increased efficiency—the highest aim of the organiser.

Vital Statistics.

The foreign population of the Settlement north of the Yangkingpang, including the outside roads and Pootung, at the last census taken on October 15, 1910, was 13,536, and consisted of 6,293 men, 4,172 women, and 3,071 children. The foreign shipping population, which numbered 1,755, was not included. The foreign population for the middle of 1913 was calculated at 14,250. The census of the foreign population taken at each quinquennial period since 1870 shows the following expansion: 1,666, 1,673, 2,197, 3,673, 3,821, 4,684, 6,774, 11,497, 13,536.

The Chinese population on October 15, 1910, was 488,005, and consisted of 227,175 men, 129,924 women, and 130,906 children. The Chinese population for the middle of 1913 was calculated at 510,000. The census of the Chinese population taken at each quinquennial period since 1870 shows roughly the following expansion: 75,000, 96,000, 108,000, 126,000, 168,000, 241,000, 345,000, 452,000, 488,000.

Deaths among the Resident Foreign Population.—During the year 1913 the total corrected number of deaths registered among foreigners, including non-Chinese Asiatics, was 367; of this number 307 occurred among the resident population.

Six months spent continuously in Shanghai is taken to constitute residence as in former reports. As the non-resident population is a variable and indeterminate factor, the deaths in this category are eliminated in the calculation of the death-rate. The death-rate per 1,000 per annum, therefore, calculated from 307 deaths occurring among the resident foreign population of 14,250, is 21·5, as against 21 in 1912. The deaths of 103 children (persons under 15) have been registered, as against 102 last year; of the deaths among adults, 126 were

Meteorology of Shanghai.

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Year 1913
Barometer.													
Mean inches ..	30·355	30·283	30·171	29·978	29·879	29·674	29·694	29·717	29·916	30·102	30·273	30·064	30·009
Departure from average ..	+0·033	+0·001	+0·003	−0·028	+0·007	−0·060	+0·084	−0·006	+0·009	−0·004	+0·080	+0·053	+0·010
Temperature.													
Mean degree ..	38·57	39·58	44·98	54·60	63·69	73·25	78·97	80·98	71·78	62·74	52·53	40·02	58·47
Departure from average ..	+0·75	+0·36	−1·05	−1·55	−1·81	−0·05	−1·39	+0·74	−1·17	−0·58	+0·68	−2·06	−0·59
Daily Range of Temperature.													
Mean degree ..	14·85	14·66	17·83	16·02	19·29	15·92	16·35	19·13	17·02	23·13	18·94	17·43	17·55
Departure from average ..	+1·67	+0·88	+3·45	−0·10	+1·59	+0·55	+1·02	+3·45	+1·28	+6·01	+1·22	+1·53	+1·88
Degree of Humidity.													
Mean (Saturation—100) ..	81·6	80·9	75·8	84·2	79·9	86·5	86·1	81·8	83·2	75·8	81·3	74·6	81·0
Departure from average ..	+2·1	+2·3	−3·7	+4·1	+0·2	+2·3	+1·9	−2·6	+0·1	−3·9	+3·7	−1·7	+0·4
Rainfall.													
Amount in inches ..	2·13	2·79	1·93	5·67	4·64	7·02	8·99	1·11	4·31	0·04	2·48	1·11	42·22
Departure from average ..	−0·07	+0·57	−1·65	+1·95	+1·06	+0·16	+3·39	−4·73	−0·20	−3·28	+0·66	−0·16	−0·19

The above figures have been kindly furnished for this report by Father Froc, Director of the Siccawei Observatory.

men and 78 women; of children, 55 were boys and 48 girls. The mean age at death among the adult resident population was 39·6.

Small-pox, the most obviously preventable of all diseases, levied a toll among the unvaccinated.

Scarlet fever, which killed so many in 1902, shows signs of increased prevalence.

Tuberculosis heads the list of fatal diseases both among foreigners and Chinese, and the prevention of this disease offers a fine field for future work.

Alcohol has been responsible for the deaths of eleven foreign residents during the year.

Lobar pneumonia, which ten years ago assumed almost epidemic proportions, caused seven deaths.

Beriberi is now a frequent cause of death among foreigners on account of the increased Japanese population.

In marked distinction from the previous year acute diarrhœa of choleraic type was not prevalent, but there was an increase in the number of cases of dysentery.

There were a large number of deaths among both foreigners and Chinese during August from heat stroke. The average maximum temperature from August 7 to August 20 inclusive was reported as 96·2° F., a period of excessive heat greater than had been observed in Shanghai for over forty years.

Deaths among the Chinese Population.—8,062 deaths among the Chinese have been reported, compared with 8,156, 8,329, and 9,663 in the three preceding years.

The death-rate per 1,000 per annum is 15·8. There were 207 deaths from small-pox, as against 124 last year. Both scarlet fever and diphtheria show increased prevalence. Of the deaths, 4,549 were male and 3,513 female. The deaths of 2,940 children (persons under 15) have been registered; of these, 1,572 were boys and 1,368 girls.

Infectious Disease.

Notification.—In the absence of legal obligation to notify, an arrangement has been made with the qualified medical practitioners of Shanghai requiring notification of infectious disease for the facilitation of preventive measures, in consideration of the use of the resources of the Public Health Laboratory for the purposes of pathological diagnosis and the payment of a fee of one tael for each case. The notifiable diseases are: Small-pox, cholera, typhoid fever, typhus fever, diphtheria, scarlet fever, tuberculosis, plague, anthrax, glanders, leprosy, and hydrophobia. Taels 239 was paid for notification fees, as against taels 385, taels 110, and taels 367 in the three preceding years.

The system of notification, so far as it goes, has worked well, and the best thanks of the community are due to my colleagues in general practice for their co-operation. Chinese cases are beginning to be usefully notified by Chinese practitioners educated according to the foreign standard.

During the year 126 Bills of Health for ships and cargoes were issued, as against 113 in the previous year.

Weekly returns of infectious disease have been exchanged so as to get in touch with the sanitary condition of places in the Far East in communication with Shanghai.

Isolation for cases of infectious disease among foreigners and Chinese is provided in the Isolation Hospital, Range Road, an account of the work of which institution will be found under Hospitals.

Disinfection.—10,369 rooms were disinfected, as against 2,162 and 7,122 in the two preceding years; 118,324 articles have been disinfected by steam, compared with 107,288 and 103,550 in the two preceding years. 24,288 articles were disinfected by formalin, compared with 29,704 last year. The Disinfection Station adjoins the Isolation Hospital. Prior to disinfection each disinfector puts on a sterile overall. The general method of disinfecting in a house after a case of infectious disease is, firstly, to remove to the station everything that can be disinfected by steam; then to spray and wash walls, floors, fittings, and furniture with disinfecting solution (cyllin). Fragile and delicate articles, such as bonnets, books, and photographs, are disinfected by formalin. In many cases, such as after typhoid fever or diphtheria, disinfection of walls, &c., is not considered always necessary, the washing with disinfectant being then limited to articles that have been actually in contact with infected material. After disinfection, painting or colour-washing of walls and ceiling is advised to be done by the occupier before the room is again occupied.

Small-pox.—The incidence of small-pox was considerable. Among the Chinese there were 207 deaths from small-pox, as compared with 124, 156, 304, 19, 143, and 863 during the preceding six years.

Small-pox is the typical preventable disease, and its presence or absence is an index of the hygienic education of a community. In Shanghai the Chinese are beginning to appreciate the benefits of vaccination as opposed to inoculation, which they have practised with little benefit for hundreds of years, and which is now illegal in almost all civilized countries.

Vaccination is done free for all Chinese and indigent foreigners applying at the Sub-district Health Offices. Vaccine is also supplied free to the Chinese hospitals in Shanghai. 13,029 vaccinations have been done by the Health Office during the year.

There is no doubt that vaccination repeated until it no longer takes always prevents small-pox. The criterion of efficient vaccination is inability to be vaccinated. In Shanghai there exists so much small-pox infection that vaccination should be repeated every three years until it no longer takes. Where previous good vaccination is not shown by white net-like scars, aggregating at least one square inch in area, particular care should be taken to get efficiently vaccinated.

The first principles of vaccination came from the

East, and thereon rests the basis of modern preventive medicine. The Chinese practised inoculation of mild small-pox as a protection against severe small-pox long before the days of Jenner. It is therefore probable that the Chinese will take up vaccination widely. Small-pox should soon be looked upon as a mediæval scourge, surviving only in countries imperfectly civilized.

Cholera.—In marked distinction from the previous year acute diarrhœa of choleraic type was not prevalent. An attempt was made to limit the facilities of the street hawkers in selling dangerous foodstuffs. Assistance was given by the managers of wharves in this matter. Practically all the foods sold hot are safe; also such articles as pea-nuts in shells; whilst cold food exposed to flies is notoriously unsafe. A proposal to limit the number of licences of fruit shops, which, perhaps, more than any other, are a sanitary danger, did not meet with general approval. It is now proposed to reduce the number of street hawkers by licensing at a monthly fee and to control, if possible, the nature of the produce sold with the object of reducing the sale of dangerous foods.

Attention was directed to the need of personal care in preventing the group of bowel diseases characteristic of life in Shanghai, which includes cholera and allied conditions, typhoid fever and dysentery and allied conditions. The same methods of prevention apply to all—namely, to eat and drink nothing that has not been recently boiled or cooked or otherwise sterilized.

Living in an alien country, the only sure way of securing purity of food is by sterilization. Sterilization means freeing from micro-organisms, especially the bacteria of disease. Sterilization may be accomplished best of all by heating to boiling point, as by cooking and boiling. The Berkefeld filter sterilizes water, provided the filter candle be boiled once a week at least. Canned goods, including butter, are necessarily sterilized during the process of canning, otherwise they would not keep. Bottled beverages of good reputation are practically devoid of dangerous bacteria. Ice is not sterile, and should not be put into drinks. Fresh fruit, tomatoes, melons, &c., may be effectively sterilized, without spoiling the flavour, by immersion for a few seconds in boiling water, any infection that may be present being invariably on the surface, provided the fruit be sound.

If the simple rule be observed of eating and drinking nothing that has not been recently cooked or boiled, or otherwise sterilized, it is practically impossible to contract any of those bowel troubles to which the Shanghai resident is especially prone. When this fundamental fact is grasped, "chills," "livers," and "cholera belts" will cease to be considered matters of importance.

Typhoid Fever.—The incidence of typhoid fever remains an important sanitary factor. The fatality of the disease, now that paratyphoid fever and Malta fever are less frequently included, approaches the true type. In nearly all cases where the origin was investigated obvious breaches of the ordinary rules of health, as laid down in the Public Health Notice, were observed.

The infection of typhoid fever may be conveyed by vegetables and oysters which have been contaminated with infected ordure, by water, by milk contaminated with infected water, through the air by means of infected dust, and directly from persons suffering from the disease or who act as "typhoid carriers" subsequent to recovery. Typhoid fever is a preventable disease, its prevention being largely a matter of individual care in the observance of the rules set forth in the Public Health Notice which has been issued to all applicants at the Health Office.

The cause of typhoid fever is practically always taken into the body with infected food, and the foods most commonly infected are vegetables, by reason of the manner in which they are grown. Especial stress should be laid on the fact that vegetables are frequently the source of infection with typhoid fever, cholera, dysentery, and other forms of diarrhœa, and particular care should be given to their thorough cooking and separation before cooking from the rest of the food. The larder or room for storing uncooked food should be separated from the pantry or serving room where table utensils, ice-chest, bread, milk, Berkefeld filter, and cooked food are kept. There should be a washing-up sink in the serving room, so that table utensils need not be taken into the kitchen to be washed. A place in the yard outside the kitchen for the washing and preparation of vegetables prior to cooking is an additional precaution that may be recommended.

Diphtheria of mild type was more than usually prevalent. Thirty-eight foreign cases were admitted into the Isolation Hospital without a death. Diphtheria antitoxin is supplied free to indigent patients in Shanghai on the recommendation of the physician. In any case of suspected diphtheria antitoxin should be given at once, without waiting for the result of the bacterial diagnosis.

Scarlet Fever.—The annual admission of foreign cases into the Isolation Hospital since 1902 has been 34, 7, 11, 11, 20, 70, 25, 9, 32, 22, 64, and 56. Of these 361 cases 65 proved fatal, a case fatality of 18·2 per cent., as compared with a case fatality in England of under 5. The case fatality has not markedly changed since the introduction of scarlet fever into Shanghai.

Although scarlet fever has hitherto failed to establish itself firmly in any part of Asia, excepting Asia Minor, and is practically unknown in the Tropics, it appears to have come to Shanghai to stay. Scarlet fever was practically unknown in Shanghai prior to 1900, when it was probably introduced by foreign immigrants. As would be expected with a recently-introduced disease, against which evolution has afforded no natural immunity, scarlet fever has been of a virulent type among the Chinese. It is probable that the passage of the disease through the susceptible Chinese has led to an intensification of the virus, so that it is more fatal to foreigners also.

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Early notification, isolation, and disinfection are especially necessary in dealing with such a fatal and infectious disease as scarlet fever is in Shanghai. The commonest mode of infection is from a previous case either by contact, by proximity, or by means of infected articles. The infection is given off by the breath in coughing and speaking, by the secretions of the mouth, nose, ear and throat, and possibly by the peeling skin.

The incidence during the year was sporadic, and indicates need for early isolation and disinfection to prevent an epidemic recurring among the vast mass of susceptible material which exists in the Settlement.

Tuberculosis.—The prevalence of tuberculosis remains at the same high level. The enormous death-rate is significant of local conditions of overcrowding, against which there is at present no legislation. The prevalence of tuberculosis bears little relation to climate, but is common wherever man closely aggregates. The spit of consumptives being infectious should only be received into receptacles which can be burnt or boiled, or the contents destroyed by strong antiseptics, fire, or boiling water. It is probable that most cases of tuberculosis of the lungs are contracted by breathing the infected droplets ejected by infected persons during coughing, sneezing, and speaking.

The prevention of tuberculosis is the greatest health problem of the day in all countries. Tuberculosis causes more deaths than all the other infective diseases put together. The prevention of the disease will be rapid and effective when the fact is recognized by all that nobody gets consumption otherwise than from another consumptive; mainly by inhaling tubercle bacilli sent out from the lungs of a consumptive living or working near. The spitting nuisance is relatively unimportant from the point of view of spreading consumption. The consumptive is the direct danger, and it is the fresh germs which are given out that sow the contagion. Once the spit is dried the germs are mostly dead. It is obvious, therefore, that the main thing is to obtain fairly complete separation of infective consumptives. But this cannot be done until the value of the measure is understood by the people. Education is essential to the success of this as of most other sanitary measures.

The main object at present is the education of public opinion on the subject. Lectures and handbills are being given to the Chinese explaining the danger of consumption and the way it spreads from one person to another. As regards the inauguration of an active campaign, it is considered too early to begin yet, although detailed plans for the future have been made so as to be put into operation when the public are ready for it. It may be noted that even in the home countries the struggle against consumption is still in a chaotic condition—in one country the sanatorium is discredited, and the main stress is laid on the importance of the Tuberculosis Dispensary. So much attention is, however, being now devoted to the subject that the most effective measures will finally be sifted out and become available for a model. A tuberculosis hospital here in Shanghai will relieve an urgent want and serve as a centre for the organization of other measures, which in a few years may materialize into an adequate scheme for fighting the disease.

The heart of the ideal scheme for the prevention of lung tuberculosis is the Tuberculosis Dispensary, which acts as head office, clearing house, diagnosis and treatment centre and information and instruction bureau for the entire movement. Two of these would be required for working a place the size of Shanghai. By entire scheme is, of course, meant going to the root of the problem by attack on both foreign and Chinese cases. Every case reported to the health officer would be visited by one of the outside nurses or inspectors, who would note the condition of the house, the number and condition of the inmates, &c. If the case has not a doctor attending he would be advised to see one, or, if too poor, he would be examined by a tuberculosis officer from the Health Office, who would advise as to the treatment to be adopted, whether at home, at the dispensary, the hospital, or sanatorium. The dispensary treatment is preventive, educative, and curative. The Tuberculosis Dispensary is the centre of the scheme for attacking the dreadful scourge of lung tuberculosis.

It is hoped, as soon as small-pox is practically exterminated, to engage in a campaign against tuberculosis among the Chinese. The establishment of a tuberculosis dispensary in connection with one or more of the Sub-district Health Offices, where treatment and advice as to preventing the communication of the disease to others could be given, would be the first step. As soon as confidence is established and co-operation gained there would be need of a hospital for advanced cases and a sanatorium for curable cases.

Plague.—Plague-infected rats were found in December, 1908. A complete plague survey of the Settlement has been maintained since. During 1913 13,333 rats were found dead and brought to the laboratory for examination, and of these 122 were plague infected, compared with 187, 249, 138, and 95 during the four preceding years. During the year nearly 153,000 rats were trapped and burnt. These, with the rats found dead and examined for plague, brought the total number of rats visibly accounted for to 166,333. In addition to the trapping, close on 6,000,000 phosphorous baits were laid, about a ton of poison being used, which proved a powerful method in dealing rapidly with infected foci. Poisoning on so large a scale carried with it certain risks, but, since using poisoned cubes coloured bright blue instead of the usual method of spreading the poison on bread, no cases of adventitious poisoning have been reported. 2,485 houses, in plague foci, were temporarily rat-proofed and pulicidally disinfected, bedding, &c., being passed through the steam disinfector. This temporary rat-proofing included the plastering up of rat holes, bricking up and wire-netting places permitting ingress of rats into houses; the furniture of the house being removed to permit of thorough

examination for rat holes and runs. 3,390 houses were permanently rat-proofed at an average cost of $12.20 each house by layiug solid ground floors, removing ceilings, lath and plaster partitious, and other hollow spaces so as to deprive rats of accommodation. All food shops are now required to be rat-proofed as one of the conditions of liceuce.

One human case of plague occurred of a boy of 14 who was admitted to the Chinese Public Isolation Hospital, where he died the following day. The diagnosis was confirmed by finding the plague bacillus. Four plague-infected rats were fouud in the immediate vicinity of the infected house, which was disinfected by sulphur dioxide, and subsequently permanently rat-proofed, as also were all the houses withiu the infected focus. During the month of June there was an outbreak of plague in Lower Yangtszepoo—8 human cases, bubonic in form, of which 7 were fatal. The block of houses where the outbreak occurred was an isolated one containing 102 one-storeyed houses, 77 of which were occupied, all in bad conditiou, and lying below the road level. The number of persons living in the block was 537. Three Chinese deaths from bubonic plague, confirmed by examination in the laboratory, were discovered on June 3. On June 4 three cases were removed to the Isolation Hospital. On June 7 and 10 a death from plague occurred on the focus. Neither rat nor human plague infection has previously been found in or near this locality. No rats were found in the space below the floors. The houses had no ceilings. Rats alive and dead, however, were found in large numbers among the roof tiles, and it is probable that infectiou was derived from this source. Pulicidal disinfection and general cleansing was rapidly done. This was followed by permanent measures—namely, laying solid ground floor and removing the roof tiles, and making them as far as possible rat-proof by closing the open ends with mortar. The outbreak was notable as showing that Chinese tiles are by no means a safe building material in places liable to plague infection. In October a case of plague occurred, and was removed to the Isolation Hospital. The district from whence it came was under special observation most of the year on account of the concentration of rat infection in that part of the Settlement for some time past. Plague prevention measures, especially permanent rat-proofing, were concentrated throughout the year on this sub-district, and it is considered that by these means a serious outbreak has been averted.

Amendment of the Building Rules, both foreign and Chinese, is urgently required to meet the danger from plague which continues to threaten the Settlement. Practically all the older foreign buildings are rat-infested, while recently erected houses soon become overrun by rats, including many of the large new blocks of offices with residential flats erected under the best available local conditions. The telephone building may be considered an ideal building from the point of view of plague prevention; on the other hand, foreign buildings with the usual ceilings and lath and plaster partitions may be considered dangerous. As regards Chinese houses, the presence of hollow ceilings and the use of the usual Chinese tiles which afford ample seclusion for rats constitute a grave danger. The local rat, which is mainly a roof rat, finds unlimited accommodation in such houses, although the ground floor be made solid. There is no doubt that if Chinese houses were built with a rat-proof roof and with solid floors throughout it would be a great safeguard against plague. The overcrowding and piling up of household goods also increases the danger by providing additional places for rats and bringing rats in closer touch with the inhabitants, and it is in houses where these conditions are most marked that plague cases have arisen. In addition to rat-proofing, shifting at regular intervals of furniture, &c., and general cleaning up is required to prevent the spread of plague.

A plague preventive measure of considerable permanent value has been the erection of rat-proof house refuse receptacles on Chinese property. A marked improvement in the cleanliness of alleys has resulted. It will be apparent that rats will thus be deprived of a vast store of nourishment, and, as the rat populatiou is to a large extent regulated by the amount of the available food supply, this is held to be a radical plague-preventive measure.

Although the initial cost of permanent rat-proofing is comparatively large, yet, if adequate building rules are promulgated and new houses built in accordance with the requirements of modern sanitation, not only will it be possible to gradually reduce to extinction the present large plague prevention staff, but this measure of permanently rat-proofing houses forms the greatest insurance against plague in the future, and is, in fact, the only permanent safeguard. A house permanently rat-proofed is not only a healthier one to live in, but is an almost certain guarantee against bubonic plague to the inmates.

Of the rats examined in the laboratory, about 70 per cent. were *Mus rattus* and the remainder *Mus decumanus*—rattus being the black or ship rat, which usually lives in houses, and decumanus, the brown or sewer rat. *Mus rattus* largely preponderated among those plague-infected. Of the fleas, *Pulex cheopis* and *Ceratophyllus fasciatus* have been identified, the former being the flea usually associated with the spread of plague from rat to man.

In formulating anti-plague measures the rat has been the chief objective, as it is held that the rat is the essential cause of epidemics, the flea being the carrier of infection from rat to rat and from rat to man, infection from human cases, which is practically limited to the few pneumonic cases which usually arise being comparatively rare. The dictum "No Rats, No Plague," has been taken as a working basis, and a house that is rat-proof has been considered for all practical purposes plague-proof.

Malaria.—A comparatively small number of cases of malarial fever, mostly of the benign tertian type, are contracted in and around Shanghai.

Periodic examination has been made of mosquitoes collected from each of the sanitary districts into

which the Settlement is divided, and the following have been found: Anopheles sinensis (malaria bearing), Stegomyia scutellaris (yellow fever bearing), Culex fatigans (the host of filaria), and Armigeres ventralis.

The prophylaxis of malaria resolves itself into (1) suppression of mosquitoes, (2) prevention of infection of man by mosquitoes, (3) prevention of infection of mosquitoes by man.

Every effort should be made by householders to do away with all receptacles of stagnant water, where mosquitoes breed, such as ponds, water plants, drains out of repair, abandoned tubs, pots, tins, and what not. The mosquito net should be assiduously used wherever there are mosquitoes, and especially in up-country houseboat trips. It is doubly necessary to surround a person suffering from malaria with mosquito netting to prevent mosquitoes being infected and acting as carriers of infection.

Beriberi.—The incidence of beriberi among the Municipal prisoners has diminished. The cause of this disease remains under close observation, though up to the present wrapt in obscurity. The evidence preponderates in favour of the disease being an infective one having no direct relation to food, but infective through body vermin.

Dysentery.—There was an increased prevalence of dysentery, especially during August and September. Most of the cases were amœbic in origin, and yielded to the new emetine treatment. Two deaths occurred from liver abscess among foreign residents.

Rabies.—Twenty-seven persons were bitten by rabid dogs within the Settlement during the year, and subsequently underwent the Pasteur treatment. The virus of rabies in Shanghai dogs is of an exceptionally intense character, the period of incubation being shorter than the rabies met with in dogs in Europe.

Leprosy is a disease which so seldom concerns foreigners in Shanghai that its study is somewhat neglected. Cases are met with occasionally, though it seldom figures in the death statistics of either foreigners or Chinese. There appears to be no urgent call for special preventive measures.

Dengue.—From its home in the Malay Archipelago, dengue has frequently during recent years spread up the coast ports to Shanghai. It very rarely kills, but frequently incapacitates from work a large section of the community. It is an intensely infectious disease, spreading in mass like influenza, but appears not to be spread by contagion.

Relapsing fever again made its appearance among Municipal prisoners. The examination in the laboratory of the blood from certain fever cases has shown that relapsing fever is probably quite common among the Chinese population, and occurs also to some extent among foreigners. This fever is much more prevalent in Shanghai than has hitherto been thought, a circumstance which may help in the future to clear up certain obscure cases of fever.

It is probable that infection is determined by the presence of body vermin, and measures which ensure their destruction will prevent the disease spreading.

Cattle plague prevailed in some of the dairies during the year. The mode of incidence appears to show that its origin is not in food nor is the infection carried by the coolies, but that insects are the probable means of spread. Immunization by Koch's gall method is usually available from the Municipal Laboratory, but seldom availed of. The ordinary preventive measures of isolating sick animals and thorough disinfection were carried out so far as possible.

Kölle and Turner's simultaneous method of immunization by virulent cattle plague blood and immune serum can be recommended as producing a greater degree of immunity than the gall method, but its application is more difficult, and there may be some slight loss of cattle as a direct result. There can be no doubt that were dairymen to have their cattle thus immunized they would be saved great subsequent financial loss from epizootics of cattle plague. No cattle were rejected from cattle plague at the slaughter-house during the year.

Public Health Laboratory.

Inasmuch as the study of the life-history of pathogenic organisms must precede all adequate measures for preventing the diseases which they cause, no pains have been spared to develop the resources of the Municipal Laboratory. It is the centre of work of the Health Department. Its purposes have been the investigation of diseases met with in Shanghai, the diagnosis of infective disease, the preparation of preventive and curative remedies against these diseases, and the analysis of products bearing on the public health. The matters which have been under investigation have been the causes of variation in virulence of small-pox vaccine, cholera antitoxic serum, the natural filtration of water through alluvium, the suitability of fruits and vegetables as media for the growth of certain pathogenic organisms, preventive inoculation against cattle plague, the causation of beriberi, the incubation period of the rabies in China, the prevalence of Malta fever, and the natural disposal of organic matter in house refuse.

The diagnostic service is being more and more utilized, not only by local medical practitioners, but by those in the outports.

Analyses.

Milk.—Five hundred and eleven samples of milk have been examined during the year, and of these 45 were returned as adulterated. In 40 samples the nature of adulteration was addition of water. Those which contained added water also contained starch, whilst starch was also present in one sample which was otherwise normal. Cream had been abstracted from three samples.

Many of the better known brands of condensed milks have been tested.

All were found to be wholesome and genuine preparations. A specimen of dried milk powder was examined and found to satisfy the claims put forward for it.

Over 300 samples of aerated waters and ice-creams were examined for bacteria, the biological contamination in the majority being excessive.

Anti-opium Remedies.—Nine samples have been examined for the presence of morphine or opium. One contained morphine and five contained opium, the latter amounting to nearly 20 per cent. in one specimen.

Toxicological Work.—Four analytical investigations have been made. In one specimen arsenic and in another morphine was detected. In a specimen of cooked rice, supposed to have been drugged by robbers as an aid to their designs on a house in the country, was found a mydriatic alkaloid, not positively identified, but having the characters of the alkaloids contained in Chinese stramonium (datura alba).

Miscellaneous Analyses.—These included analyses of bloodstains, urine, albumen, oxygen gas, cement, human milk, stomach contents after test meals, coal tar, paint, and road materials, medicines, &c., checks upon the consumption of kerosene and crude oil for mosquito extermination work were also made. Chemicals seized by the police in connection with the manufacture of bombs have been examined and identified.

Manufacture of Rat Poison.—2,500 lb. of phosphorus poison has been prepared for use in rat destruction. This preparation contains 1 in 80 of yellow phosphorus, and is coloured a distinct blue to minimize risk. It is issued in the form of small cubes.

Vaccines.—The supply of glycerinated calf vaccine has been widely distributed in the Far East. 20,005 tubes were sent out from the laboratory during the year—the equivalent of 100,025 persons protected against small-pox. The vaccine is sent out in tubes sufficing for five vaccinations, each tube bearing a label marked "Shanghai Municipal Laboratory," the date of issue from the Laboratory, and the number of the calf yielding the vaccine, so that any fault can be traced to the source. The vaccine is guaranteed to produce successful results for one month after the date marked on the tube if kept under suitable conditions. Vaccine is also sent out in bulk in rubber-corked tubes containing one or more grams, in which form it is convenient for making a large number of consecutive vaccinations.

As light and heat destroy the vaccine virus it is advisable to use it as fresh as possible and to keep it in the dark, and, during high temperatures, in an ice-chest. The vaccine is glycerinated and kept in the laboratory before issue with the object of eliminating extraneous organisms. It is obtained from calves proved healthy by *post-mortem* examination, and is tested as regards purity and activity before issue.

Those who have occasion to use small-pox vaccine during the warm weather should remember its great sensitiveness to even a moderately elevated temperature. It may be noted that vaccine at a temperature of 57° C. becomes inert in five minutes. Even at 37° C., a temperature often reached in summer in China, vaccine is rendered inert in twenty-four hours. On the other hand, at 5° C. below zero vaccine will remain unaltered for a year. Unless, therefore, there is some special reason, vaccination during the warm weather, say, between May 1 and September 30, is inadvisable in China owing to rapid loss of virulence at the prevailing atmospheric temperature. For this reason small-pox vaccine between these dates cannot be guaranteed effective. The best time for vaccination undoubtedly is in the early winter months; that is to say, before small-pox becomes prevalent. The Chinese, following their old custom of inoculation, still hanker after spring vaccination.

Plague, typhoid, and other bacterial vaccines have been sent out from the laboratory. The demand for bacterial vaccines prepared according to the methods of Sir Almroth Wright is increasing.

Anti-rabic Treatment of Pasteur.—Since the opening of the Shanghai Pasteur Institute in 1899, 393 persons have received the treatment. During the past year 41 persons were treated, in 24 of which the animals responsible were proved rabid by inoculation. Twenty-seven of the cases were the result of dog bites within the Settlement. Two cases died subsequently of hydrophobia, one four days and the other ten days after the completion of treatment, and consequently before its effects were fully established. They were both severely bitten, one of them on the face.

Eighty-six dogs were admitted to the Observation Kennels, eight of which proved rabid. Twenty-two animals suspected of rabies were examined in the laboratory, and of these twenty-one were proved rabid by inoculation.

The incubation period of rabies in rabbits inoculated with the brain of dogs sent to the laboratory for examination averaged thirteen days.

Hospitals.

In order to provide for adequate training of native nurses for the Chinese hospitals under the Department the learning of Chinese has been encouraged, and there are now five nurses studying the language with this object.

Isolation for cases of infectious disease is provided at the Isolation Hospital. There is a separate hospital for Chinese cases. Admission to either hospital is voluntary, and the institutions are for the benefit not only of the patients admitted, but of the community. Every endeavour is made to make the hospital as comfortable as possible and the surroundings pleasant, while the fees are arranged so that in no case may the question of payment of fees prevent anyone from coming into the hospital. Wherever possible the patients or their friends arrange for medical attendance. Admission to the Chinese Hospital is free, but a small charge is made for private rooms. In the Chinese Hospital patients may be attended by their own native doctors if they so desire. Considerable improvement is expected to result from the organization of the nursing of Chinese by Chinese under the supervision of the matron. It is gratifying to be able to report the increasing popularity of this hospital.

Colonial Medical Reports.—No. 66.—Shanghai Health Department (*continued*).

Ambulances are provided for the conveyance of patients suffering from infectious disease to the Isolation Hospital. Other vehicles used for conveyance of cases of infectious disease to the hospital are detained at the hospital until disinfected.

More accommodation is needed for cases among foreigners of minor infectious diseases, such as measles, chicken-pox, mumps, and erysipelas, and for observation of cases before diagnosis is confirmed. Isolated accommodation is also required for cases of tuberculosis among foreigners, for which there is at present no adequate provision in the Settlement. Were this provided benefit would accrue both as regards the prevention and treatment of this disease. At present if a case of consumption occurs in a family who cannot afford to send the patient away to a proper European or American sanatorium, he often has to remain at home, becomes a source of infection to those with whom he comes in contact, and lives under conditions which render small the chance of cure. On the other hand, were there adequate accommodation for isolation and treatment it would then be possible to remove the patient to hospital, where the hygienic conditions would tend towards cure, and a dangerous source of infection would be removed from the patient's own home. There is also need for dispensaries in different parts of the Settlement for the treatment and education in the means of prevention of Chinese cases of tuberculosis, for a hospital for advanced cases, and for a sanatorium for the treatment and isolation of curable cases.

Victoria Nursing Home.—The policy has been continued to make the nursing home as comfortable and efficient as possible in every particular. The main building was closed during May, June, and July for remodelling. A sanitary annexe was built which provides modern sink rooms, lavatories, &c., completely cut off by cross ventilation from the main building. A passenger lift was installed. The top floor was converted into private rooms for patients. The operation and sterilizing room was enlarged and improved. Cork linoleum and automatic door slams were fixed so as to minimize noise. Most of the private rooms were refurnished throughout so as to have them as comfortable and home-like as would be consistent with the proper treatment of the sick, which requires that a sick room should be simple, with as few hangings and dust traps as possible.

The Maternity Home was opened early in the year, has been well patronized, and appears to fill a long-felt want.

The *mental wards* appear to adequately fulfil their present function. Twenty-six cases were received during the year. Admission is procured by the signature on Form A or Form B obtainable from the matron. Form A requires the signature of the person immediately responsible for patient, who undertakes responsibility for payment of fees, provision of medical attendance, for procuring any order that may be required by the law of the country to whom the patient belongs, and for removal of patient after six months if still remaining in the wards. Form B is used when no one immediately responsible is forthcoming, the responsibility then naturally devolving upon the Consul of the nationality of the patient. There still remain cases where a Consul will not assume responsibility, and some sort of humane provision should be made for these cases to prevent them from becoming a nuisance or a danger both to the public and themselves, and at the same time to keep the mental wards from being filled with chronic lunatics, for which class of case they were never intended.

Police Hospitals.

Indian Police.—The health of the Indian police has been well maintained. The average number of days off duty sick was 6·2 days per man, as against 6·9, 6·5, 8 and 7 days in the four preceding years. Tuberculosis of the lungs was again the chief cause of invaliding out of the service.

Chinese Police.—Ten men were invalided on account of tuberculosis. Nine cases of relapsing fever occurred mostly among men living in their own homes. The average number of days off duty sick has been still further reduced. All were vaccinated during the year.

Chinese Prisoners.—Weekly inspections of the prisoners in cells at the various police stations have been made, and cases of skin and venereal diseases, which are very common, sent for treatment to the Police and Isolation Hospitals, resulting in considerable improvement in the condition of prisoners admitted subsequently to the gaol. Twenty-one cases of relapsing fever were admitted to the cells mostly in the incubation period; all stations were affected, the more severe incidence being in April. The spread of the disease was prevented by thorough disinfection from body vermin, isolation of cases, and segregation for fourteen days of contacts.

Gaol.—The improvement in the health of the prisoners has been maintained. Tuberculosis was again the main cause of death, most of the cases having signs of the disease on admission. Segregation of the tuberculous and of suspects is carried out thoroughly. The Chinese appear to have a low resistance against this disease.

Two new cases of beriberi occurred. From 1899 to 1901 the ordinary sanitary measures of isolation and disinfection were carefully carried out without success, no special measures against infestation with body vermin being taken. The new gaol, presumably vermin free, was then occupied, and at first no cases of beriberi occurred, in marked contrast to the severe infection in the old gaol. From 1904 till 1909 the cases of beriberi gradually increased, reaching a maximum in 1909, when the gaol was found infested throughout with bugs. During the last three years measures were taken to exterminate bugs which, though not entirely successful, are held responsible for the reduction in the number of cases of beriberi. The diet during the whole of this period was substantially the same. The west block at the

gaol was made vermin-proof during the year by making the walls smooth, replacing the wooden skirting boards by cement and by putting in cement ceilings below the wooden floors, so as to get rid of all cracks and crannies which might harbour vermin.

Most of the cases of dysentery were diagnosed microscopically to be of the amœbic type, and responded remarkably to hypodermic injections of emetine hydrochloride.

The *Municipal Sanatorium* was opened on May 1 and closed on October 31. Since its opening in 1907 the number of visitors each year has been 9, 71, 62, 76, 81, 108, and 87 during the past year, the blockage of the river and railway, caused by the insurrection, accounting for the lessened number. The difficulty of transport has been met by providing a houseboat to meet the railway at Hangchow (Kon Zai Chiao) connecting with Sanjaopu at the foot of Mokanshan.

Sanitary Inspection.

By means of a system, inaugurated six years ago, of examinations in sanitary knowledge as applicable locally, divided into three stages each carrying extra pay, health inspectors, recruited locally, are being trained to a higher state of efficiency. In addition, monetary encouragement is given to obtain, while on long leave, the certificates of the Royal Sanitary Institute and other examining bodies in touch with sanitary work. As a rule, our men find little difficulty in obtaining these home diplomas. The learning of Chinese by the foreign sanitary staff cannot but be a benefit in enabling them to instil the sanitary idea directly into the minds of Chinese residents.

The subsidiary health offices in each of the sixteen sub-districts into which the Settlement is divided for sanitary purposes have been further developed. Chinese houses have been rented and turned into pretty good local centres for sanitary work. Each sub-district office controls the sanitation of the sub-district in which it is situate, an area containing some 30,000 inhabitants, or 3,000 houses. Complete sets of books for record have been provided. Vaccinations are done weekly during the proper season; public health notices are distributed; inquiries are answered; deaths and cases of infectious disease may be reported, and lectures on sanitary matters are given weekly. The sub-district has been made the sanitary unit with its own complete staff, and the Sub-district Office is a Health Office in miniature full of possibilities for the future.

The circulation of public health notices in Chinese has been found to be a good way of propagating sanitary knowledge. The following notices have been widely distributed, namely, the general Public Health Notice, the Tuberculosis, Vaccination, Cholera, Plague Prevention and Mosquito notices. Each district has its fugleman, whose duty it is to collect crowds round him by means of a bell in the alleys and tea-houses, to whom he recites the notice appropriate to the occasion. A translation of such parts of the Annual Report as concern the Chinese population has been made and distributed. A translation into Chinese of the plague number of the *Municipal Gazette* has been made. A translation of the Public Health Notices into Japanese has also been made for the benefit of the Japanese community.

A Chinese of the better educated class is provided for each district to lecture on health matters once weekly at each sub-district office. The subjects taken are those appropriate to the season, such as the notices dealing with vaccination and small-pox, plague prevention by rat-proofing houses and rat destruction, tuberculosis, cholera, mosquito reduction, and general preventive measures. These lectures are calculated to remove ignorant prejudices and promote better feeling between the Chinese and the Health Office with a view to disease prevention. At many of the native schools the same lecturer gives short lessons to the pupils by arrangement with the schoolmaster, and is generally well received.

The question of plague has an important bearing on the construction of Chinese dwellings. This was recognized at the time the Chinese Building Rules were first drawn out. It is held that a house which provides places where rats may obtain seclusion is insanitary on account of the special danger the Settlement runs from plague. The amendment of the Chinese Building Rules made two years ago, which called for solid ground floors and prohibited hollow lath and plaster walls and partitions—the maximum that a committee of property owners would agree to—have done some good. But the building rules as they stand are not a sufficient safeguard against plague as was pointed out at the time, and has since been shown by cases of plague occurring in new houses erected under these amended rules. In these particular houses dead rats, undoubtedly the cause of the plague cases, were found in the hollow ceilings below the first floor and also among the roof tiles. After a practical experience of rat-proofing over 11,000 Chinese houses, it can be demonstrated that the ceilings below the first floor are unnecessary and, being dangerous through the possibility of harbouring plague-infected rats, should be prohibited. A very large number of these ceilings have been removed without complaint of any kind. A considerable number of the upper ceilings have also been removed in districts badly infested with plague, and the houses have been made quite comfortable; but in the case of the removal of upper ceilings some complaints have been received from the tenants, chiefly complaints of rain coming through the roof which, although primarily due to defective roofs, were made more noticeable by the absence of the ceiling, and complaints occasioned by the complete turning out of the tenants during these operations on the upper story. The removal of the upper ceiling also adds very considerably to the expense of rat-proofing operations. Latterly, the removal of upper ceilings has not been carried out, as the danger from plague through rats in the upper ceilings is less than in the

ceilings below the first floor in close proximity to the beds of the dwellers. For this reason, and the comparatively greater expense of the work of removing upper ceilings, it was considered a better plan to rat-proof a correspondingly greater number of houses by putting in solid ground floors and removing the ceiling below the first floor only. As a sanitary measure for the prevention of plague, it is therefore again strongly recommended that ceilings below the first floor of Chinese houses should be prohibited. It should be remembered that ceilings in Chinese houses are a foreign innovation, and by no means a desirable one from a sanitary point of view.

Foreign Dwellings.—Every house should, if possible, have a serving-room adjoining the dining-room and separate from the kitchen. The serving-room should be fitted with a washing-up sink, Berkefeld filter, shelves for all the table utensils, groceries, &c., and room for the ice-chest. It is held that the separation of the serving-room from the kitchen is an important means of preventing those food infections which are so prevalent in Shanghai, and which are brought into a house chiefly by infected vegetables. Cooking destroys the infective material, so that food that leaves the kitchen should reach the table without contamination. This can be ensured by having table utensils kept in, and the service of food done from, a serving-room kept quite separate from the kitchen. The serving-room should be rather a part of the dining-room than of the kitchen. As an additional safeguard, a place for the washing and preparation of vegetables prior to cooking may be provided in the yard outside the kitchen. A great number of foreign houses lack a proper serving-room, and use the space under the staircase for that important purpose. This space is usually too small, dark, and ill-ventilated, and is often without a washing-up sink. The wooden zinc-lined sinks are frequently abominable, and glazed earthenware sinks with proper waste pipes of lead should replace them.

Many foreign houses are infested with rats and, should plague become prevalent, may become a source of great danger. In these houses the gratings under the ground floor are generally found loose or broken, so that the interior of the house is easily accessible to rats, which then make use of all the hollow spaces which ceilings and lath and plaster partitions provide. It is advisable to have the ground floor as far as possible solid. The floor of the kitchen, larder, and outhouses should be solid and of cement if possible. Lath and plaster partitions are better avoided, but if used may be made fairly rat-proof by being made solid for about a foot from the floor, as rats generally obtain access by gnawing through near the floor level. The reinforced concrete method of construction is well suited to local conditions in view of the need for rat-proof buildings.

The disposal of house refuse is beset with difficulties, but they have so far been satisfactorily met. Careful checking has accounted for nearly every ton sent away from the shoots. "Country boatmen" have been encouraged to come to the shoots and remove house refuse for agricultural purposes, and of the total quantity brought to the shoots half has been disposed of in this way, and more than a fifth used for filling and raising purposes.

Observations extending over eleven years on the natural disposal of organic matter in house refuse, with frequent inspection of the garbage heaps, tend to show that within a year and a half all the decomposable organic refuse disappears by oxidation, which is tantamount to slow combustion—the heat generated spontaneously in a garbage heap being very considerable—and leaves an innocuous mass, without smell, which forms a suitable material for filling in low-lying ground and shallow stagnant pools. It is not necessary to go so far as to recommend its use for raising building sites to be used within two years, but it would be excellent material for raising garden sites and for filling the holes left near houses by the excavation of mud if not below the ground water level. In the large garbage heaps at the depôt the nuisance from smell and flies disappear after three months; and in properly conducted filling-in operations it is possible by covering recent house refuse with a layer of clean earth to remove nuisance from these causes and at the same time promote oxidation and destruction of the objectionable organic matter. In this way may be removed to some extent the further objectionable accumulation along the banks of the creek and the dumping of garbage into the waterways, which is difficult to entirely prevent. When it is remembered that every stagnant pool means mosquitoes, which are the potential cause of malaria, it is held that any temporary nuisance that may occur during the course of filling-in is outweighed by the sanitary advantages which subsequently accrue. This method, therefore, is advisable both from the point of view of economy and sanitation. Unfortunately, distance prevents the use of this method for the refuse from the crowded districts of the centre of the Settlement, unless some cheaper form of transport becomes available, *e.g.*, electric traction. House refuse should not be used for filling in below the ground water level as purification is much delayed under water, but deep places should be filled by mud from the surrounding banks leaving a larger shallow area which can be safely and effectively obliterated by house refuse.

House Refuse Receptacles.—Primarily as a plague preventive measure, in order to limit the food supply of rats, 3,879 house refuse receptacles, rat- and fly-proof, have been erected during the last three years. After years of experiment, the form of receptacle now erected appears to fulfil its object best. The Chinese like them and mostly use them instead of throwing their garbage outside their doors, so that in all save the worst neighbourhoods a marked improvement in the cleanliness of alleys is found. It is apparent that rats will thus be deprived of a vast store of nourishment, and, as the rat population is to a large extent regulated by the amount of the available food supply, this is held to be a radical plague preventive measure. The approved form of

receptacle is made of brick and cement or of cement concrete, is 3 ft. long by 2 ft. deep, with a sloping top having a small iron slam door which cannot be opened beyond the vertical, and so automatically shuts itself after house refuse has been emptied in, and having an iron door at the side with a special fastening, of which the house refuse removal coolie only has the key and through which the refuse is daily removed.

Drainage and Paving.—The defect usually met with, in the course of inspection, is that of blocked surface drains, due to absence of proper surface inlets. The use of gully traps with hinged grids with lineal openings is desirable, instead of the small circular openings at present so frequently used. Although the standard of drainage is improved, much is still required before the materials used are laid so as to obtain maximum self-cleansing and ability to stand the test of hard wear and tear.

Mosquito Reduction.—A special staff was organized which worked from the beginning of April until the middle of October. The results are considered satisfactory. The work of the Chinese staff required very careful foreign supervision. Co-operation was obtained from most foreigners, but the majority of Chinese showed a complete indifference, amounting occasionally to active opposition. No prosecutions were undertaken to enforce these mosquito extermination measures, but this would appear desirable in flagrant cases after repeated warning.

Flies.—Against what has been truly described as "the deadly house fly," the careful collection and disposal of house refuse is a measure of primary importance. Among other public measures has been the requirement as one of the conditions of licence, in premises licensed for the purpose of safeguarding the food supply, of adequate means being taken to prevent the access of flies to foodstuffs by the use of perforated zinc in windows and spring doors. This screening against flies is also an important individual measure and should be applied to the serving-room, kitchen, and servants' latrine; while cleanliness should be maintained in and about the house, so as to deprive the insect of food and of breeding-places.

All the *laundries* within the Settlement are licensed and regularly inspected.

The native lodging-houses and hotels have been regularly inspected and those of the lower class periodically disinfected, and permanently rat-proofed.

During the year all the premises licensed for public health purposes have been lime-washed, and cleansing operations of the nature of disinfection have been carried out in insanitary property in many parts of the Settlement.

Applications are still received from time to time for permission to instal water-closets. Foreign Building Rule 76 is now, however, quite clear and definitely prohibitive under all circumstances. The main object is the safeguarding of the water supply.

The practice of coating urinals with crude petroleum has greatly improved their condition, preventing deposit in a remarkable manner. In order to prevent disease carried by flies from infected fæces the fly-proofing of latrines was undertaken.

Food.

As the preventable diseases specially prevalent in Shanghai are mostly caused by infected food, food inspection has been considered of paramount importance. The foreign food supply is under complete sanitary supervision, and the same is gradually being done for the Chinese, premises being licensed as soon as the necessary conditions have been met.

The periodic analyses of water supply by the Shanghai Waterworks Company show that filtration is carefully done. The question of the prohibition of water-closets is one that chiefly concerns the purity of the water supply, and is therefore of fundamental importance to the community.

There has been a progressive improvement in the quality of milk supplied. The standard of cleanliness in dairies has been maintained. The windows of the milk rooms are now required to be unopenable and provided with perforated zinc instead of glass, and the door with a spring slam to prevent ingress of flies. Efforts are being made to prevent the smuggling of milk from unlicensed dairies in Pootung. As regards the result of punishment fining is the least effective, the offence being invariably repeated, while it tends to increase the price of milk to compensate for losses sustained. On the other hand, imprisonment and the cangue have a marked deterrent effect.

The licensed butchers, poultry, game, and vegetable shops have been kept in good sanitary condition. The regulation of fruit shops has presented great difficulty. Endeavour has been made to get the dealers to keep their skinned fruits in fly-proof cases, but with indifferent success. It is considered best to rely on the public, both foreign and Chinese, to sterilize fruit, as it is impossible to ensure that fruit is not exposed to infection by flies at some stage of its journey from the tree to the consumer.

Residents are requested not to patronize hawkers of fruit and other foodstuffs who come to their houses.

The examination of cattle and carcases at the municipal slaughter-house affords adequate protection of the meat supply.

Good meat is stamped with a circular stamp for beef and a triangular stamp for mutton, pork, and veal, with the words "killed municipal slaughter-house" and the date of slaughter. Meat inferior in quality, but free from disease, passed for sale on stalls only, is marked "second quality."

Colonial Medical Reports.—No. 67.—Federated Malay States.

MEDICAL REPORT FOR THE YEAR 1914.

By CHARLES LANE SANSOM,

Principal Medical Officer.

Vital Statistics.

In the early part of the year there was some reduction in population, and since August immigration has been stopped and a large exodus of people has taken place, therefore, to estimate population for the purpose of calculating death-rates and birth-rates with anything like accuracy is not advisable. There is no means of obtaining reliable figures, and guesswork totals are not of any real value or to be recommended. Two examples of interference with the normal increase of population are:—

(*i*) Twenty-two thousand and six Indian immigrants were quarantined in Port Swettenham during 1914, whereas 62,193 was the number in 1913.

(*ii*) Twelve thousand and ninety-three Chinese were passed through the camp for repatriation during 1914 and none in 1913, and there is no record of those who left this country without Government assistance. Taking all these difficulties into consideration, it will be seen that estimation of population with any degree of accuracy is not advisable.

The births in 1914 were 27,978.

There were 5,514 deaths of infants under 1 year of age, showing an infant mortality of 197·85 per mille. In 1913, the infant mortality was 221·6 per mille.

The deaths in 1914 numbered 39,003.

The death-rate of the principal townships are thus shown:—

	Population	Crude death-rate per mille	Corrected death-rate per mille
Kuala Lumpur	58,107 ...	54·42 ...	33·89
Ipoh	27,675 ..	51·8 ...	30·8
Taiping	21,577 ...	70·97 ...	45·78
Seremban	10,594 ...	116·57 ..	63·9

The crude death-rate is calculated on the total number of deaths within Sanitary Board limits. The corrected death-rate is calculated after excluding the deaths of those persons known to have been at date of death resident for less than thirty days within Sanitary Board limits.

Principal Causes of Death.

Malaria fever accounts for 13,634 deaths, or 34·95 per cent. of the total deaths.

Twenty-nine thousand seven hundred and twenty-seven cases were treated in the different hospitals in the Federated Malay States, with 1,793 deaths, as compared with 31,456 cases and 1,931 deaths during the previous year.

It is satisfactory to note improvements in the malaria figures for the different hospitals have been maintained and there has been a slight decrease in the number of victims from this malady, but the loss of life caused by this disease is very serious in a population of a little over one million. The actual mortality figures do not represent all the mischief caused by malaria, because an infected person is an easy prey when attacked by other diseases; the eradication of malaria would mean a low death-rate, higher birth-rate, and fewer infantile victims. Financial conditions have necessarily interrupted some anti-malarial operation, but it is to be hoped that immediately money is available, no delay will be made in continuing to prosecute a vigorous campaign against a preventable disease, the presence of which, in anything like the extent disclosed, should be reckoned a reproach to a Government if not very much reduced in the near future. It is noteworthy that general interest in the subject of malarial prevention still prevails, and it appears to me that there is a fairly large number of people convinced that the disease has got to be tackled vigorously, and there are many who are ready to undertake operations either independently or in co-operation with Government. Some very satisfactory work has been done on rubber estates with good results, and the report of the Malaria Advisory Board shows that what has already been undertaken continues to be very satisfactory. The distribution of quinine in tabloid form accompanied by a leaflet, giving instructions in two vernaculars as well as English, has been continued, and reports have been sent that it is very much appreciated and gives good results. The reduction in deaths from malaria may be reasonably attributed to anti-malarial measures and distribution of quinine.

Dysentery and *diarrhœa* was the registered cause of death in 5,235 cases, or 13·42 per cent. of the total deaths.

The total cases treated in hospitals were 5,982, with 1,429 deaths.

Beriberi accounted for 1,223 deaths, or 3·13 per cent. of the total deaths.

The number of cases treated in hospitals was 6,240, with 686 deaths.

Pulmonary tuberculosis accounted for 1,665 deaths, or 4·24 per cent. of the total deaths.

Year	Deaths	Per cent.
1911	2,300 ...	5·93
1912	1,354 ...	3·33
1913	1,623 ...	4·27
1914	1,655 ...	4·24

Return of Diseases and Deaths in 1914 in the Hospitals in Perak, Selangor, Negri Sembilan, and Pahang.

Federated Malay States.

GENERAL DISEASES.

	Admissions	Deaths	Total Cases Treated
Alcoholism	31	—	31
Anæmia	545	81	582
Anthrax	5471	686	6240
Beriberi	—	—	—
Bilharziosis	—	—	—
Blackwater Fever	17	0	17
Chicken pox	24	—	—
Cholera	109	39	—
Choleraic Diarrhœa	—	—	—
Congenital Malformation	—	—	—
Debility	—	—	—
Delirium Tremens	—	—	—
Dengue	22	—	—
Diabetes Mellitus	27	4	29
Diabetes Insipidus	—	—	—
Diphtheria	1	1	—
Dysentery	5704	1429	5982
Enteric Fever	73	34	76
Erysipelas	41	8	49
Febricula	—	—	—
Filariasis	—	—	—
Gonorrhœa	1037	10	1097
Gout	—	—	—
Hydrophobia	—	—	—
Influenza	—	—	—
Kalar-Azar	—	—	—
Leprosy	443	119	987
(*a*) Nodular	—	—	—
(*b*) Anæsthetic	—	—	—
(*c*) Mixed	—	—	—
Malarial Fever—	—	—	—
(*a*) Intermittent	—	—	—
Quotidian	—	—	—
Tertian	17295	1307	17792
Quartan	829	46	842
Irregular	368	44	368
Type undiagnosed	8775	287	9031
(*b*) Remittent	—	—	—
(*c*) Pernicious	—	—	—
(*d*) Malarial Cachexia	1604	109	1674
Malta Fever	—	—	—
Measles	50	—	52
Mumps	28	1	29
New Growths—	—	—	—
Non-malignant	79	2	79
Malignant	133	58	140
Old Age	—	—	—
Other Diseases	—	—	—
Pellagra	—	—	—
Plague	—	—	—
Pyæmia	7	7	8
Rachitis	—	—	—
Rheumatic Fever	—	—	—
Rheumatism	708	7	765
Rheumatoid Arthritis	—	—	—
Scarlet Fever	—	—	—
Scurvy	—	—	—
Septicæmia	34	28	34
Sleeping Sickness	—	—	—
Sloughing Phagedæna	66	16	70
Small pox	54	7	54
Syphilis	—	—	—
(*a*) Primary	583	1	642
(*b*) Secondary	3418	84	3680
(*c*) Tertiary	—	—	—
(*d*) Congenital	442	29	480
Tetanus	62	8	65
Trypanosoma Fever	—	—	—
Tubercle—	—	—	—
(*a*) Phthisis Pulmonalis	1644	842	1756
(*b*) Tuberculosis of Glands	40	10	46
(*c*) Lupus	—	—	—

General Diseases—*continued.*	Admissions	Deaths	Total Cases Treated
(*d*) Tabes Mesenterica	—	—	—
(*e*) Tuberculous Disease of Bones	—	—	—
Other Tubercular Diseases	—	—	—
Varicella	—	—	—
Whooping Cough	7	1	7
Yaws	55	1	61
Yellow Fever	—	—	—

LOCAL DISEASES.

Diseases of the—			
Cellular Tissue	2003	115	2113
Circulatory System	—	—	—
(*a*) Valvular Disease of Heart	320	107	334
(*b*) Other Diseases	117	23	121
Digestive System—	—	—	—
(*a*) Diarrhœa	1967	440	2084
(*b*) Hill Diarrhœa	—	—	—
(*c*) Hepatitis	48	7	52
Congestion of Liver	1	—	1
(*d*) Abscess of Liver	35	12	39
(*e*) Tropical Liver	—	—	—
(*f*) Jaundice, Catarrhal	69	7	78
(*g*) Cirrhosis of Liver	360	166	391
(*h*) Acute Yellow Atrophy	—	—	—
(*i*) Sprue	30	2	31
(*j*) Other Diseases	2229	167	2306
Ear	98	—	106
Eye	1227	22	1509
Generative System—	386	40	400
Male Organs	1741	19	1847
Female Organs	147	5	153
Lymphatic System	1484	21	1620
Mental Diseases	674	14	1265
Nervous System	817	133	956
Nose	27	—	27
Organs of Locomotion	543	21	594
Respiratory System	2189	190	2324
Skin—	—	—	—
(*a*) Scabies	1270	3	1319
(*b*) Ringworm	—	—	—
(*c*) Tinea Imbricata	—	—	—
(*d*) Favus	—	—	—
(*e*) Eczema	470	2	486
(*f*) Other Diseases	10131	156	11966
Urinary System	820	226	880
Injuries, General, Local—	5184	150	5447
(*a*) Sirisasis (Heatstroke)	—	—	—
(*b*) Sunstroke (Heat Prostration)	—	—	—
(*c*) Other Injuries	37	1	38
Parasites—	—	—	—
Ascaris lumbricoides	730	10	753
Oxyuris vermicularis	2	—	2
Dochmius duodenalis, or Ankylostoma duodenale	3636	473	3831
Filaria medinensis (Guinea-worm)	24	—	28
Tape-worm	158	1	153
Poisons—	—	—	—
Snake-bites	—	—	—
Corrosive Acids	—	—	—
Metallic Poisons	9	—	9
Vegetable Alkaloids	19	3	19
Nature Unknown	—	—	—
Other Poisons	28	3	28
Surgical Operations—	18	4	18
Amputations, Major	593	1	595
,, Minor	2530	2	2541
Other Operations	—	—	—
Eye	—	—	—
(*a*) Cataract	—	—	—
(*b*) Iridectomy	—	—	—
(*c*) Other Eye Operations	—	—	—

The number treated in hospitals was 1,786, with 849 deaths.

The Senior Medical Officer, Perak, remarks: "It is impossible to persuade natives to seek admission in the early stages, and without the intelligent co-operation of the sufferer a campaign against the insidious and elusive tubercle bacillus could not be undertaken with much prospect of success."

Pneumonia accounted for 1,081 deaths, equal to 2·77 per cent. of the total deaths.

Convulsions accounted for 3,136, or 8·04 of the total deaths.

Small-pox.

Perak.—Eighteen cases occurred during the year with four deaths, as against 134 cases with 38 deaths in 1913.

Selangor.—Sixty-two cases of small-pox occurred in the State during the year with seven deaths, including one European.

Negri Sembilan and Pahang.—Of the dangerous infectious diseases these States were particularly free. No cases of cholera or plague were reported during the year, only two cases of small-pox—one in Kuantan and one in Pekan. The latter was imported from Singapore on the last day of the year. Last year 36 cases with 13 deaths were recorded for Pahang.

There were twenty-four cases of *chicken-pox*, as follows: Perak, 15; Selangor, 7; Negri Sembilan, 2.

Measles occurred as follows: Perak, 17; Selangor, 15; Negri Sembilan, 4; Pahang, 298.

An epidemic of measles broke out in the mukims of Pengor, Tulong, and Tamai Pekan in August and September, and continued into October and November. There were in all 298 cases with one death. Persons of all ages were attacked from 6 months to 50 years old.

Cholera.—There were at Perak 506 cases with 230 deaths; Selangor, 57 cases with 53 deaths. Total: 563 cases, 283 deaths, as against 26 cases and 17 deaths in 1913. The outbreak at Lower Perak was a severe epidemic, a special Medical Officer and the Health Officer, Perak North, were on cholera duty for some time on the Perak River from Parit to Telok Anson. In Kinta, the majority of cases occurred at Batu Gajah Gaol and were transferred to the Isolation Hospital.

In Selangor, 51 cases with 47 deaths occurred at Sabak Bernam, and six cases, all fatal, at Quarantine Camp, Port Swettenham.

Ankylostomiasis.—The following cases were treated: Perak, 1898; Selangor, 1,180; Negri Sembilan, 534; Pahang, 219. Total: 3,831.

The Senior Medical Officer, Perak, reports that admission for ankylostomiasis are rapidly increasing as compared with the figures for the past three years. Every case of ankylostomiasis is diagnosed microscopically.

Dr. Hart states that a systematic examination of all patients admitted to Kuala Pilah Hospital showed that 50 per cent. of Malays, 30 per cent. of Tamils, and 25 per cent. of Chinese harboured the worms.

Year	Cases
1911	2,225
1912	2,485
1913	3,150
1914	3,831

The above figures for this disease would make it appear that there is an increase in its prevalence, although I am not prepared to assert that it is not so, yet it should be noted that from the latter part of 1913 I specially asked for a more systematic investigation of the excreta of patients admitted to hospital, and this has disclosed the presence of ankylostome in many more people than were suspected of harbouring the worm. Amongst Europeans in other countries ankylostomiasis produces very marked symptoms, causes great distress to the individual, and is a very serious disease. Its ravages in certain States of America, amongst Cornish miners and Italian labourers, roused attention, and necessitated very careful investigation and thorough treatment. As far as observation goes Eastern races do not suffer so acutely; in large numbers they show a certain amount of anæmia and debility, and naturally possess less resistance to other diseases because of this anæmia and debility; therefore it is a great benefit to them to be relieved of the worm. More general attention is being paid to the treatment of the disease and prevention of infection; in addition, a systematic investigation of its prevalence is contemplated. The impression appears to be that doses of chenopodium oil give the best results. It is seldom wise to attach little importance to a discase because for a time it happens to cause less serious results in a place than might be expected from the experience of people in other countries—diseases so frequently develop in intensity—therefore, in future, more careful attention will be paid to it.

Cases of *enteric* occurred as below: Perak, 11 with 4 deaths; Selangor, 52 with 24 deaths; Negri Sembilan, 6. Total: 69 cases with 28 deaths.

The figures for 1913 were 60 cases with 17 deaths.

Venereal Diseases.

Eight thousand and forty-three cases were admitted, as against 8,764 for the previous year.

These cases are the recently infected and do not include all those who suffer from ultimate results of infection; anyhow, they represent but a small fraction of the sufferers in the Federated Malay States where venereal diseases are very prevalent. Eastern races attach but little importance to these diseases unless much pain is caused or locomotion interfered with—even then they very often prefer to try and treat them with quack remedies. The Principal Medical Officer, Protector of Chinese; Senior Medical Officer, Selangor; Health Officer, Kinta; and Dr. Day formed a Committee, and made

some recommendations to Government on this subject.

The following operations were performed:—

	Major	Minor
Perak	326 ...	1,543
Selangor	278 ...	769
Negri Sembilan	296 ...	1,351
Pahang	9 ...	382
	909	4,045

Lunatic Asylums.

The Superintendent, Central Lunatic Asylum, in forwarding his fourth annual report of the asylum, reports as follows:—

	Males	Females	Total
There remained at the end of 1913	400 ...	98 ...	498
Admitted during 1914	343 ...	42 ...	385
Discharged	135 ...	25 ...	160
Absconded	18 ...	1 ...	19
Died	72 ...	11 ...	83
Transferred	1 ...	0 ...	1
Remaining on December 31, 1914	517 ...	103 ...	620

The total increase on the previous year is 126, made up as follows: Males, 117; females, 5; and criminals, 4.

This large increase is partly accounted for by a large number of chronics having been transferred from Selangor and Negri Sembilan.

Admission.—Of the admission, 191 males were direct and 151 transfer. In other words, 191 admissions were from Perak and 151 from the other States.

It may appear strange that, though the Central Asylum is a Federal Institution, there are two classes of admission, one for Perak State and another for the remaining States. This is, however, due to the method at present in vogue of keeping patients in certain centres for a variable time before transferring them to Tanjong Rambutan, and then, in many cases, sending them in batches, some large and some small. The size of the batches, I am happy to say, has diminished very considerably, thus giving one some chance of examining, and becoming acquainted with, the various patients. The delay has not been lessened very much. This is particularly noticeable in one district, where, in spite of remonstrance, it still happens that two months elapse between the certification of a patient and its transfer here.

This is partly due to the defective Lunacy Act, which was passed long before a Central Asylum or treatment of mental disease was thought of, partly other causes into which I cannot enter.

It will, however, be necessary to have the cordial co-operation of the Medical Officer and medical practitioners if the greatest benefit is to be obtained for the patients.

Amongst the females all were direct admission, as, though two of the admissions were from other States, they happen to come from districts where all concerned have done their best to minimize the delay inevitable at present.

When we come to study the recovery rate, it will be seen how important this matter of early treatment is.

Discharges.—On analysing the discharges we find that amongst the females 25 were discharged; of these 23 were discharged recovered.

Of the males, from direct admissions 90 were recovered, and from transfers 28.

Recovery Rate.—The recovery rates are as follows: Females, 54·76 per cent.; males, direct admissions (Perak), 47·12 per cent.; transfers (other States), 18·42 per cent.

It is only necessary to glance at this table to see the disadvantage under which the States other than Perak labour.

This recovery rate is exceptionally high, and will be extremely difficult to live up to. It is extremely gratifying, but may lead to disappointment in other years, when the rate is lower.

As to the reason for the high rate this year I cannot offer an explanation

While on the subject of discharges I should like to allude to the assistance given to discharged patients by the "After-care Association," which is composed of leading men of each nationality, from which our patients are drawn. This association, under the Chairmanship of the Protector of Chinese, Ipoh, helps discharged patients, who have no friends, or no work to go back to, to find work on leaving the asylum.

It has done very good work during 1914, and I hope in the future to be able to arrange for branches in the other States.

We have found employment as grass cutters, &c., for six discharged patients, and at present four are employed here. The only difficulty in employing ex-patients is that it is not advisable to employ them in the wards, and outside the wards there are few appointments.

Absconding.—The number of patients absconding is extremely high, I regret to say, but this can be, to a large extent, attributed to the fact that during the whole year building has been proceeding which necessitates openings in the fences, and the continual passing backwards and forwards of tukans and bullock-carts, so that the opportunities for escape were numerous. In a few cases, however, the escapes were directly due to carelessness on the part of attendants, necessitating in some cases dismissal. There were no escapes from the farms.

The two escapes amongst the criminals are a mystery, which, though inquired into both by myself and the police, have never been cleared up.

It is to be hoped when the additions to the institution have been completed that this high rate will cease, but until then I cannot hold out much hope of improvement in this direction.

Deaths.—The total deaths numbered 85, two of these being criminals. The deaths amongst the males, excluding criminals, 72, and females 11. The death-rate was 9·22 per cent.

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The commonest causes were as follows: Dysentery, phthisis, general paralysis of the insane.

Dysentery (30 deaths) was extremely prevalent; in fact, too prevalent, and, in spite of all efforts, is still present. It was principally—in fact, almost wholly—on the male side. The difficulties were largely increased by the number of patients admitted suffering from this disease. I have now, after making necessary repairs, begun to send all cases of dysentery to the Infectious Disease Ward, thus completely isolating them. It is too early yet to say what effect this will have.

Phthisis was the next most common cause, accounting for 15 deaths. This is what one would naturally expect, as asylum patients are very prone to develop phthisis.

General paralysis of the insane takes third place, appearing nine times. There can be no doubt now as to the presence of this disease in this country.

Several cases were admitted in an extremely bad state, and four died within a week of admission.

Fatal Accidents.—There were two deaths from ruptured spleen, and I believe I can fairly describe them as accidents.

In one case a patient was extremely excited, dancing, shouting, and gesticulating as he commonly did. He suddenly fell, and on the attendant reaching him was collapsed. He died within a few minutes, and the *post-mortem* showed a large rent in a greatly enlarged spleen. The evidence in this case is quite clear and convincing that there was no blow struck by anyone. What probably happened is that the man slipped and fell, and in his fall struck the edge of his bed.

The other case was that of a patient who snatched some tobacco from another patient and ran away. The owner of the tobacco followed the thief and struck him. Result: Collapse, death; *post-mortem*, a very large spleen ruptured.

In neither case could any blame attach to the attendants, as an excited patient may slip and fall at any time, and accident of an enlarged spleen could not be prevented. In the other case quarrels between patients arise with the utmost suddenness and are comparatively common, and their prevention in many cases is absolutely impossible, so that one has only to be thankful that ruptured spleens are not more common.

Post-mortem.—*Post-mortem* examinations were made in the case of 70 deaths. Of the remaining 15, nine were Muhammadans; in the case of the other six, the friends refused permission for *post-mortem*.

Suicide.—I am happy to say there has been no suicide during the year, though there have been many attempts. This, I believe, points to the fact that the attendants are paying more attention to their duty. Though sleeping on night duty is still too common, in spite of the fact that this offence is invariably visited with punishment, and if frequently repeated leads to dismissal.

Forms.—The commonest form of insanity amongst the admission is again melancholia, which appears seventy-nine times. Next in order is mania sixty-one, and confusional insanity sixty times. This latter appearing so frequently is due, to a large extent, to the number of cases due to malaria, which, though they may be either depressed or exalted, show as their most marked future confusion.

Alternating insanity appears on twenty-two occasions. This, I believe, is too high, but owing to the marked difference between the notes taken before transfer, the certificate, and the notes taken here, nothing was left to me but to return them as alternating, as it was only after prolonged observation they could be definitely proved to be of some other type.

General paralysis of the insane appears twelve times. It may be interesting to mention that there is at present in the asylum a woman who has been fed regularly with the nasal tube since September 9 last. At first I fed her myself, but soon handed her over to the matron, who has fed her ever since.

Ætiology.—Turning to the ætiological table we find malaria appearing, either as a principal or contributory cause, on thirty-five occasions. I am convinced that malaria is, in this country, a very potent cause of insanity, although I saw in the public press a supposed interview with a medical man, in another tropical country, in which it was denied that malaria was a cause of insanity. In this interview, however, the medical man was reported to have described malaria as "merely an exciting cause," which to my mind acknowledges the fact that it is a cause.

As a matter of fact, in our cases malaria was returned as a cause in many more instances than the thirty-five shown in the return, but I could not satisfy myself in the other cases that it really was so.

Syphilis appears twenty-eight times, but the number of syphilitic histories is far in excess of this number, though again I could only satisfy myself in twenty-eight cases that syphilis could be honestly blamed. Alcohol appears twenty-four times, and the number of Chinese in whom the attack can be attributed to alcohol is remarkable. Opium was also blamed in a few cases, but, though I have accepted it, I am very doubtful if it really exists as a cause.

"Gastro-intestinal system" appears eleven times. Intestinal parasites, I believe, are in some cases to blame. Certainly in two cases the improvement after the expulsion of round worms was very marked. So convinced am I now of the importance of intestinal parasites that an examination of the fæces is made in the case of every admission, as well as an examination of the blood and urine.

Privation and starvation appears ten times against two occasions last year. The War is to a great extent to blame for this, as at the commencement a number of coolies were thrown out of work, and suffered considerably. The condition of some of them on admission was pitiable in the extreme.

Most of these cases were admitted in the end of August and in September. It is interesting to note that in one case delusions were coloured by the war, the man saying that he was once protected from his enemies by the Germans. That though Chinese, he might with equal truth be called a German, and that when discharged he would go to Germany.

Another man attributed his attack to fear that the Germans would come here, as he heard they had sunk some British ships. Yet another amused himself by making a "popping" noise with his mouth, informing me that it was German guns.

A remarkable fact to be noticed in the ætiological table is the almost complete absence of heredity as a cause. This is due, I believe, to the fact that many of the Chinese are strangers in this country, and the person who fills the form knowing only the patient himself and is quite ignorant of his family history. Again, there is a considerable disinclination to acknowledge insanity, owing to the stigma unfortunately attaching to the insane even in this country. There were several cases which I am almost sure had an insane hereditary, but the relations and friends denied that there ever was such a thing as a case of mental disease in the family before.

In many cases the forms sent out to patients' relations or friends asking for information failed to reach the person to whom it was addressed, and was returned by the post office marked "addressee unknown." In a considerable number of these cases on the forms being then sent through the police they were returned filled up, the police appearing to be a better medium for the delivery of correspondence than the post office. As a rule, when the friends were found, they returned the forms filled up more or less completely.

Criminals.—It will be noted I have not included the criminals in the above tables except in the case of death-rate.

The criminals now live quite apart from the other patients, No. VI having been turned into a criminal ward.

Delusional insanity was the commonest form, and there is no doubt but that it is the form that most commonly leads to serious crime.

Two criminals were found not insane.

One interesting case of feigned insanity was tried early in the year. Though the man appeared in last year's return as not insane and was discharged in 1913, the trial did not come on till January, 1914, when the man was convicted of murder.

Our trouble with the criminals is the difficulty of getting rid of them when declared fit for discharge. There is still one awaiting removal who was reported "not insane" on December 8.

Attendant Staff.—The attendant staff has been, on the whole, satisfactory. Several cases of dismissal occurred amongst them, but in almost every case it was amongst those of under one year's service. It appears that the first year is the most critical, and that once weathered the attendants settle down to steady work.

The first examination was held in January, and the results were quite satisfactory; in fact, amongst the male attendants very satisfactory. A new class has attended lecture this year, and the examination will be held shortly.

The Staff.—I am glad to report that the staff has been most satisfactory, and has worked with a will all through. In fact, the recovery rate is a tribute to the work done both by the staff and the attendant staff, as, without their keen co-operation, nothing could be done, much depending upon them in this respect.

The long expected Assistant Medical Superintendent has not yet arrived. The home authorities failed to obtain a man, and, as a consequence, I am still alone, and am feeling the strain very much. I hope, however, when I return from leave that I shall be no longer single-handed.

MEDICAL INSTITUTIONS.

	Hospitals	Gaol hospitals	Lunatic asylums	Leper asylums
Perak ...	17	3	1	2
Selangor ...	13	1	1	1
Negri Sembilan ...	7	1	—	—
Pahang ...	5	4	—	—
Total ...	42	9	2	3

NUMBER OF IN-PATIENTS TREATED.

	Number	Deaths	Per cent.
Perak ...	45,595	3,811	8·35
Selangor ...	31,754	3,048	9·59
Negri Sembilan ...	17,054	1,405	8·23
Pahang ...	6,211	360	5·79
Total ...	100,614	8,624	

as compared with 100,660 and 8,653 deaths for last year.

Two thousand seven hundred and sixty-nine Malays attended Kuala Pilah Hospital as out-patients, against 2,600 in 1913. A Malay dresser from Seremban Hospital visited the kampongs in Seremban district once a week and dispensed medicine to 1,056 patients, and a dresser from Tampin Hospital did the same at Kampong Batu to 610 patients. The Medical Officer at Pekan also paid visits to the kampongs on the coast and treated 1,768 patients.

Leper Asylums.—There were 699 cases under treatment. 105 died and 31 absconded.

QUARANTINE STATION, PORT SWETTENHAM.

Twenty-two thousand and six immigrant coolies passed through the camp during the year, 13 of whom died in the quarantine station. Last year 62,193 coolies passed through the camp.

Early in August, at the outbreak of War, Indian immigration was stopped, and the camp was utilized for the accommodation of Chinese awaiting repatriation. In all 12,093 were repatriated. The new quarantine station was occupied on June 5; this establishment is designed on novel lines, and has been visited by many people interested in such places. The station is circular, each section

radiating from a centre where kitchen and store are situated, making the distribution of food, general observation over the whole station, and collection of refuse particularly convenient and labour saving. The sleeping sheds are of iron, with tile roofs and screened by a verandah; they are fitted with two tiers of bunks and have very ample ventilation, the floor is of concrete and "barrel" shaped, so that water used for cleaning purposes rapidly removes dirt and runs off quickly, leaving the surface dry very soon afterwards. These sheds are comfortably cool during the day, and provide adequate shelter from wind and rain during the night, and therefore are much appreciated by occupants. The drainage from each section is kept absolutely separate, and does not mingle with the drainage of any other section until it is outside the boundary of the station. Latrines consist of a cement trough sunk in a cement floor, short movable planks are placed transversely over the trough for squatting upon—the bottom of the trough is divided into sections by means of a small cement lip, so that a pool of water 2½ in. deep is found under each squatting place, each lip is carefully sloped on the upper side so that flow of water is not impeded—a flush tank is erected at the end of each trough which sluices at regular intervals. A hospital, disinfector, and adequate staff accommodation complete an excellent establishment.

Vaccination.—The figures for 1914 are lower because immigration was stopped. If the full number of Indians—viz., 62,193, as against 22,006—had been admitted as in previous years, vaccinations would show a considerable increase, so the number indicates satisfactory progress in the country itself.

Estates.

The number of estates from which returns are available is 672, against 609 in 1913.

The average number of labourers employed was 176,226, which is 12,711 less than in 1913. They are distributed as follows:—

State	Average labour force	Estates
Perak	67,751 ...	294
Selangor	75,631 ...	231
Negri Sembilan	27,782 ...	129
Pahang	5,062 ...	18

	Number of labourers	Deaths	Death-rate per mille per annum
1911 ...	143,614 ...	9,054 ...	62·95
1912 ...	171,968 ...	7,054 ...	41·02
1913 ...	188,937 ...	5,592 ...	29·6
1914 ...	176,226 ...	4,635 ...	26·3

Death-rate.—Perak, 22·18; Selangor, 29·8; Negri Sembilan, 34·48; Pahang, 16·19.

In the broken hilly country malaria is the principal cause of death; in flat lands lack of good water is largely responsible for sickness.

The reduction in death-rate is satisfactory, and as the figures for population and deaths are known, the calculations can be accepted with confidence.

Several causes contributed towards this diminution in mortality—anti-malarial measures, attention to the general well-being of labourers, which was encouraged in 1912, and has been a matter concerning which managers of estates have taken much more trouble, and further improvements in estate sanitation. There are some estates with a very high death-rate; on the majority of them those responsible are making efforts to reduce it. The causes are not due to neglect of ordinary precautions to secure good health, but principally due to locality and the difficulties in the way of undertaking anti-malarial drainage.

The Health Officer, Negri Sembilan, reports that recruiting in Negri Sembilan should be done in small numbers, and local recruits are often liable to be coolies who have been discharged from estates as being unsuitable for reasons of health; he also says, on the whole, the health on estates has not shown any improvement, rather the reverse. Four estates have a death-rate of over 80 per mille, and five estates have a death-rate among Indians of over 100 per mille.

During the year the Principal Medical Officer, Government chemist, and Dr. Whitby, chemical expert to a group of rubber companies, formed a commission to inquire into the composition of toddy, the favourite beverage of Indians. Some interesting facts were brought to light. It was curious to discover that toddy would not continue to ferment after about forty-eight hours, and did not become even then a strongly intoxicating liquor. The strongest toddy contained only 8·3 per cent. alcohol by volume; on the other hand, the prolonged keeping of toddy promoted the formation of considerable quantities of acetic acid—in some samples as much as two-thirds of an ounce of pure acetic acid would be formed in an ordinary bottle of toddy. The disclosure of these investigations on the nature of toddy should be of value to Government. In the first place unadulterated toddy is shown to be a comparatively harmless beverage, and although it has the reputation of causing intoxication, it should not do so except fairly large quantities are imbibed and unless spirit is added to it, and it should be possible to prevent this to a great extent. In the second place prolonged storage of toddy, so that it develops a large content of acetic acid, should be forbidden, a beverage containing so much poisonous acid being very harmful. If toddy manufacture is controlled there is every reason to expect an improvement in health of Indians, especially on estates.

It has been thought that the increase of Chinese estate labourers has contributed towards a lowering estate death-rate, because the Chinaman offers greater resistance to disease than the Indian, but the figures for the year 1914 showing race incidence amongst estate labourers do not seem to support this. In Negri Sembilan, for instance, the great difference between the two death-rates of the town Seremban should be taken into consideration, as the gross death-rate is probably largely made up of Chinese labourers belonging to estates, because they

leave a plantation and remove themselves to the town when seriously ill.

Veterinary.

An outbreak of rinderpest occurred in May, at 26th mile, Kuala Selangor-Klang road. There were 54 cases with 30 deaths.

Selangor.—With the exception of January, September, and October, foot-and-mouth disease prevailed all over the State during the year. There was a total of 3,906 cases with 86 deaths. The disease was as usual of the ordinary mild type.

Perak.—Three hundred and thirty-one cases were reported from this State; five died and 209 were destroyed.

Negri Sembilan.—One thousand nine hundred and sixty-nine cases of a mild type occurred amongst cattle in Negri Sembilan with 28 deaths.

There were two separate outbreaks in Ulu Pahang. 1,188 cases were detected with 20 deaths.

There were five cases of surra in Perak, one in Selangor, twenty in Negri Sembilan, and fourteen in Pahang.

Three hundred and forty-five cases of swine fever with 226 deaths were recorded in Selangor. A severe outbreak was found at Batang Malaka and Gemencheh (N.S.) during August. These places are situated near the Malacca boundary, and the disease was introduced from Malacca. Four hundred and fifty cases with 300 deaths were reported to have occurred before the outbreak was discovered, and a number of people had to be prosecuted for not reporting the disease. Fifty-seven cases with 38 deaths occurred subsequently, and at the end of the year the disease had been stamped out. Swine fever also broke out in the Seremban district during September, but was confined to certain areas, 271 cases occurring with 193 deaths, the majority of deaths being amongst young pigs.

An outbreak of *pleuro-pneumonia* amongst goats occurred in a herd brought from Kedah or Siam to Lenggong in October. Out of 34 goats, 30 died; 12 cases were also reported at Grit.

Quarantine Stations.

Two thousand six hundred and ninety-seven cattle were imported into Perak North *vid* Port Weld, Parit Buntar, Selama, and Upper Perak, as against 4,433 in 1913.

Two hundred and sixty-seven head of Government cattle were treated during the year by the Veterinary Department.

Port Swettenham.—Four thousand five hundred and eighty-four cattle were quarantined at this station. There were 23 deaths.

Bukit Sentul.—Two hundred and forty-three cattle were quarantined and 289 released during the year, including 51 left over from 1913; five deaths occurred and 103 cases of foot-and-mouth disease were treated.

Kuala Kubu.—Seventy-seven cattle were quarantined. There were 53 cases of foot-and-mouth disease, all of which recovered.

Negri Sembilan.—The quarantine stations at Tampin and Port Dickson were completed during the year.

Pahang.—The station at Teluk Sisek is now ready for reception of animals arriving at Kuantan by sea.

The ground for the Raub quarantine station has been selected, but nothing further has been done.

In dealing with all these outbreaks the Veterinary Department has shown energy and promptitude, and thus saved greater loss of life amongst cattle. The management of cattle quarantine stations has also been very satisfactory.

During the year there were 1,346 police-court cases, resulting 1,254 convictions, and fines amounting to $11,830 were imposed.

Meteorology.

Perak.

The mean temperature of the air for Taiping and Batu Gajah was 81·5° and 82·5° respectively.

The highest temperature recorded at Taiping was 96° in the month of May, June, and July, as against 94° in the months of February, June, and October, 1913.

At Teluk Anson and Grit the highest temperature was 95° and 98° respectively.

The lowest mean temperature was 79·5° at Klian Intan, 80·5° at Gopeng, Tapah, and Tanjong Malim.

The highest rainfall was at Taiping, 204·71 in., the highest annual rainfall recorded for the past ten years; 1914 was therefore an exceptionally wet year.

The Senior Medical Officer, Perak, reports that Taiping seems to be particularly unfortunate in the fact that, notwithstanding its excessive rainfall and abundance of streams in the adjacent hills, in the town and outlying villages after a dry spell of some ten days' duration, the supply begins to get scanty and much inconvenience is experienced. During the dry months of July and August the water supply to the town was cut off except for a few hours during the day. There was a serious outbreak of dysentery at Matang and Port Weld, the inhabitants suffered great hardship, water for prisoners at the gaol had to be greatly reduced, and at the hospital much inconvenience was experienced for the same reason. The public bath-houses were temporarily closed when really most needed.

Selangor.

Highest temperature: Kuala Langat, 105°; lowest, 60°.

Rainfall: Kuala Lumpur, 122·31 in.; Kuala Selangor, 65·68 in.

Negri Sembilan.

Highest temperature: Tampin, 98°; lowest, 68°.

Rainfall: Seremban, 92·68 in.; Port Dickson, 51·98 in.

Pahang.

Highest temperature: Kuala Lipis, 98°; lowest, 66°.

Rainfall: Pekan, 108·18 in.: Kuala Tembeling, 58·68. in.

Colonial Medical Reports.—No. 67.—Federated Malay States (*continued*).

General.

Dr. Fox, in the course of a very useful report, remarks on the value of hypodermic injections of quinine, says that 1,000 have been administered in Perak with good results, and that he cannot call to memory a single case of tetanus following injections in Government hospitals; in view of what has been said elsewhere this statement is of value. In Kuala Kangsar the death-rate from malignant malaria amongst hospital patients has been reduced by near 50 per cent. per mille, and this is attributed to the prompt intramuscular injections in serious cases. Dr. Fox also includes a report from the Medical Officer, Batu Gajah, disclosing a very good record of surgical and other work, a description of some interesting preparations of *Treponema pallidum* and *Pertenue* carried out by Mr. Lesslar derived from cases of syphilis, and an account of a successful operation performed by the Medical Officer, Telok Anson, on a prolapsed degenerated spleen found in the right iliac region, weighing 2 lb. 12 oz.

Dr. McClosky sends a carefully compiled statement for Selangor, Negri Sembilan, and Pahang. In it he refers to the rise in spleen rate in Klang from 7·57 to 11·72, to Dr. Hennessy's remark that great care and rapidity of examination of stools for amœbæ in cases of dysentery is essential, and that the mortality amongst maternity cases brought to the General Hospital, Kuala Lumpur, is still very high, because so many of the women are brought there too late to deal with them successfully.

In all the larger hospitals the training of probationer dressers has been carried out carefully, and the staff have spent much time and trouble in making subordinate officers efficient and capable; a high standard has been demanded of them, and is obtained.

The general condition of medical institutions throughout the Federated Malay States is very good and creditable to the officers concerned. There is a spirit of keenness to obtain the best possible results amongst all classes of patients. In my opinion the treatment of medical and surgical cases in our hospitals will bear favourable comparison with that found in any other country.

Government has always been ready to provide what is asked for in order to relieve the sick. This is appreciated by the staff, and encourages them to take a pride and interest in their work. I have pleasure in acknowledging assistance rendered by the Public Works, Government architect, and the Police Departments during the year.

Perak.

The new hospital at Ipoh was opened in November, 1914. There is now a second class male and female paying ward and maternity ward, the need of which was greatly felt in the old hospital. The accommodation in the new hospital is for 406 beds, as compared with 275 in the old institution. The new hospital is in every way an excellent set of buildings, and a distinct advance on hospital construction.

Malaria-Advisory Board.

At a meeting of the Board on March 2 it was decided to drain a defined area on Terentang Estate, Negri Sembilan, an intensely malarious plantation. This place was selected as having the most suitable features for a demonstration on the value of rural anti-malarial work; the drainage of the area is approaching completion, and a full report will be issued.

Dr. Wellington, Health Officer, Selangor, has made searches for anophelines in the model area, and failed to find any except a few amongst some weeds at the edge of Sidney Lake. Recommendations have also been made for improvement in drainage in other places.

Anopheles maculatus is now a comparatively rare mosquito in Kuala Lumpur; whereas in 1910 it was the commonest anopheline in the valleys, and accounted for much of the fever in the European residential areas. The absence of this mosquito is no doubt due to the extensive sub-soil pipe drainage, which has done away with the spring water pools and streams which formerly were so plentiful.

This is, however, not the only malarial carrier, and the survey shows that there are still a great many places on the flat land and at the sides of streams which need attention.

Batu Road swamp is still a danger spot. The Government have filled up their portion of the land, but nothing has been done on lot II, belonging to a private person. The larvæ of the following anophelines were recently found there: *A. rossi*, *A. kochi*, *A. barbirostris*, *A. sinensis*, *A. albirostris*, and *A. fuliginosus*. The last three are proved malaria carriers.

Institute for Medical Research.

Dr. Fraser, in his report, notes the results of experiments undertaken to show that beriberi is not transferred from one individual to another by means of pediculi, bugs, &c.

Some interesting experiments were made to cultivate the leprosy bacillus on media prepared from preserved fish; at the close of the year no culture had been obtained. Twenty-five leprosy inoculation experiments were performed without producing results.

Experiments were conducted with Dr. Kedrowsky's culture, which did not give evidence that the acid-fast bacillus of Kedrowsky is the leprosy bacillus.

Dr. Fletcher made investigations to determine if the value of the Wassermann reaction, as employed in the Institute Laboratory for the diagnosis of syphilis, is discounted by the occurrence of positive reactions in lepers—samples of blood were collected from the adjacent leper asylum—the sera were inactivated a few hours after the blood had been

obtained, and the tests carried out within twenty-four hours of the time at which the samples were taken; the method adopted was that of Browning, Cruickshank and McKenzie. In the place of the anti-oxhæmolytic system used by the authors of the method an anti-human system was employed; for purposes of comparison, 110 inmates of the District Hospital were examined for syphilis. The results were striking. The percentage of positive Wassermann reactions in the leper group was more than twice as large as that obtained in the control group of non-leprous patients. Dr. Fletcher remarks that, owing to the comparatively small number of cases investigated, it cannot be concluded on these grounds alone that the larger number obtained in the former group was due to the action of some factor other than syphilis. The luetin reaction was also applied to some cases of leprosy; there was not a single positive luetin reaction among the lepers, while among a control group there were no fewer than eleven. The evidence of the luetin reaction as applied to these cases of leprosy is negative evidence, and too much value should not be attached to it; but, as far as it goes, it is opposed to the view that positive Wassermann reactions in leprosy are due to syphilitic infection.

Summary.

(1) One hundred lepers were examined by Browning, Cruickshank and McKenzie's modification of the Wassermann reaction, with positive results in twenty-two cases. The amount of complement deviated was, in some cases, exceptionally large.

(2) In a control group of 110 non-leprous persons there were eleven positive reactions.

(3) In only one of the lepers was there visible evidence of former venereal disease, but thirty-three of the lepers admitted that they had suffered from syphilis or chancres, and of these thirty-three, thirteen reacted positively, while only nine of the remaining sixty-six gave positive reactions.

(4) In the control group, twenty-one admitted former syphilitic infection, and of these eight reacted positively. Among the remaining eighty-nine, who denied syphilis, there were three positive reactions.

(5) There were twelve positive reactions among forty-four cases of tubercular leprosy, and ten positive reactions among fifty-six cases of the anæsthetic type.

(6) The average duration of the disease, among the twenty-two lepers who reacted positively, was four years and eight months, as compared with an average of three years and eight months for the seventy-eight patients who reacted negatively; but among the latter there were many old-standing cases.

(7) Seventeen of the twenty-two positive cases were in an advanced stage of leprosy, and in some of them the disease was progressing; but among those lepers who reacted negatively there were also many advanced and progressing cases.

(8) Serum from the lesions in ten of the lepers who reacted positively was examined by dark-ground illumination, but in no case was the *Treponema pallidum* found.

(9) The luetin test was applied to twenty-one lepers, with negative results in every instance; thirteen of these cases gave positive and eight gave negative Wassermann reactions. The test was also applied to a control group of non-leprous persons, selected because they were likely to be latent syphilitics. In this group there were eleven positive luetin reactions.

The Conclusions to be Drawn from the Results.

There were no clinical criteria by which one could foretell the results of the application of the Wassermann test to the lepers who were examined, and, if it be admitted that the positive reactions were due to leprosy and not to syphilis, it is difficult to understand why some tubercular and some anæsthetic cases reacted positively, while others, clinically similar, did not; or why some actively progressing cases reacted positively, while others as active and as progressive gave negative reactions; but because the determining factor in these reactions has not been demonstrated, it must not be concluded that this is necessarily latent syphilis.

The number of positive reactions in the group of lepers was double that which occurred in the control group; but, in the former, a larger number of individuals admitted antecedent syphilitic disease.

A striking feature, in some instances, was the strength of the positive reactions given by the leper sera tested, not once only, but on several occasions. The deviation of complement in such amounts as fifty or thirty doses is, at least, a rare occurrence in latent syphilis.

The negative results of the luetin test and of the search for *Treponemata* are in favour of the view that the positive Wassermann reactions were due to some other cause than syphilis.

On the whole it appears probable, from the results of this investigation, that leprosy, apart from syphilis, may cause a positive deviation of complement when the serum is examined by the method of Browning, Cruickshank, and McKenzie.

Leprosy does not cause the luetin reaction to become positive.

Dr. Stanton examined several thousands of specimens of mosquitoes and larvæ sent for identification.

It was observed that the mosquito fauna of the neighbouring islands—Java, Sumatra, and Borneo—corresponds closely to that of the Malay Peninsula. The alleged absence of the species *Maculatus* and *Umbrosus* from Sumatra was found to be an error. Specimens of the first of these mosquitoes were taken by Messrs. Robinson and Kloss during their expedition to Korinchi Peak, and specimens of the latter by Dr. Schuffner near Medan, Deli.

The larvæ of a number of uncommon jungle mosquitoes were identified for the first time, and specimens sent to the British Museum for detailed examination. Differences were observed between the larvæ of the closely related anopheline species,

Sinensis and *Barbirostris*, which permit their specific identification. A new species of larva, related to *Anopheles culiciformis* of India, was obtained from the water in cut bamboos, but no specimens of the adult insect have so far been taken.

A new species of *Anopheles* was recorded from the Lampongs, Sumatra, and a new species of *Phlebotomus* (*P. stantoni*, Newstead) from the Federated Malay States.

The precipitin test for the origin of bloodstains was carried out in connection with various medico-legal cases.

The Director calls attention to the impression that apparently prevails that effective extermination of rats can be accomplished by use of one or other of the so-called rat viruses; he points out that, time and again, it has been shown that these viruses, in the conditions met with in actual practice, will not produce the results claimed for them that they are not innocuous to man. Unsatisfactory results were obtained in Africa, and in India the use of viruses has long since been abandoned.

Bacterial vaccines were prepared from twelve cases, and improvement or cure is stated to have followed their employment in treatment.

A number of worms alleged to be parasitic in man were received for identification. In several cases these proved to be well-known free living forms with which human fæces had become contaminated by accident.

Tissues received for examination numbered fifty-two. One specimen of nasal polypus was found to contain the protozoon, *Rhinosporidium kinealvi*. In three cases the negri bodies of rabies were identified. Other tumour tissues call for no special comment.

Deleterious Drugs.—There was a small increase in the number of these examinations. Of the 145 powders analysed, 123 were found to contain morphine hydrochloride and one morphine sulphate. In some cases the drug was fairly pure, but in many it was mixed with some cheap adulterant, usually milk sugar. Cocaine hydrochloride was found in six powders, in all cases in a state of great purity. Of the fifteen powders containing no deleterious drug, three consisted of quinine sulphate. Fifteen samples of pills were found to contain morphine hydrochloride. The remaining articles examined consisted of Chinese scales, hypodermic syringes, and porcelain bowls. In all of these morphine hydrochloride was found to be present.

There was a considerable increase in the number of waters examined. The systematic examination of the Taiping supply was continued, and a number of well waters from Taiping were also analysed. During the latter half of the year both sources of supply of Kuala Lumpur have been analysed twice a month.

Samples of the river water from Alor Star were examined during the outbreak of cholera in Kedah, and were found to contain an excessive amount of salt. Samples of water from wells sunk by the railway engineers at Alor Star also contained so large a quantity of salt as to render them quite unsuitable for steam-raising purposes.

There was again a decrease in the number of milks examined, following a large decrease in 1913. Only ten samples were found to be adulterated with water.

The systematic investigation of the milk supply of Kuala Lumpur, with a view to obtaining a milk standard, was resumed, but was again discontinued in August. The problem is complicated by the fact that the milk is obtained partly from cows and partly from buffaloes, and the milk of these two animals differs considerably. For the results to be of value, daily analyses should be made of the morning and afternoon milks obtained from individual cows and buffaloes. Hitherto it has not been possible to do this.

Twenty-four samples of alcoholic liquors were analysed completely, nine for alcoholic strength only, and four samples of stout were examined for adulterants. No foreign matter was found, but the samples were deficient in alcohol.

Nine samples of toddy were examined.

The miscellaneous analyses included samples of rice from North Borneo and Kedah, a deposit from the boiler tubes of a steam launch, samples of bread, tinned salmon, salted fish, yeast, wine, minerals, and an incrustation from the inlet and outlet channels of Ampang reservoir.

The special investigations included the analyses of samples of fresh milk already mentioned. A number of analyses were made of toddy obtained from local shops and in some cases direct from the tree. These experiments were undertaken for the Toddy Committee, with a view to fixing a standard for toddy. It was found that the alcoholic strength and also the acidity increase on keeping, at first rapidly, afterwards more slowly to a maximum which, in the case of the alcohol, is reached in three or four days. The alcoholic content then appears to decrease slightly, while the acidity continue to increase slowly.

During the year a preliminary inquiry was undertaken as to the characters of the bacilli commonly associated with dysentery in this country.

At the request of the Kedah Government an inquiry into a serious outbreak of cholera was undertaken by Dr. Stanton.

Cholera vibrios were isolated from a number of cases of the disease—from the intestinal discharges during life, from the gall-bladder, and intestine *post-mortem*.

Experiments were carried out to test the inability of freshly isolated cholera vibrios in water from various sources. A series of observations showed that such cholera vibrios inoculated into water drawn from the river at Alor Star could be recovered from it as long as eighty days thereafter, and that they were unchanged in their essential characters; similar numbers of cholera vibrios inoculated into similar quantities of Kuala Lumpur tap water were dead in less than twenty-four hours in nearly every case. A precise explanation of this remarkable difference was not obtained, though some evidence was forthcoming that it was related to the content of waters in inorganic salts rather than to their content in organic matter.

A means was devised for supplying to medical officers remote from the facilities of a laboratory the results of a bacteriological examination of material from suspected cases of cholera. Tubes of a medium favouring the growth of the cholera vibrio were supplied to health officers. Inoculations of the dejecta were ready for examination by the time the tubes reached the institute. Even in those cases which did not furnish a pure culture, it was found that the mixed growth could be tested by means of a cholera immune serum and the presence or absence of the specific vibrio speedily determined, the necessity of isolating the vibrio in pure culture before identification was thus done away with, and valuable time saved in the recognition of the disease in new areas.

During the year fifty-nine cases were examined with twenty positive results.

Dr. Fletcher continued his researches on the luetin reaction in syphilis with a fresh supply kindly forwarded by Dr. Noguchi. In one group of 130 individuals, 79 cases the reaction was positive and 51 negative, the proportion of positive results was least in primary syphilis, greater in secondary, and greatest in the tertiary stage. Results of the Wassermann reaction were compared with those of the luetin test in 100 patients; results were as follows:—

(1) Primary syphilis, 7 cases: Positive Wassermann reactions, 6; positive luetin reactions, 3.

(2) Secondary syphilis, 36 cases: Positive Wassermann reactions, 29; positive luetin reactions, 24.

(3) Tertiary syphilis, 66 cases: Positive Wassermann reactions, 35; positive luetin reactions, 48.

It appears that the action of luetin is specific; positive results occur only in syphilis; but, in cases of this disease, the proportion of positive reactions observed here was much smaller than that obtained by Noguchi.

The results of the luetin test in the group of syphilitics examined in the course of this investigation were not so frequently positive as in the cases examined by Noguchi and other observers in America. This divergence of results is probably due to: (1) The deterioration from storage of the sample of luetin employed here; (2) difference in the methods of treatment in force in the Federated Malay States and the United States of America respectively.

No positive reactions were obtained in persons free from syphilis; they occurred in syphilitics only.

The luetin test is so easily carried out that it would be of the greatest use in general practice if one could always decide, from the results of its application, whether a patient were, or were not, free from syphilis. Unfortunately, this is not the case, for while a positive reaction is of great significance, a negative result does not exclude syphilis.

When performed in conjunction with the Wassermann reaction the luetin test is of great value; in the early stages of syphilis the Wassermann reaction and, in the later stages, the luetin reaction is most constantly positive. In the great majority of instances one or other reaction is positive; but, in a given case, even though both reactions be negative, syphilis is not absolutely excluded.

MALARIA BOARD BUREAU, KUALA LUMPUR, F.M.S., MARCH 1, 1915.

By C. Strickland, *Travelling Medical Entomologist, F.M.S.*

My main work has been on the biology of the anopheline mosquito, the research which was asked to be carried out.

This research, as in a research on the biology of any creature, resolves itself into observations on the *habitat* of the mosquito with the correlated physiographical conditions; in fact, with every circumstance of mosquito environment, to paraphrase Dr. Bentley. This necessitates a preliminary study into the principles of geology, mineralogy, chemistry, phytology, zoology, meteorology, and, in fact, almost every ology. That is all that the research is, but as these diversities of environment not only need study in themselves, but also are so numerous, and their combinations almost infinite in number, it is really a very lengthy one. When one comes to think that Dr. Watson has only committed himself to practically two statements with regard to it in thirteen years, it will be seen that it is not a subject to be lightly talked about, and I am sure no scientist worthy of the name would venture to do so, with Dr. Watson's example before him, without a thorough examination of all the factors concerned.

With the ideal stated above I have continued my observations this year mainly in the *sawahs* of the Negri Sembilan, first in the Malacca River valley, and then in the Muar River valley, staying at Tampin, Tebong, Batang, Malaka, Gemas, Rompin, and Kuala Pilah. I also visited Rembau, and now consider that I have nearly enough observations on that part of the country. I also made short visits to Port Dickson, Terentang, Ulu Gombak, Morib, and Jugra.

Unfortunately, my observations were restricted to the first seven months of the year owing to the outbreak of the War.

With regard to the study of the morphology of the mosquito which stands in relation to the biology, as the A B C to writing, I have discovered that the larva of *Nyssomyzomyia ludlowi* is distinct from that of *Nyssomyzomyia rossi*, and have sent for publication to the *Bulletin of Entomological Research* a paper dealing with the comparative structure of the two species. I have, moreover, prepared a "Short Key to the Anopheline larvæ of the Peninsula," as a sequel to that on the adult flies, previously published. It is to be hoped that it will soon be published. It is illustrated by drawings from Miss O'Connor's pen. During the year my paper on the rare larva, *Lophoscelomyia asiatica*, appeared in *Parasitolgy*.

Colonial Medical Reports.—No. 67.—Federated Malay States (*continued*).

On the epidemiological side of the question I have sent for publication to *Parasitology* a paper on the outbreak of fever at Morib. I concluded at Morib that the fever there was truly endemic, and I recommended measures directed to exterminating the great numbers of *N. ludlowi* to be found there. I have since found a very interesting new form of anopheline at Morib which, quite probably, is the cause of some of the fever. This anopheline comes midway between *umbrosus* and *aitkeni* in point of structure. Experiments are now being directed to determining its pathogenicity. If it prove pathogenic the discovery will have been important, because *Culiciform* mosquitoes are not usually suspected, and, usually, are left alone.

The Morib outbreak was the subject of a special report, and other local reports were made concerning the area round Kampong Kapor Besar, Port Dickson, and on Kuala Pilah. Another one on the Terentang experiment has been prepared.

I also publish some notes in the *Journal of the Royal Geographical Society* on coast erosion at Morib, which show that man by his works sometimes defeats Nature's ends to his own detriment.

At the Bureau the "millions" have now well settled in the home prepared for them, and are increasing satisfactorily.

My work on malaria has left scant time for work on other insect-transmitted diseases, but I have collected a certain number of blood-sucking arthropods, I have published in *Parasitology* notes on the blood pathology in cases of East Coast fever, in the *Lancet* "On the Incidence of Plague in Europe," and have sent for publication in the *Bulletin of Entomological Research* a paper on a new species of *Stegomyia* found at Morib.

The Bureau came into occupation in May. I hope it will be a matter of satisfaction to Government that this, which was partly organized as a base for my field work, has enabled me perhaps to treble my efficiency in this matter of collecting observations and materials in my pursuit of fresh knowledge of the incidence of malaria all over the country. I am now getting the materials which I require at as great a rate as I can cope with them. In this, I am glad to say, I am ably and well served by my staff and assistants, who have now been with me some time, and have reached a high pitch of efficiency.

It is difficult now to see how I used to get along with all my specimens being taken about the country in boxes.

As I have said, the Bureau has been of great value to me in my researches, but it was hoped that it would fulfil also a useful function in providing knowledge on malaria and disease-producing insects generally to any of the public who wished to utilize the material there.

For this purpose it is necessary to provide specimens for exhibition to various grades of intellect, and this has been done.

The Comparative Morphology of the Anophelines Ludlowi and Rossi.

Some confusion existing in the minds of medical men in the Malay States as to the differentiation of the anophelines *ludlowi* and *rossi*, I have thought it worth while to give the following comparative notes of the two species, particularly as I believe that the larva of *ludlowi* has been previously held to be indistinguishable from *rossi*, whereas it is in reality very distinct.

My material was taken at Morib, Selangor, to which place I was sent in connection with an outbreak of fever; and I am much indebted to a Zeiss binocular dissecting microscope and to a small *camera lucida* for the figures which I give:—

The *egg* was studied in specimens both laid by mosquitoes and taken from their ovaries when ripe.

In estimating the comparative size of the ova it must be borne in mind that when using the microscope optical sections at the same place must be compared. Perhaps the best way to effect this is to rack the focussing adjustment up and down until the *greatest length* of the opaque part of the egg is seen in the species to be compared; the frilled cuticle can be disregarded because it seems to be variable in thickness even at the same plane.

Likewise, the broadest part of the float should be taken for comparative tests. The frilled cuticle varies in thickness, possibly due to foreshortening over different regions of the egg, being especially thick at the prow- and stern-points.

If these precautions are not taken it may appear that two species have different characters in the ova, while they may actually be similar.

It may be mentioned here that we think the usual statement that the floats of the egg contain air is not correct. What seems to be actually the case is that the frilled cuticle as well as the floats attach a thin film of air *on their surface* when placed dry on water.

When eggs are in the egg-sac they are immersed in body fluids, and so when placed in water the water can permeate directly into all the crannies of the cuticle, no surface film of air forms, and the egg sinks.

We found the eggs of two species indistinguishable in structure, and of practically the same size. The length of the opaque portion of the egg was the same in both cases, the floats were equally broad and the frills of the floats similar in size, and the frilled cuticle also similar in both cases.

The larva was studied in specimens hatched out from the egg laid by gravid females of either species. We found in both species the phenomenon observed by Stanton (1911) that the palmate hairs exist at first as merely buds, which finally open up.

The leaflets of the young larva are always more cylindrical than in the older specimens, which are much jagged at the shoulder-joint below the origin of the filament, so that, in comparing two species, larvæ of about the same size should be taken.

We observe the following:—

(1) That *rossi* has its frontal hairs, as described

by Stanton, the *internal anterior* hairs are excessively long and filamentous, the *external anterior* rather variable in length in different individuals, but usually not much more than a quarter the length of the former, while the posterior hairs, as Stanton first pointed out, lie considerably *within* the *anterior internal*, projecting over the clypeus.

On the other hand, in *ludlowi* the anterior internal hairs are not so excessively long and filamentous, while the posterior hairs invariably in the different individuals lie almost in a direct line with them. They are much finer than in *rossi*, and do not reach further than about the point of origin of the former.

(2) The palmate hairs of *ludlowi* are rudimentary on the first abdominal segment, and well-developed from the second to the seventh. In *rossi* they are similar.

(3) The relative length of the filament to the leaflet in *ludlowi* a little less than in *rossi*, but the distinction is too fine to be of any practical use.

The larva of *ludlowi* is, therefore, quite distinct from *rossi*.

As a certain amount of confirmation we may note that, given either adult *rossi* or *ludlowi* hatched out in our breeding bottles, we found in *every* case, although we need not have expected such favourable evidence, when we examined the larvæ remaining in the bottle, that they corresponded to the types which we now assign to the two species.

The adult. The imago.

In the adult stage we find (1) distinct palpal banding in the two species—*ludlowi* having a terminal white band succeeded by a black band of nearly equal width, whereafter is the other narrow white band; *rossi* having a terminal white band of much greater absolute length than the terminal band in *ludlowi* succeeded by a very narrow black band, and this by the other white band of similar width to the black band; (2) the size of the mosquito differs. The male of each species is bigger than the female, but the comparative size of the two species, sex for sex, can be judged from the figures. I think the two species can be diagnosed with the naked eye by their size alone.

(3) The general coloration of *ludlowi* is jet-black, rather like *fuliginosus* in this respect, but *rossi* is very light coloured; in fact, with the exception of *kochi*, it is perhaps the lightest coloured mosquito we have.

(4) The leg marking differs. *Ludlowi* is as spotted as *maculatus*, with the distinction that the spots are golden, whereas in *rossi* there is nothing more than a little tawny mottling due to the black leg scales not completely covering the chitin beneath.

With regard to the imago, it need only be said that in a series of 255, which we examined, there was never a fly which could not be referred to the one species or the other. I think the confusion which exists in the minds of medical men in this country is due to two factors: (1) That the palps when being examined have been foreshortened and the relation of the palpal bands is not seen; and (2) that old specimens of *ludlowi* lose the lustre in the leg spotting, and this is not then well seen, while, on the other hand, the tawny mottling which exists in *rossi* is rather increased in dry specimens, partly duc to contraction of the scales over the tawny coloured and partly to denudation.

We thus see that the diagnosis of the two species *ludlowi* and *rossi* can be readily made in either the larval or imaginal stage.

It is satisfactory that this is so with regard to the larva, for diagnosis of the larva in the field saves much trouble, is preferable if it is feasible to breeding out the imago.

An Outbreak of Fever at Morib in the Federated Malay States.

Morib being a seaside resort for the jaded European community of the State of Selangor, much consternation was caused when a succession of visitors there went down with fever.

I was thus enabled to visit the place and come to some conclusion as to the epidemiology of the outbreak.

The Endemicity of Fever at Morib.

In the first place, the question of endemicity arose. As to this, I ascertained that two of the cases in the European visitors were first attacked, one a lady, and the other her little daughter. Of course, it is not conclusive that the infection was not contracted elsewhere, for infections, such as malaria, for instance, are now known to sometimes arise in the human long before any symptoms reveal themselves.

The other Europeans who went down had all a previous history of fever, and their illness may have been due to relapse of the previous infection by reason of too much cold or fatigue.

But I turned to the native population round about, and immediately found that if the case-rate of a disease is any index to endemicity, then here whatever fever the natives were suffering from was truly endemic. Moreover, Mr. Munro, late President of the Planters' Association of Malaya, who lives here, informed me that fever has always been prevalent, and that only the recent large influx of visitors has caused attention to be drawn to it.

The following notes will show the distribution of the cases and the spleen index among the local population in the vicinity of the rest-house.

(1) The Government rest-houses. Four Chinese servants were questioned, and two admitted that they had had fever while serving here. The headboy, who had been at the rest-house for four years, had a greatly enlarged spleen.

(2) Among the Malay servants living near the rest-house there were two married couples, each with one child. The men both complained of suffering constantly from fever, and one of them had a greatly enlarged spleen; of the women, one only complained of fever, and she had an enlarged

spleen; while the children, who had been both born here, had high fever on them when I saw them, and had enlargement of their spleens. One of them was terribly anæmic and cachectic. The examination of the blood of the children was made, and parasites of malignant tertian were found.

(3) The Chinese landed gentry behind the rest-house. The towkay confessed to an occasional bout of fever, his son said that he himself had never had it, and he had no palpable enlargement of the spleen, and looked a fine, healthy chap; while his little sister was also reported never to have suffered, and she had no splenic enlargement. On the other hand, the coolie of the house was always ill, and he had great enlargement of the spleen and looked miserable. The blood of these people was not examined.

(4) Among the Chinese shop people of the village. The village lies about 100 yards from the rest-house as the crow flies, and any day that one went into the houses one could find a half-dozen of the inhabitants prostrate with fever. There were only two children who had been born here, and of these only one had a palpable spleen. An examination of the blood was made in six cases, and crescents found in two.

(5) Among the Tamil estate coolies who lived in lines adjoining the village. The manager of the coco-nut estate on which these Tamils worked informed me that they were always going down with fever, and that they then left the village to recover at a spot two or three miles inland. I palpated the spleens of eight of the coolies, and found five with definite enlargement.

(6) In a European gentleman's compound, 300 yards away from the village. The *orang puteh* himself suffered from a bad attack of fever when he first came here, while his servants are constantly down with it.

(7) Among the Malay kampong population. Three houses were visited. In two of them a little occasional fever among the children was confessed to, although in five cases no spleen was palpable. However, in the third house, under 100 yards away, two children were down with fever, and all four seen had enlarged spleen. Crescents were found in two of these cases.

Enough has, therefore, been said to show that the whole population here is subject to fever, and, further, the fact that the children of the stationary population suffer, and present signs of chronic disease, proves, almost conclusively, that the fever is *endemic* here.

The Mosquitoes at Morib.

It was necessary to establish the point that malaria was endemic here, for otherwise it had been useless to dissect mosquitoes to look for parasites.

My main object was to find out, if possible, which species was or were causing the trouble, and to what extent.

The following anopheline species were taken: *ludlowi*, *rossi*, *umbrosus*, *sinensis*, and *tesselatus*.

Now what was the relative importance of these species in the incidence of the disease at Morib? We know that *ludlowi* (Christophers), *umbrosus* (Watson), and *sinensis* (Tsuzuki) have all been incriminated as the actual cause of malaria, *i.e.*, they actually carried the disease under circumstances; but, nevertheless, it does not follow that because any one of these species were discovered at Morib that it was doing any harm.

For instance, I have found *ludlowi*, in great numbers, as Pasir Permatang over the river from Kuala Selangor, to mention but one place in the Malay States, and yet the natives never have fever there, and none of the children had enlargement of the spleen. Similarly, at Jeram, in Selangor, which is a village which could almost be changed with Morib without anyone knowing the difference except there is an additional Malay fishing community at Jeram, I found large numbers of *umbrosus* in the fishing community's huts, although the spleen index of the Malay children (fifty examined) is practically *nil* there.

As for *sinensis* at Alor Pongsu, in the State of Perak, the manager of an estate told me that at dusk anophelines came over like a flight of locusts, and I had the opportunity of seeing that, figuratively speaking, he was correct. I could easily have caught 100 *sinensis* in five minutes if I had wished to. Nevertheless, the manager's family and the children of the Javanese coolies who lived a few yards away never suffered from fever.

Enough has, therefore, been said to show that, although we found three reputed pathophers at Morib, we would not be *a priori* justified in saying that anyone was causing trouble at Morib. Now if we knew the relative rate of infection of the different species of anophelines under the circumstances which we are considering, and we knew their relative prevalence at the time, we could with certainty calculate the relative amount of harm that each species was doing, for the other factors are the same for all. For instance, supposing 1 per cent. of *rossi* and 5 per cent. of *ludlowi* become infected under the conditions obtaining at Morib, and we should find five times as many 0 *rossi* as 0 *ludlowi*, it is obvious that the greater or lesser relative prevalence of one species exactly compensates for the less or greater relative infectivity of that species, and that, therefore, the two species are exactly equally responsible for any illness which is occurring.

We, unfortunately, however, do not know much of the relative infectivity of the species under review. It would be extremely useful to any country if such figures could be worked out for that country, but as a great number of dissections would have to be made in order to obviate the "errors of random sampling," the research would need a big organization and considerable expense.

If we knew the relative infectivity of the various species, then in any situation we could soon find out the relative amount of harm which was doing by taking a mosquito census.

In coming to any conclusion, therefore, at Marib, we must rely on the restricted data at our disposal

which may hold some "error of random sampling," and to more general considerations.

We will, however, first note the relative prevalence of our species. These were captured within a space of nine days:—

Ludlowi, 236, of which 90 were ♀; *umbrosus* 39, of which 38 were ♀; *rossi*, 36, of which 15 were ♀; *sinensis*, 1 ♀; *tesselatus*, 1 ♀.

What we know of the relative infectivity of these species is as follows:—

Ludlowi.—Christophers in the Andamans found 2/53 *ludlowi* infected, and it is thought that the parasites which de Vogel found in a *rossi*-like mosquito were really found in a *ludlowi*. Horne in India has also lately reported finding *ludlowi* infected.

Umbrosus.—Watson says that he has found *umbrosus* infected, but he does not say what proportion he found so, and it is reported that the species has also been found infected in Borneo.

Stanton has noted that of eleven specimens which had been exposed to infection not one was parasitized. I have myself examined several—about six—previously, and never found one infected.

Rossi.—Eysell contends that several observers have found *rossi* infected, but it seems a matter of doubt whether the species had not been confused with *ludlowi*. Stanton has, however, found no infection in thirty-six dissected.

Sinensis certainly does become parasitized by the *Plasmodium* (Tsuzuki, Kinoshita, and Stanton found two out of ninety-eight specimens which had been exposed to infection growing zygotes).

Tesselatus.—Of this species nothing is known.

To these data must be added the result of my dissections at Morib as follows:—

Ludlowi, 80; *umbrosus*, 38; *rossi*, 13; *sinensis*, 1; *tesselatus*, 1; none were infected.

Conclusions on relative infectivity drawn from these figures would certainly be very fallacious; for instance, it will be noticed while Christophers found two out of fifty-three *ludlowi* infected; not one of eighty which I collected in a spot heavily infected with fever was so.

We can, nevertheless, say with some certainty that *rossi*, if infected at all, is only so to a much less degree than the others. Further, although *sinensis* has been found to the extent of about 2 per cent. to be infected, yet its presence in great numbers in certain districts without causing any fever is in marked contrast to what we read of the amount of sickness caused by *umbrosus* and *ludlowi*: it is, therefore, probably less infective than these two species. We have only a little indirect evidence which shows that probably *umbrosus* is not so infected as *ludlowi*.

The evidence is this: there was no fever, we caught large numbers of *umbrosus* in a few minutes, yet at Morib we caught only thirty-nine in nine days, and the lesser number is not likely to have caused more fever than the greater. The conditions, as said before, were almost identical. It is, therefore, probable that at Morib very little of the fever was being caused by *umbrosus* and most of it by *ludlowi;* in other words, in spite of *ludlowi* being twice as numerous, we can conclude it is the more infective mosquito of the two.

At Morib, it would seem when we consider these rough calculations as to relative infectivity with the actual relative prevalence which we ascertained that *rossi* and *sinensis* are both negligible factors in the situation, and this view is borne out by the cases mentioned above, where, in spite of great numbers of these species, there was no fever. The conclusion we came to at Morib was that *ludlowi* was the greater cause of the trouble, not only because of its greater infectivity, but also because of its greater numbers than *umbrosus*.

These conclusions by their necessary lack of precision show us how useful it would be if we had an accurate relative table of the infectivity of the different species, for we would then by merely counting the relative numbers of the prevalent species in any place find out exactly their relative culpability, and act accordingly.

With regard to the consideration of preventive measures, we may note here that it would seem that greater success might be anticipated from a campaign against a mosquito which was causing trouble more by reason of its larger numbers than its high infectivity, than against a mosquito which was of high infectivity and low prevalance, for it is obvious that a larger *proportion* of the former type would be found and destroyed. This theorem might account for the great success which has attended anti-mosquito efforts in places of the Federated Malay States like Port Swettenham, and for the comparative lack of results in the hill-country, for in a place like the former, *ludlowi*, the cause of the fever, is a mosquito of relatively low infectivity, but of usually great prevalence. It breeds in enormous quantities, a fact which is probably due to the larval characteristic, as in *rossi*, disappearing at the slightest approach of danger. On the hill land, on the other hand, *maculatus* and *albirostris* are never to be found in such great numbers, but they are of great infective powers.

It is a corollary to this to say that if fever is easily allayed in any community, by anti-mosquito works, none of the anophelines in such a place are highly infective.

At Morib, therefore, the prospects would seem excellent of greatly reducing the disease by anti-*ludlowi* methods.

Summary.

Consideration of the outbreak of fever at Morib in Selangor, Federated Malay States, impresses us with the great importance and utility of, if we possessed it, an exact comparative infectivity table of the various anophelines compiled on a comprehensive basis; for it is borne upon us by this outbreak at Morib that it is only by accurate measurement of a disease and the factors responsible for it that the disease can be economically treated.

At Morib we can only rely on general considerations, and conclude that the species *ludlowi* was causing most of the trouble.

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Further, because it would seem that the reason that hill-land malaria in Malaya, and perhaps in India, is so difficult to get rid of is because it is caused by mosquitoes of high infectivity and low prevalence, whereas on the low-lands malaria can be easily allayed because it is caused by mosquitoes of low infectivity and high prevalence.

It is a corollary to this that if malaria in any community can be easily allayed, it is caused by mosquitoes which are of low infectivity.

Malaria Board Bureau, Kuala Lumpur, Federated Malay States.

It will be remembered that when the fish first arrived in this country they were placed in the following situations:—

(1) In a concrete reservoir on Bukit Rajah Estate.
(2) In an earth reservoir on Midlands Estate.
(3) In a swamp at Seremban.
(4) In a mining hole at Seremban.
(5) In a plant-house tank in Sydney Lake Gardens.
(6) In a lakelet in Sydney Lake Gardens.

Those on Bukit Rajah Estate disappeared and have not been seen since.

On Midlands Estate the fish likewise disappeared, but subsequently reappeared in a nice little shoal. They have remained here ever since, and have increased greatly in numbers. It is unfortunate that they will now have to be moved, because of the concreting of the sides of the reservoir which is about to be carried out. We owe our thanks to the manager, Mr. Harrison, and to the acting manager, Mr. McGill, for the interest they have taken in this lot of the fish.

With regard to those placed in the swamp at Seremban, it was thought that they would not reappear for many a day because of the extensive nature of the swamp, but a short time ago I visited the place in which they were put, and it appeared to me that they had come back. It is possible that I mistook a local species of *Cyprinodont* for our species, for I had no means at hand to catch any for closer examination, but as those I saw were marked with red, as "millions" are, it is quite possible that here we have another culture of "millions" to draw upon.

Those placed in the old mining hole at Seremban disappeared, because the water did. The plant-house tank in the Lake Gardens have been very useful as a sort of nursery where no possible harm could be apprehended for the little fish. They have bred and increased quite satisfactory in this tank, and some still remain there, although most have been removed to stock what is hoped to be a permanent home for them.

Those in the lakelet, as I have already reported, seriously decreased, and the survivors were placed in the Gardens tank; none have since been seen in this lakelet.

The next stage has been the building of a special *breeding trough* of concrete, at this Bureau, and fish from the Gardens tank were used wherewith to stock it. They are now here, and increasing satisfactorily.

A few have also been used to stock two of the aquarium tanks which were built for the collection of local fish.

Power of Increase of "Millions."

We will here only draw our conclusions on this point from the culture in the Gardens tank. Here the fish were regularly fed, free of natural enemies, and undisturbed for a long period. Yet, although we did get thousands where we only placed tens, nevertheless *millions* were not produced as we had hoped. In fact, in spite of all the varying conditions in which they have been placed, they have not proved prolific breeders so far. It is quite possible that we have an exaggerated idea of their powers in this respect.

Naturalization.

To keep such creatures as "millions" alive by nursing them is one thing, to get them to breed while under protection is another (and in both of these we can congratulate ourselves on our success), but to get them to naturalize themselves, to look after themselves, and survive the competition of the natural world is quite another matter.

Each creature, it may be trite to remark, is so finely adapted to his environment—in fact, is the complement of his environment—that the *chances* are that he will not survive if taken out of the environment to which he is complementary.

However, we must remember that notable instances of the chances of survival of a creature being *enhanced* have occurred after importation into a fresh environment. The rabbit was an importation into Australia, and the lady-bird insect into California. Each has flourished exceedingly, and I may mention here that, although there were local species of lady-bird in California, which were ineffective in stopping the scale disease of plants, yet the imported lady-bird not only flourished exceedingly, but was effective in eradicating the scale disease.

The first stage of our experiment with the "millions," therefore, was to nurse them and to get them to breed, and the next stage has been to try to colonize them in the "natural waters" of the country. In this stage up to date we have, I think, had a notable success in the culture on Midlands Estate. Here the fish are not fed or protected in any way from natural enemies; in fact, "big fish" are constantly being caught in the reservoir, yet they have increased from eighty to many thousands. This place is just such a one in which "millions" will be placed for anti-malarial work in the future, and the outlook is therefore very cheerful. Moreover, if the "millions" have reappeared in the Seremban swamp a great success will have been achieved, for there are hundreds of thousands of acres of similar swamp in this country in which the

fish could be placed. We have chosen a very good place at Ayer Angat for an experimental culture in a swamp, and when the situation has been prepared for the fish we will be enabled to proceed a stage still further in our courses. The swamp at Puehong would, I think, offer a further suitable breeding-place for the fish.

Altogether the chances seem to me to be very rosy that this little fish will, with care, become one of the indigenous creatures of Malays.

Whether it will be as successful as was the lady-bird in California when it comes to eradication of disease remains to be seen.

" Millions " as Larva Destroyers.

When I came back from Morib on September 2 I found two of the aquarium tanks (4 ft. square) swarming with mosquito larvæ. I then put five " millions " in each of the tanks, and by September 10 I could not find a single larva remaining. Each fish must have eaten countless numbers.

Therefore, it is certain that if we can colonize these fish, that they must do some good even if they only eat one larva each during their lifetime. And when, as Sir Ronald Ross has shown mathematically, it is not necessary to do more than destroy a certain *proportion* of larvæ in order to completely eradicate malaria, I think the chances that they will prove efficient malaria-preventers are decidedly hopeful where they can be used for that purpose.

To summarize, we have very good evidence that we will be able to naturalize this fish, and *ipso facto* they will be efficient anti-malarial agents.

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MEDICAL REPORT FOR THE YEAR 1913.

By R. A. CLEVELAND,

Chief Medical Officer.

The general health and the sanitary condition of the island during the year has been very satisfactory.

The prevailing diseases were much the same as in the previous year, viz., malaria, diseases of the digestive, eye, and respiratory systems. Epidemics, limited in extent, of the following diseases occurred during the year: Small-pox, chicken-pox, E.C.S. meningitis, diphtheria, measles, and mumps. The island again enjoyed complete exemption from plague, cholera, and yellow fever.

An attempt has been made to improve the returns of births and deaths in the island. The returns are, I regret to state, incomplete, and also to some extent inaccurate. It is almost impossible to give

Vital Statistics for the Year 1913.

Returns of Births and Deaths in the Six Districts of the Island.

District	Estimated population on December 31, 1913	Deaths			
		No. of births	Under 5 years	Over 5 years	Total
Nicosia	85,164	2,407	625	988	1,613
Larnaca	31,075	881	227	411	638
Limassol	48,158	1,412	318	512	830
Famagusta	61,164	1,735	495	722	1,217
Paphos	40,241	1,411	300	476	776
Kyrenia	20,640	601	152	175	327
Total	286,442	8,447	2,117	3,284	5,401

details of cause of death, as the number of medical practitioners in the island is still too limited to insist upon a death certificate in every case. In the absence also of registrars it is difficult to attain accuracy. Still, these defects will be overcome in time, and meanwhile the returns are improving in reliability as the registering officers, usually Muktars, are being better paid for the work. The death-rate is not high, and compares favourably with that of other countries. The comparison with the Registrar-General's figures for 1912 for the United Kingdom is of interest:—

The death-rate for 1912 was 13·8 per 1,000, against 18·8 for Cyprus in 1913.

The birth-rate for 1912 was 24·0 per 1,000, against 29·4 for Cyprus in 1913.

Malaria.—The year under report has been an important one as regards this disease. March 20, 1913, will, I venture to hope, become memorable in the history of the island, as being the date of the arrival of the Malarial Expert, Sir Ronald Ross, K.C.B., &c., and the commencement of the campaign against malaria. His visit of a month was a short one, but it was sufficient for an inspection of the important parts of the island, and for a full and instructive report on the disease as it occurs in Cyprus.

A spleen census had been commenced prior to the expert's arrival, and under his direction it was extended, and was followed by a distribution of quinine, free to all children found to be suffering in this way. During the months of October, November, and December, a more extensive spleen census has been taken, and a large indent for quinine, in the form of tannate, has been despatched and will be distributed as soon as received. The latter census shows an almost general reduction in the spleen rates and in the average spleen figures compared with the previous one. I attach an

Return of Diseases and Deaths in 1913 at the various Institutions.

Cyprus.

GENERAL DISEASES.

	Admissions	Deaths	Total Cases Treated
Alcoholism	1	—	1
Anæmia	12	—	12
Anthrax	5	1	5
Beriberi	—	—	—
Bilharziosis	—	—	—
Blackwater Fever	—	—	—
Chicken-pox	—	—	—
Cholera	—	—	—
Choleraic Diarrhœa	—	—	—
Congenital Malformation	—	—	—
Debility	19	2	19
Delirium Tremens	—	—	—
Dengue	—	—	—
Diabetes Mellitus	3	—	3
Diabetes Insipidus	—	—	—
Dipbtheria	8	3	9
Dysentery	63	4	67
Enteric Fever	44	8	46
Erysipelas	3	—	3
Febricula	40	—	40
Filariasis	—	—	—
Gonorrhœa	19	—	21
Gout	—	—	—
Hydrophobia	—	—	—
Influenza	120	—	121
Kala-Azar	—	—	—
Leprosy	—	—	—
(*a*) Nodular	4	7	51
(*b*) Anæsthetic	8	7	58
(*c*) Mixed	—	—	—
Malarial Fever—	—	—	—
(*a*) Intermittent	—	—	—
Quoidian	138	2	139
Tertian	130	3	130
Quartan	25	—	25
Irregular	99	—	99
Type undiagnosed	33	—	35
(*b*) Remittent	1	—	3
(*c*) Pernicious	—	—	—
(*d*) Malarial Cachexia	—	—	—
Malta Fever	—	—	—
Measles	2	—	2
Mumps	—	—	—
New Growths—	—	—	—
Non-malignant	21	—	23
Malignant	18	2	18
Old Age	—	—	—
Other Diseases	—	—	—
Pellagra	—	—	—
Plague	—	—	—
Pyæmia	—	—	—
Rachitis	—	—	—
Rheumatic Fever	19	—	19
Rheumatism	64	—	64
Rheumatoid Arthritis	—	—	—
Scarlet Fever	—	—	—
Scurvy	—	—	—
Septicæmia	2	1	2
Sleeping Sickness	—	—	—
Sloughing Phagedæna	—	—	—
Small-pox	—	—	—
Syphilis	—	—	—
(*a*) Primary	14	—	14
(*b*) Secondary	10	—	10
(*c*) Tertiary	—	—	—
(*d*) Congenital	—	—	—
Tetanus	4	3	4
Trypanosoma Fever	—	—	—
Tubercle—	—	—	—
(*a*) Phtbisis Pulmonalis	—	—	—
(*b*) Tuberculosis of Glands	—	—	—
(*c*) Lupus	—	—	—
General Diseases—*continued.*			
(*d*) Tabes Mesenterica	—	—	—
(*e*) Tuberculous Disease of Bones	—	—	—
Other Tubercular Diseases	—	—	—
Varicella	—	—	—
Whooping-cough	—	—	—
Yaws	—	—	—
Yellow Fever	—	—	—

LOCAL DISEASES.

	Admissions	Deaths	Total Cases Treated
Diseases of the—			
Cellular Tissue	103	5	109
Circulatory System	—	—	—
(*a*) Valvular Disease of Heart	30	2	31
(*b*) Other Diseases	15	7	16
Digestive System—	—	—	—
(*a*) Diarrbœa	40	1	40
(*b*) Hill Diarrhœa	—	—	—
(*c*) Hepatitis	—	—	—
Congestion of Liver	—	—	—
(*d*) Abscess of Liver	—	—	—
(*e*) Tropical Liver	—	—	—
(*f*) Jaundice, Catarrhal	1	—	1
(*g*) Cirrhosis of Liver	19	2	19
(*h*) Acute Yellow Atrophy	—	—	—
(*i*) Sprue	—	—	—
(*j*) Other Diseases	253	9	256
Ear	10	—	10
Eye	86	—	94
Generative System—	—	—	—
Male Organs	29	1	29
Female Organs	62	1	65
Lymphatic System	21	—	21
Mental Diseases	26	4	100
Nervous System	50	8	55
Nose	19	—	19
Organs of Locomotion	—	—	—
Respiratory System	212	49	217
Skin—	—	—	—
(*a*) Scabies	—	—	—
(*b*) Ringworm	—	—	—
(*c*) Tinea Imbricata	—	—	—
(*d*) Favus	—	—	—
(*e*) Eczema	6	—	6
(*f*) Other Diseases	91	—	95
Urinary System	39	6	39
Injuries, General, Local—	—	—	—
(*a*) Siriasis (Heatstroke)	—	—	—
(*b*) Sunstroke (Heat Prostration)	1	—	1
(*c*) Other Injuries	235	2	243
Parasites—	1	—	1
Ascaris lumbricoides	—	—	—
Oxyuris vermicularis	—	—	—
Dochmius duodenalis, or Ankylostoma duodenale	—	—	—
Filaria medinensis (Guinea worm)	—	—	—
Tape-worm	—	—	—
Poisons—	—	—	—
Snake-bites	—	—	—
Corrosive Acids	—	—	—
Metallic Poisons	—	—	—
Vegetable Alkaloids	—	—	—
Nature Unknown	—	—	—
Other Poisons	—	—	—
Surgical Operations—	326	3	331
Amputations, Major	—	—	—
,, Minor	—	—	—
Other Operations	—	—	—
Eye	—	—	—
(*a*) Cataract	3	—	3
(*b*) Iridectomy	—	—	—
(*c*) Other Eye Operations	—	—	—

abstract of both. It will be noted that the latter census is much more extensive, nearly double the number of children having been examined. Speaking generally, the mountain villages are comparatively free from malaria, while it is more prevalent in those in the plains, especially in the low-lying parts of the Famagusta district, in the district of Larnaca, and in the villages on the Acroteri peninsula in the Limassol district. In one of these localities the spleen rate is very high, and in one or two instances, e.g., Vorokleni in Larnaca district, and Spatharico in Famagusta district, it reaches 100 per cent.

Abstract of Spleen Rate Figures, February, March and April, 1913.

District	Total examined	1	3	6	9	Spleen rate	Average spleen
Nicosia ...	3,980	3,424	319	158	79	13·96	1·51
Larnaca ...	756	380	256	95	25	49·73	2·57
Limassol ...	718	502	121	61	34	30·08	2·14
Famagusta	1,701	1,269	271	104	57	25·39	1·89
Paphos ...	1,074	838	119	68	49	21·97	1·90
Kyrenia ...	949	762	120	44	23	19·70	1·67
Total ...	9,178	7,175	1,206	530	267	21·82	1·78

Abstract of Spleen Rate Figures, October, November and December, 1913.

District	Total examined	1	3	6	9	Spleen rate	Average
Nicosia ...	5,083	4,497	479	92	15	11·5	1·3
Larnaca ...	1,542	893	540	80	29	42·0	2·1
Limassol ...	2,986	2,769	161	49	7	7·2	1·2
Famagusta	4,383	3,172	941	202	68	27·6	1·7
Paphos ...	3,100	2,676	311	86	27	13·6	1·4
Kyrenia ...	1,887	1,710	131	35	11	9·3	1·2
Total ...	18,981	15,717	2,563	544	157	17·2	1·4

The enlargements of the spleen are classed under 1, 3, 6, and 9, because these numbers are likely to give roughly the comparative sizes of the organs with no enlargement, and small, medium, and great enlargement, respectively.

As far as possible steps were at once taken to carry out the expert's recommendations. Five probationary sanitary officers were trained and appointed; two remained in Nicosia, while the others were sent to Larnaca, Limassol, and Famagusta. The anti-malarial measures adopted were chiefly directed to the principal towns and their environment, although all medical officers, district and rural, were instructed to give careful attention to these measures in their respective districts. Quinine in large quantities was distributed from medical stores, the stock being well maintained.

The subjoined figures show the total amount of the drug distributed in the year under report and in 1912: 1912, 3,280 oz.; 1913, 3,420 oz.

Larvicides were also used in considerable quantity all over the island. Experiments have been conducted in this direction, and it is hoped a substance has been found that will prove of service to the campaign. A mixture of crude carbolic, caustic soda, and resin, when prepared, has been found to form an emulsion with water, and a very few drops of this are sufficient to kill the larvæ of mosquitoes; a small quantity also added to petroleum causes the latter to spread rapidly and to form an excellent film, which is also rapidly fatal to the larvæ.

The district medical officers of Limassol and Larnaca were quick to adopt the recommendations of the expert, and it was soon remarked that mosquitoes were less numerous than usual. Drainage of certain swamps and marshy places was carried out in these and in other districts; notably, marshy land at old Papho, the Bampoula and St. Lazarus Marshes of Larnaca, swampy land near the village of Acheritou in the Famagusta district and other collections of water likely to form breeding grounds in or near important towns and villages. It was not possible during the year to carry the campaign to any extent into the rural divisions, but arrangements are being made to include these in the coming year, and to make it more general.

I am glad to be able to report that the returns show a considerable reduction in the number of cases of malaria treated by the medical officers during the year. The figures given below represent the number of cases reported in each district of the island, giving reduction of 2,693 cases of the disease compared with the previous year.

The reduction is more noticeable when the returns of the six chief towns are examined; the figures in every case compare favourably with those of the previous year, and a total reduction of 1,463 cases is apparent, which tends to show that the best results have been attained in and around the chief towns, where also the chief efforts at mosquito reduction were carried out. The following table gives these figures in detail:—

Number of Cases Treated at the Six District Dispensaries during 1912 and 1913.

	1912	1913
Nicosia	1,646	1,044
Larnaca	1,142	929
Limassol	1,279	1,069
Famagusta	945	805
Paphos	299	124
Kyrenia	508	385
Total	5,819	4,356

As indicated, however, in my report for 1912 under this head, the incidence of malarial fevers is greatly influenced by the rainfall, climatic conditions, &c., and it is necessary, therefore, to accept these figures with caution, as the improvement may not be permanent; future reports will demonstrate if it is so, and if the campaign is succeeding.

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Again, it is necessary to state that the figures only represent the cases seen and treated by Government officers, and do not, therefore, give the total number of cases occurring in the whole island. Taken on the whole, however, I am disposed to look upon the results of this first year of the campaign as favourable, and I venture to hope that, with its extension in the coming year, a still further reduction will occur, resulting in a gradual extermination year by year of the disease from the island.

Small-pox.—This disease was very prevalent in Asia Minor and Syria throughout the year. It was not surprising, therefore, to receive the announcement on April 14, 1913, of a case of the disease in the island. It was one of a man, a Cyprian, returning to his village near Nicosia, and the disease, owing to its long incubation period, did not appear until some days after his arrival.

Strict measures of isolation, quarantine of suspects and contacts, and disinfection with extensive vaccinations, were successful in limiting the outbreak to ten cases, the last of which was reported on July 26, 1913. Two districts were involved in the outbreak, Nicosia and Kyrenia; one case only occurred in the latter district. A total of 8,710 vaccinations was performed during the year.

Most districts are providing, or have provided already, isolation hospitals, which will facilitate the work of the department considerably in dealing with infectious disease.

As it is usual when small-pox occurs, cases of chicken-pox are also reported, and a few cases of this disease were notified.

E.C.S. Meningitis.—Unfortunately, this disease is still with us. Twenty-five cases with one death were reported during the year, against twenty-four cases in 1912. The rate of mortality was low, and they were of a milder type than usual. Strict isolation and curative serum treatment was resorted to in each case, and I do not think there is any danger of a great increase of the epidemic.

Diphtheria.—This disease has been more prevalent than in recent years. Twenty-one cases with three deaths were returned. In this disease also strict isolation with treatment by curative serum was promptly adopted.

Measles and Mumps.—Slight epidemics of these diseases were reported during the year; neither were of severe type, and the mortality was slight.

Enteric (Typhoid).—It is pleasing to be able to report a considerable reduction in this disease. There were about 100 cases less than in the previous year. The subjoined figures show the number of cases of the disease reported by the Government medical officers during the last four years:—

Year	No cases	Deaths
1910	334	8
1911	299	13
1912	447	3
1913	339	8

The disease, as often stated by me, is generally mild in type. It prevails on account of the scarcity of water and the carelessness on the drinking water.

During the hotter months of the year water becomes scarce in the towns and villages and the inhabitants are driven to surface well water, which is often contaminated. Improvements in the water supplies of the chief towns of the island would reduce the incidence of the disease considerably. Disused wells within municipal limits might then be closed down or filled in; this would have the additional advantage of reducing malaria.

Syphilis.—Owing to the recent advances in treatment this disease has received careful consideration. All forms of the new treatment by salvarsan have been available for use by the medical staff as soon as they were discovered.

It has been decided to await the report of the Royal Commission now sitting before considering what can be done in this direction.

The disease, however, is not very prevalent in Cyprus, and it is, generally speaking, milder in type than in neighbouring countries. A total of 202 cases is reported; of these 89 were primary, 105 secondary, and 8 inherited. No deaths are reported in the returns.

Institutions.

Hospitals and Dispensaries.—The total number of patients treated at the six district hospitals during the year was 19,332, against 23,396 in the previous year. The returns show a considerable reduction in the number of out-patients compared with the previous year. This reduction is doubtless in a measure due to the decline in the number of cases of malaria.

These institutions have been successfully administered, and excellent work in relief of the sick has been done by them. The surgical work, which was an important primary object in their foundation, has much increased. A total of 800 operations was performed; of these 334 were major operations, while 466 minor operations are recorded.

I regret that the efforts made to popularize the maternity wards of the Central Hospital, Nicosia, have not been successful. There were thirteen admissions during the year, against seventeen in the previous year, but four native midwives were trained and granted certificates, after satisfactory reports from the district medical officer and sister-in-charge. The total number that have received training since the wards were opened two years ago is eight, and the number of applications is increasing, but, unfortunately, the wards are often empty.

Rural Service.—The returns from the thirteen rural medical officers show a total of 13,481 cases attended, and the work done has been very satisfactory and a great boon to the people.

There is a gradual improvement in the condition of the Government district and rural dispensaries year by year, and the supply of drugs, instruments, and dressings has been maintained, and is sufficient for the requirements.

Lunatic Asylum.—The general health and the sanitary conditions of the inmates of this institution, who now number eighty-four, have much improved since the transfer to the new quarters. There were

twenty-nine admissions during the year, fifteen were released cured or partly cured, and nine cases terminated fatally. There is, I regret to state, a tendency to an increase of insanity in the island, due, in all probability, to the extended use of alcohol, and to the stress of modern life which is commencing to make itself felt in Cyprus.

Leper Farm.—There is a further reduction in the number of cases of leprosy in the farm. There were ninety-seven cases of the disease on December 31, 1912, while ninety-five are returned on the same date of the year under report. There were twelve admissions and fourteen deaths. There was one birth in the Farm during the year. Ten children are now living in the home in Nicosia. Four healthy children, born in the Farm, three girls and one boy, having been educated and taught a trade, and being also free from signs of the disease, were discharged to the care of relatives outside the Farm. Of the children remaining in the home none show any indications of the disease.

Quarantine Department.—During the year it was not necessary to impose any quarantine restrictions beyond medical inspection, which was generally carried out at the port of arrival. The Lazaretto at Larnaca and the quarantine stations of Limassol and Famagusta were, however, kept in repair and in readiness for any emergency.

Colonial Medical Reports.—No. 69.—British Guiana.

MEDICAL REPORT FOR THE YEAR 1913-1914.

By K. S. WISE,

Surgeon-General.

Public Hospitals.

Public Hospital, Georgetown.

This institution has accommodation for 295 males and 238 females, or 533 in all.

Nine thousand four hundred and thirty patients were admitted during the year, which, with 473 patients remaining in hospital on April 1, 1913, make a total of 9,903 patients treated, against 9,925 for last year.

The number of out-patients treated was 19,593, against 33,731 for last year. This is a decrease of 14,138 for this year, and a decrease of 25,365 in the last two years.

There were 932 deaths, against 1,157 for last year. The death-rate on the total number treated was 9·88 per cent., against 11·6 per cent. of last year. Of the total deaths 200, or 21·4 per cent., died within twenty-four hours, and no less than 341, or 36·5 per cent., died within seventy-two hours of admission. During this year the number of enteric fever cases treated was slightly less, 181 against 194 for last year. The number of deaths, however, is greater, viz., 58 against 44, the percentage death-rate being 32·04 per cent., against 22·6 per cent. for 1912-13. Pneumonia still claims a large number of victims, though the number of cases treated is considerably less than last year, 165 against 308 for 1912-13. The percentage mortality remains much the same. Three hundred and forty-one cases of phthisis were treated, with 140 deaths. This shows the wide prevalence of tuberculosis and its fatal character. One hundred and sixty-eight deaths occurred in children under 5 years of age, or 18·2 per cent. of the total deaths. There were 615 deliveries in the maternity ward with 22 deaths, against 638 deliveries and 33 deaths for last year. Seventeen of the 22 deaths were due to eclampsia, an excessive mortality almost wholly due to the advanced state of renal disease prevalent in the colony. Still-births amounted to 77 and abortions 46. These figures represent a most unsatisfactory waste of life which is due to the constitutional ravages of syphilis.

Nursing Staff.—The Senior Divisional Nurse, Miss Fleming, took up the appointment as Superintendent of Nurses at the Public Hospital, Berbice, on November 1, and was replaced by the Junior Divisional Nurse, Miss Crow. Miss Walker arrived from England on November 20, and assumed duty as Junior Divisional Nurse. During the year 208 lectures were given, and practical demonstrations held in the wards in connection with the various classes for training nurses. The following examinations were held: *For Probationers.* In September, 1913, 21 entered and 13 passed. In February, 1914, 22 entered and 20 passed. *For Nurses.* In March, 1914, 19 entered and 17 passed. *For Nurse-Midwives.* In April, 1913, 9 entered and 7 passed. In October, 1913, 5 entered and 2 passed. The services of the outdoor midwives are much utilized, 259 deliveries having taken place with their attendance. The number of visits paid by these maternity nurses was 6,225.

Public Hospital, New Amsterdam.

This institution has accommodation for 96 males and 54 females.

There were 2,317 patients admitted during the year, and with 113 remaining on April 1, 1913, these make a total of 2,430 patients treated, against 3,007 for last year.

The number of out-patients treated was 16,867, against 21,434 for last year.

RETURN OF DISEASES AND DEATHS IN 1914 IN THE GEORGETOWN HOSPITAL, AND BERBICE, SUDDIE, BARTICA, AND N.W.D. HOSPITALS.

British Guiana.

GENERAL DISEASES.

	Admissions	Deaths	Total Cases Treated
Alcoholism	10	—	10
Anæmia	109	3	109
Anthrax	—	—	—
Beriberi	—	—	—
Bilharziosis	—	—	—
Blackwater Fever	4	—	4
Chicken-pox	16	—	16
Cholera	—	—	—
Choleraic Diarrhœa	—	—	—
Congenital Malformation	—	—	—
Debility	214	13	214
Delirium Tremens	—	—	—
Dengue	—	—	—
Diabetes Mellitus	9	—	9
Diabetes Insipidus	—	—	—
Diphtheria	14	3	14
Dysentery	366	69	366
Enteric Fever	200	66	200
Erysipelas	3	1	3
Febricula	—	—	—
Filariasis	—	—	—
Gonorrhœa	164	—	164
Gout	—	—	—
Hydrophobia	—	—	—
Influenza	19	—	19
Kalar-Azar	—	—	—
Leprosy	6	—	6
(*a*) Nodular	—	—	—
(*b*) Anæsthetic	3	—	3
(*c*) Mixed	18	—	18
Malarial Fever—	156	13	156
(*a*) Intermittent	1273	17	1273
Quotidian	—	—	—
Tertian	—	—	—
Quartan	—	—	—
Irregular	—	—	—
Type undiagnosed	—	—	—
(*b*) Remittent	6	2	6
(*c*) Pernicious	33	16	33
(*d*) Malarial Cachexia	6	—	6
Malta Fever	—	—	—
Measles	1	—	1
Mumps	3	—	3
New Growths—	—	—	—
Non-malignant	63	1	63
Malignant	69	16	69
Old Age	—	—	—
Other Diseases	6	2	6
Pellagra	—	—	—
Plague	—	—	—
Pyæmia	10	8	10
Rachitis	—	—	—
Rheumatic Fever	2	—	2
Rheumatism	194	1	194
Rheumatoid Arthritis	—	—	—
Scarlet Fever	—	—	—
Scurvy	—	—	—
Septicæmia	38	32	38
Sleeping Sickness	—	—	—
Sloughing Phagedæna	—	—	—
Small-pox	—	—	—
Syphilis	6	—	6
(*a*) Primary	4	—	4
(*b*) Secondary	50	—	50
(*c*) Tertiary	109	9	109
(*d*) Congenital	16	—	16
Tetanus	25	11	25
Trypanosoma Fever	—	—	—
Tubercle—	38	18	38
(*a*) Phthisis Pulmonalis	—	—	—
(*b*) Tuberculosis of Glands	—	—	—
(*c*) Lupus	—	—	—
GENERAL DISEASES—*continued.*			
(*d*) Tabes Mesenterica	—	—	—
(*e*) Tuberculous Disease of Bones	—	—	—
Other Tubercular Diseases	—	—	—
Varicella	—	—	—
Whooping Cough	17	—	17
Yaws	43	—	43
Yellow Fever	—	—	—

LOCAL DISEASES.

	Admissions	Deaths	Total Cases Treated
Diseases of the—			
Cellular Tissue	822	26	822
Circulatory System	—	—	—
(*a*) Valvular Disease of Heart	52	12	52
(*b*) Other Diseases	167	52	167
Digestive System—	—	—	—
(*a*) Diarrhœa	226	18	226
(*b*) Hill Diarrhœa	—	—	—
(*c*) Hepatitis	19	—	19
Congestion of Liver	—	—	—
(*d*) Abscess of Liver	7	3	7
(*e*) Tropical Liver	—	—	—
(*f*) Jaundice, Catarrhal	17	2	17
(*g*) Cirrhosis of Liver	—	—	—
(*h*) Acute Yellow Atrophy	—	—	—
(*i*) Sprue	—	—	—
(*j*) Other Diseases	269	23	269
Ear	27	—	27
Eye	204	—	204
Generative System—	—	—	—
Male Organs	395	2	395
Female Organs	1992	76	1992
Lymphatic System	136	1	136
Mental Diseases	141	1	141
Nervous System	250	37	250
Nose	23	—	23
Organs of Locomotion	205	6	205
Respiratory System	1337	372	1337
Skin—	—	—	—
(*a*) Scabies	63	—	63
(*b*) Ringworm	2	—	2
(*c*) Tinea Imbricata	—	—	—
(*d*) Favus	—	—	—
(*e*) Eczema	16	—	16
(*f*) Other Diseases	617	6	617
Urinary System	608	176	608
Injuries, General, Local—	696	13	696
(*a*) Sirisasis (Heatstroke)	—	—	—
(*b*) Sunstroke (Heat Prostration)	—	—	—
(*c*) Other Injuries	—	—	—
Parasites—	12	3	12
Ascaris lumbricoides	—	—	—
Oxyuris vermicularis	—	—	—
Dochmius duodenalis, or Ankylostoma duodenale	313	47	313
Filaria medinensis (Guinea-worm)	360	26	360
Tape-worm	—	—	—
Poisons—	—	—	—
Snake bites	4	—	4
Corrosive Acids	1	—	1
Metallic Poisons	1	—	1
Vegetable Alkaloids	13	—	13
Nature Unknown	—	—	—
Other Poisons	—	—	—
Surgical Operations—	5368	51	5368
Amputations, Major	—	—	—
Minor	—	—	—
Other Operations	—	—	—
Eye	—	—	—
(*a*) Cataract	12	—	12
(*b*) Iridectomy	21	—	21
(*c*) Other Eye Operations	—	—	—

There were 254 deaths, which give a death-rate of 10·45 per cent. of the cases treated.

Of the total deaths, 21, or 8·2 per cent., died within twelve hours of admission, and 36, or 14·1 per cent., within twenty-four hours of admission.

Twenty cases of enteric fever were treated, with seven deaths.

There were 116 births in the maternity ward.

Public Hospital, Suddie.

This institution has accommodation for 54 males and 26 females.

There were 732 patients admitted, and with 63 remaining on April 1, 1913, make a total of 795 patients treated, against 1,396 for last year.

The number of out-patients treated was 3,813, against 5,485 for last year.

There were 105 deaths, which give a death-rate of 13·20 per cent. of the cases treated.

Of the total deaths, 48, or 45·7 per cent., died within seventy-two hours of admission.

There were five cases of enteric fever treated, with no deaths.

There were eighteen births in this hospital.

The buildings of the hospital are exposed to the full force of the wind and rain during the tempestuous squalls which visit Suddie from time to time. On these occasions the windows and jalouses are unable to prevent the entrance of rain, and the portion of the wards to the windward are flooded and have to be evacuated until such time as the storm ceases. The resident surgeon rightly recommends the construction of a hood for the whole length of the weather side.

Public Hospital, Bartica.

This institution has accommodation for twenty-four males and eleven females.

There were 293 patients admitted, and with the eight remaining on April 1, 1913, make a total of 301 treated, against 275 for the previous year.

The number of out-patients treated was 729, against 1,196 for the previous year.

There were twenty-three deaths, which give a death-rate of 7·8 per cent. of the cases treated.

Of the total deaths five, or 21·7 per cent., died within seventy-two hours of admission.

There were nine births during the year in this hospital.

Public Hospital, Morawhanna, and Arakaka Ward.

The hospital at Morawhanna has accommodation for fourteen males and eleven females, and the Arakaka Ward for twelve females.

There were 461 patients treated, with thirty-six deaths, which give a death-rate of 7·8 per cent. of the cases treated.

In the previous year 818 patients were treated, with fifty-one deaths, a death-rate of 6·2 per cent. of the cases treated.

Of the total deaths fourteen died within seventy-two hours of admission

There were 3,203 out-patients treated, as against 3,891 for last year.

ASYLUM.

Lunatic Asylum.

There were 434 males and 283 females in this asylum on April 1, 1913.

During the year eighty-one males and fifty-seven females were admitted, thirty-seven males and twenty-eight females discharged, and twenty-seven males and twelve females died.

The percentage mortality on the total number of inmates was 5·38, against 14·7 for the previous year.

The average number resident daily during the year was: Males, 439, and females, 285; total, 724.

Leper Asylum.

On April 1, 1913, there were 266 males and 121 females in the asylum. During the year eighty-seven males and eighteen females were admitted, and forty-four males and nine females discharged.

There were forty deaths—thirty-one males and nine females. The percentage mortality on the total number of inmates was 8·1, against 21·3 per cent. for last year.

The farm was well cultivated, and produced:—

Ground provisions valued	...	$301.99
Cocoanut oil	,, ...	30.82.

The majority of inmates keep their cottages and grounds neat and tidy. Small plots of land are given on which the inmates may grow vegetables, and these are either used by themselves or sold to the store for consumption within the asylum.

PUBLIC DISPENSARIES.

There are two dispensaries in Georgetown and six country dispensaries.

During this year the decrease of sickness has allowed the closure of two dispensaries, viz., one in Georgetown at the Alms House and one at Albouystown.

The total number of persons treated were 18,397.

Free medicines were supplied to the followiug Missions: Bara Cara, Caria Caria, Chalk Hill, Epera, Eupukari, Oxcalla, Rupununi, St. Bede's, St. Peter's, Santa Rosa, Saxacalli.

PRISON HOSPITALS.

The uumber of prisoners admitted in these hospitals during the year were 634, with four deaths.

THE ONDERNEEMING INDUSTRIAL SCHOOL FOR BOYS.

The average daily number of boys was 112·8; the percentage of sick to this daily average was 0·41.

The prophylactic use of quiniue has produced a marked improvement, as shown by the following figures: 1909-10, 241 cases; 1910-11, 113; 1911-12, 52; 1912-13, 25; 1913-14, 25.

In consequence of the generally improved health the hospital at this school has now been closed.

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ALMS HOUSE AND ORPHAN ASYLUM.

Alms House.

The average number of inmates was 775. The total number treated was 2,193.

The death-rate was 16·64 per cent., which is less than the rate 21·80 per cent. for last year.

Special attention has been paid to the prevalence of flies and the various measures adopted, especially the free use of the formalin spray, have done much to reduce this nuisance. The number of cases of dysentery and diarrhœa have been reduced to half and the deaths to one quarter of the average for the previous four years.

Orphan Asylum.

The daily average in this institution is eighty-six, viz., boys, fifty-seven, and girls, twenty-nine.

Improvement is noticeable in this institution during the year, and the changes of diet from salt to fresh food has had a great benefit upon the children.

The diet of the infants under 1 year is also now under revision.

It is regrettable to report that filarial infection is very frequent in these children, and no improvement is noticeable in three years. Examination in 1911 show 45·7 per cent. infected, and examination (many of these the same children), and in 1914 showed 45·4 per cent. infected.

GENERAL HEALTH.

The general health of the colony during this year has still continued the improvement noticeable during the past two years.

The total population has increased by nearly 5,000 persons, and stands at 303,984.

The birth-rate has steadily increased from 28·8 per 1,000 persons living in 1911 to 33·1 in 1912, and to 34·6 in 1913.

The death-rate shows a gratifying reduction from 31·7 per 1,000 persons living in 1911 to 29·2 in 1912, and to 24·2 in 1913. This death-rate is the lowest for thirty years with the single exception of 1911 (23·6).

These figures represent very clearly the great change for the better which has swept over the whole colony. Ample support is found in the large reduction of in-patients in the hospitals and the extraordinary decrease of out-patient attendance.

The mortality of infants, always an important indication of a country's medical influence, also slowly improves, standing at 229 deaths per 1,000 births in 1911, it has fallen to 190 in 1912, and 179 in 1913. This figure is greatly in excess of what should be natural in such favourable and equable climatic conditions.

Wet years have an evil effect and dry years a beneficial effect on the health of this country. The unusually wet years 1907 to 1911 brought a very heavy mortality and greatly increased sickness. With the drought of 1912 this sickness began to cease, and it may be considered that the colony by now has returned to a normal condition of health.

It is a matter of interest that the evil influence of much rainfall has only been noticeable since the year 1890. In the previous twenty years wet years and dry years showed much the same death-rate, and whatever fluctuation occurred was independent of meteorological changes.

In 1890 the great pandemic of influenza reached British Guiana, doubling the mortality, trebling the sickness, and spreading far and wide pneumonia, that most fatal of respiratory disorders.

Since 1890 a series of wet years has always demonstrated the presence of influenza and a great increase of pneumonia.

The health of British Guiana may be gauged by the extent of the well-known acute forms of disease, but the spread and influence of such acute diseases are necessarily much affected by the resisting powers of each individual. This resisting power to infection of each individual is regrettably low in British Guiana, and is adversely affected by the influence of certain constitutional diseases which weaken the vitality until the mildest form of acute disease becomes a dangerous and fatal malady.

Malarial fever, as it recurs from time to time, destroys by degrees the tissues of the vital organs; then the strong and healthy man slowly and gradually becomes a shiftless and chronic invalid, and sooner or later, after being a trouble to his relations and an inmate of the charitable institutions, succumbs to an attack of pneumonia, which in his prime would have passed him by.

So also hookworm disease. The sanitary conditions so conducive to frequent infection; the gradual developing anæmia, the depressed spirit, the loss of ambition, the inability to work, followed by poverty and the round of charitable institutions, ends finally in one of the numerous causes of death recorded in this colony.

Syphilis equally lays a heavy hand on this country, and exercises a full influence on the needlessly excessive mortality.

Remove these three great radical defects and you will remove the greatest of all difficulties to progress, viz., the large sickness and death-rate of British Guiana.

No case of small-pox, cholera, yellow fever, and plague have occurred during 1913-14.

The last epidemic of small-pox was in 1904, of yellow fever in 1885. The occurrence of plague and cholera are beyond human recollection.

URBAN DISTRICTS.

The city of Georgetown has participated in the improved health of the colony.

The death-rate was 26·5 per 1,000 persons living, which, as far back as research has been possible, constitutes the lowest on record for the city.

The birth-rate (30·6 per 1,000 persons living) exceeded the death-rate. This feature has occurred but once before in twenty years, viz., in 1901.

These results are very gratifying, and are an

eloquent testimony to the value of the services rendered by Dr. Wishart, the whole-time medical officer of health.

This post was first instituted in 1911, and the Mayor and Town Council of Georgetown, in establishing this special sanitary department, supervised by a whole-time medical officer of health and strengthened by the appointment of a chief sanitary inspector with English training and experience, have found more than ample justification for the special expenditure.

The sanitation of Georgetown will repay still further strenuous attention, and it is not incredible to expect a death-rate gradually falling to that of many English cities.

The rate of infantile mortality remains a serious feature of the medical officer's annual report, being 235 deaths under 1 year for every 1,000 births.

A serious start has been made to prevent this great loss of life. The early Notification of Birth Act was adopted during this year, and two lady health visitors were appointed, who undertake the important work of visiting newly born infants in their own homes.

The town of New Amsterdam has made efforts to meet the demand for sanitation by the appointment of two sanitary inspectors.

Attention is more especially devoted to superfluous vegetation, rubbish in yards, cleaning of drains, and condition of the privies.

The town is favourably situated, well laid out, and not overcrowded. With comparatively little expenditure and attention it might well be a model for tropical towns.

The birth-rate of 29·9, and the death-rate of 25·0 per 1,000 persons living, and an infantile mortality of 143 per 1,000 births do not realize the conditions which could be achieved by this town.

Village Areas.

The villages are in general well drained. Beyond this there is little that can be considered as sanitation.

The Public Health Department, organized in 1912, is now beginning to deal with these rural areas, having started in Kitty and Agricola.

Most of these villages are in a grossly unhealthy condition, and it is little wonder that mortality is great and that the number of births rarely equal the deaths.

Lack of yard drains, the presence of low bush and unnecessary vegetation leading to dark and moist surroundings, irregular mosquito-breeding pools, unscreened barrels, and absence of any privy accommodation represent some of the preventable evils.

Sugar Estates.

The sugar estates are a welcome contrast, presenting their cleanly well-drained yards, absence of mosquito breeding, and universal provision of latrines.

The result is notable, as the following statistics show:—

	Birth-rate per 1,000 persons living	Death-rate per 1,000 persons living
Free on estates ...	50·3	14·4
Indentured on estates ...	—	9·6

These records are as good as any civilized city in Europe.

Forest and Savannah Areas.

The large hinterland forest areas bear an unhealthy reputation. From the gold-fields and from balata-collecting expeditions occasionally come accounts of great and severe sickness.

The recent large expedition which accompanied his Excellency the Governor on a journey of two months through the forest regions to the southern savannahs has shown that the adoption of suitable precautions renders travelling in the hinterland forest areas almost devoid of danger.

The savannah hinterland is a grassy undulating plain, uninhabited save for a few aboriginal Indians and an occasional rancher.

The savannah land, though but a degree or two from the Equator, is remarkably healthy, and probably the healthiest part of the colony.

Enteric Fever.

This disease shows little or no signs of reduction.

The cases notified throughout the colony for the year 1913 are 435 in number. Compulsory notification began on February 24, 1912.

The number of deaths is 106, an increase of thirteen over last year.

The deaths from enteric fever have largely increased in number during the last few years.

Year	Deaths per year in whole Colony
1886-1890	6·6
1891-1895	10·4
1896-1900	9·6
1901-1905	4·4
1906-1910	27·6
1911	76
1912	93
1913	106

Many vehicles of the infection no doubt at times play a part in the spread of this disease in British Guiana, but the social conditions and habits of the people are so favourable to spread by personal contact that little doubt can be entertained as to the great influence of this method.

There is much epidemiological evidence which gives great support to this view.

Prompt isolation and equally prompt disinfection of the patients' premises alone offer any prospect of success in dealing with enteric fever.

The city of Georgetown is the home of this disease, and the more persons infected, the more carriers will exist, and the further over the colony will the disease spread.

Tuberculosis.

This disease, though gradually decreasing, is much too frequent.

In 1913 there were 531 deaths, as against 555 for 1912.

This disease, as might be expected, is most prevalent and most fatal in the city of Georgetown and the town of New Amsterdam.

Tuberculosis is widespread over the whole colony; almost every village and every estate records cases from time to time, and even outlying hamlets and scattered river communities contribute their quota.

This disease finds social conditions of British Guiana all in favour of an early spread. The more advanced the disease the more bedridden and the more infectious the patient, so much the more do men, women, and susceptible children crowd into undersized, ill-ventilated rooms offering advice and assistance. Such no doubt is welcome evidence of a kind heart and of a warm sympathy, but stricken later by all the trouble and woe which follow phthisical infection, one can well believe that the cause and effect are unknown.

Advanced cases of consumption in the last stages before death are potent sources of infection; they require the most care, show the greatest reluctance to enter institutions knowing that the end is near, and yet probably infect the most people.

The Society for the Prevention and Treatment of Tuberculosis has accomplished one more year of quiet and unobtrusive work. Two lady visitors are now employed, who visit all of the poorer classes of consumptives in Georgetown.

Their helpful advice and kindly tact do much to obviate infection to others and to instruct the friends in the infectious character of this disease.

Much has been done by the Mayor and Town Council of Georgetown in enforcing the present Tenement Rooms By-laws. Two hundred and sixty-five rooms have been ventilated, 354 rooms found dirty and cleaned, and sixty-six cases of overcrowding abated.

More still remains to be done, and persistent work along these lines will in time show the beneficial effect.

Malaria.

This disease shows further reduction during this year.

The death-rate per 1,000 persons living from malaria alone has fallen from 5·5 in 1911 to 4·7 in 1912 and to 2·9 in 1913.

In the towns and villages quinine is on sale in the post offices, and the following figures indicate the value sold since December, 1906:—

(December-March)		Ounces		Value
1906-07	...	326	...	$ 95.08
1907-08	...	1,211	...	353.20
1908-09	...	2,076	...	529.81
1909-10	...	3,000	...	765.62
1910-11	...	3,120	...	882.88
1911-12	...	2,640	...	682.50
1912-13	...	1,952	...	588.00
1913-14	...	2,448	...	717.50

In Georgetown much of the low vegetation has been cleared away from around the houses, the tanks, and barrels are in general screened, and the casual tins, bottles, &c., have been abolished.

In New Amsterdam two sanitary inspectors are now at work, and superfluous vegetation is receiving attention. No attempt has yet been made to screen all tanks, vats, barrels in the town. Mosquitoes are still greatly in evidence.

In the village little or no anti-malarial work is done. A start is made by the Public Health Department with anti-mosquito and general sanitary measures in Kitty and Agricola, where great improvement is noticeable. This work will gradually extend, but of necessity the progress is slow.

Quinine has been distributed free to children in schools in Georgetown, New Amsterdam, &c., as follows:—

Georgetown, ten schools; West Bank, Demerara, nine schools; East Coast Demerara, three schools; New Amsterdam, two schools; Berbice River, one school; Essequebo, one school.

On the sugar estates excellent work has been done during the past few years, simple sanitary precautions including the abolition of mosquito-breeding places, screening of barrels and other receptacles, the free distribution of quinine to resident labourers, and especially to children.

It has long been recognized that the amount of malarial fever in the children is an excellent index of the general health of a tropical community, mainly on account of the fact that children are specially susceptible to malaria. The readiest indicator of the amount of malaria in a child is the size of the spleen. The percentage of enlarged spleens in 100 children (or the spleen rate) is a valuable factor in estimating the health of communities.

Amongst average children in non-malarial countries the spleen rate is about 1 to 2. On fifteen out of thirty-nine estates the spleen rate conforms to the non-malarial standard, and it is apparent that malaria is absent from the children and also that malaria must be absent or rare amongst the adults. Among 31,407 East Indian immigrants employed on those fifteen estates the malarial death-rate was 0·3 per 1,000 persons living, or, in other words, only nine deaths from malaria was recorded amongst these 31,407 immigrants.

The number of cases of malaria treated in the estates' hospitals are as follows: Average for five years: 1906-07 to 1910-11, 27,444; 1911-12, 15,028; 1912-13, 7,384; 1913-14, 7,447.

Many of the cases returned as malarial fever are slight rises of temperature for a few hours and perhaps better described as febricula, which may or may not be of malarial origin.

All prisoners, members of the police force and their families, the boys at the industrial school, the children at the orphan asylum, and attendants at Government institutions are supplied with quinine free.

Ankylostomiasis.

In the towns and villages no measures specially directed against this disease are in force. It is doubtful to what extent infection exists in the towns. In the villages the figure will be higher and probably reaches 40 to 50 per cent.

On the sugar estates the following measures are in force:—

(*a*) Latrines are provided on all estates and in the

majority of instances are constantly used. Here and there areas of ground are found especially used by the immigrants.

(*b*) The newly-arrived immigrants from India, usually showing an infection of 65 to 75 per cent., are subjected to microscopical examination and subsequent course of thymol.

(*c*) All patients in estates' hospitals are examined microscopically and treated accordingly.

The severe types of ankylostome anæmia are now rarely seen; the milder type of infection with chronic degeneration changes is the ankylostome disease now encountered, the principal fatality occurring amongst pregnant females too anæmic to survive the extra burden of childbirth.

The International Health Commission of the Rockefeller Foundation has arranged to carry out the important work of eradicating entirely all hookworm infection from a special area in the Peter's Hall Medical District. The work begun in April, 1914, and its progress and results are awaited with great interest.

Syphilis.

No special inquiries have been directed to this disease, but it is universally acknowledged to be widespread, and most practitioners will agree that it is on the increase. Its effects are readily recognized both in the acute and in the constitutional form.

The following table shows the number of still-births during the last four years. Most of these are probably the effect of syphilis infection, and the table bears deplorable testimony to the ravages of this disease:—

	1913	1912	1911	1910
Number of still-births ..	885 ..	862 ..	878 ..	813

Maternity and Infantile Mortality.

Much loss of life occurs in childbirth. The dangers to the mothers are from the weakness of constitutional disease and also from the ignorance of untrained old-time women practising as midwives.

The dangers to the infant are from the effect of constitutional hereditary disease, such as syphilis, and also from ignorance of the feeding of infants on the part of the mothers and her advisers.

During the year nine nurse-midwives passed the qualifying examination after a special training, making a total of 118 trained and qualified.

Five students received assistance in maintaining themselves whilst undergoing training.

Sign-plate and midwives' outfits are presented to these women so as to enable them to begin their duties satisfactorily.

In July, 1908, an outdoor Maternity Department was started in connection with the Public Hospital, Georgetown. This is utilized by poor women who do not enter the Hospital and are delivered in their own homes.

1909-10—	70 cases attended and	1,172 visits paid.	
1910-11—134	,,	,,	2,872 ,,
1911-12—170	,,	,,	4,208 ,,
1912-13—256	,,	,,	5,723 ,,
1913-14—259	,,	,,	6,225 ,,

Special nurse-midwives are also subsidized by the Government in certain districts, the total cases delivered in 1913-14 being eighty-two.

The principles of infant feeding are now taught by all female teachers in primary schools under the advice of the Government Medical Officer of the district. Special classes in this subject for female teachers and assistants are held in the Hospital, Georgetown.

In the latter part of this year the Baby Saving League was formed. This is an organization which includes the principal members of the community and has considerable funds at its disposal.

The objects are in general the care of the expectant mother, the provision of trained nurse-midwives in populated districts within the reach of all, and the education of mothers in the care of infants.

There is great scope for this important organization, and its work will without donbt exert great influence not only on the special problem to which it directs immediate attention, but also to numerous, correlated social conditions of the people of British Guiana.

Public Health Department.

This special department was established last year and has now completed one year's work.

It proceeds of necessity slowly, but surely, and has an enormous area to cover and many years' arduons work before it.

Attention to the prevention of disease is nrgently required in British Guiana, and possibly in no other colony can the direct benefit of remedial measures be so easily and so readily accomplished.

The benefit derived from simple and inexpensive sanitary measures has been demonstrated on frequent occasions in many parts of the colony, and it now rests with the department to enforce these advantages in every village.

Special attention was devoted to the milk supply from the district around Georgetown. Seven hundred and eighteen certified concreted pens have been newly erected, 1,099 milk-selling licences issued, with 138 prosecntions for breaches of the regnlations.

General sanitary measures have been enforced in Kitty, Lodge, and Agricola. Twelve hnndred and fifty-one notices served, and twenty-seven convictions for failure to comply. Much improvement is obvious.

The re-organization of the crowded La Penitence rural area has been accomplished. Many of the buildings have been entirely removed and overcrowding of houses is absent.

Quarantine.

During the year quarantine was enforced for:—

Plague against Venezuela and Brazil.

Yellow Fever against Trinidad, Venezuela and Brazil.

Smallpox against Grenada, St. Lucia, and Guadeloupe.