

The treatment of hookworm is not yet on a sound scientific basis. Until a few years ago the value of a drug as an anthelmintic and its dosage were based on clinical experience, with no research work or very little to prove its efficacy. The history of the popular hookworm remedies of to-day clearly indicates this. Male fern, thymol and oil of chenopodium were all introduced about 1881. Of these, male fern is now not heard of in hookworm treatment; thymol became the popular drug and held its position until a dozen years ago, when it was replaced in favour by chenopodium. This drug, introduced into Europe from Brazil in 1881, was adversely reported on and came into favour only about 1913, forty years after its introduction. From that date it was largely used all over the world, until in 1921 Hall introduced carbon tetrachloride. Introduced in 1904  $\beta$  naphthol is still used by some, but it is inferior to the last three mentioned.

The number of drugs in use and the lack of unanimity as to their relative efficiency, safety and so forth clearly indicates that the ideal drug has yet to be discovered. Such ideal drug must combine maximum efficiency with safety, palatability, ease of administration and cheapness.

But those of us who are entrusted with the care of natives, of whom the greater percentage suffer from hookworm, cannot await the discovery of this ideal drug. We have, therefore, to work with the drugs at our disposal and in our choice of drugs must consider all the circumstances. To the physician in a European community where this disease is infrequently met with, such considerations as palatability, ease of administration and cost do not arise. He is concerned solely with the questions of efficacy and safety. But where mass treatment of large numbers of natives has to be carried out, these matters are of importance.

The question of which drug should be used in Samoa, was chiefly determined by the work of the Rockefeller Foundation and the successful results obtained by Lambert with carbon tetrachloride in his campaign in Fiji. The dose given by Lambert was four cubic centimetres, but as a few deaths (believed to be due to impure drug) had occurred by the time we were ready to commence work, we decided to make the adult dose three cubic centimetres. In 1924 we commenced using a mixture of carbon tetrachloride three parts, oil of chenopodium one part, the dose being 0.12 mils (two minims) per year of age, with a maximum dose of two mils (thirty-five minims). The drug was given with a dose of Epsom salts, except during the first year, when the Epsom salts were given after the drug. The change was made owing to the prevalence of *Ascaris lumbricoides* in Samoa, a parasite on which carbon tetrachloride has no effect.

Since the commencement of our campaign late in 1923, we have given over 40,000 treatments, without any known fatal results.

There is in this paper no record of any original research carried out by the medical staff in Samoa. There is one medical officer to every five or six thousand inhabitants and our first duty is to remedy

as far as possible the conditions which take the greatest toll of the community, either in lives or in suffering. To this all our energies are at present directed and until it has been accomplished, we cannot afford either time or money or divert the activities of our staff. That we had and still have a great deal of leeway to make up, will be evident from the fact that until 1921 the only institution for treatment of the sick by trained personnel was in Apia and of sanitation there was none.

#### TREMATODE INFESTATIONS IN NORTHERN MELANESIA.

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TREMATODE parasites of man in the tropics and elsewhere include some exceedingly dangerous varieties and Australasia is fortunate, so far as records go, in being almost free of such.

The area preeminently infested with these parasites is the Orient, where *Fasciolopsis buskii*, *Clonorchis sinensis*, *Opisthorchis felineus*, *Heterophyes heterophyes*, *Loxotrema ovatum* (*Metagonimus yokogawi*), *Paragonimus ringeri* (*westermanii*) and *Schistosoma japonicum* are all more or less common. Some, indeed, occur nowhere else as common parasites.

Oceania has known many ancient and modern invasions and immigrations from Indo-Malaya and the Orient and the fact that a very considerable proportion of all the plant and insect life of Northern Melanesia is from these sources, while the inhabitants themselves are a hybrid race derived from Papuo-Melanesian stocks with an infusion of Oceanic mongol blood suggests the probability that trematode parasites would have had easy entrance here and suitable soil for endemic continuance.

On the contrary, exceedingly few have been found, however, and in no case to my knowledge had trematode parasites been found in natives up to a short time ago, though some few cases had been seen in Chinese. It had almost come to be regarded as proven that there was no extension of trematode infestation to these islands, no endemic trematode disease and probably (though the question had not been investigated) that no intermediary host existed locally for most of these diseases.

These conclusions have been rudely upset by the discovery several weeks ago of paragonimiasis in a native recently recruited from a distant and rarely visited native village, a village indeed only visited three times by white men, so far as is known and until 1924 not shown on the district maps.

There are several significant points in this discovery:

- (i) The disease is a dangerous one.
- (ii) This is the first recorded occurrence of the disease (in a native) in any territory south of the Philippines, except Sumatra.
- (iii) The native patient came from a little visited area, indicating that the disease is locally endemic.

(iv) Since he had never been away from his village there must be effective intermediary hosts for paragonimiasis in the Territory of New Guinea.

That the disease is a dangerous one, figures readily show; Clayton Lane and Low<sup>(1)</sup> place paragonimiasis first among the three trematode infestations (other than hæmal) producing grave effects; Manson-Bahr<sup>(2)</sup> states that in "many of the endemic districts a notable percentage of the population is affected"; since recovery is rare, though immediate danger is unusual, the disease obviously assumes considerable importance.

With regard to distribution authorities note the occurrence of the parasite commonly in China, Korea, Japan, Formosa and the Philippines; Castellani and Chalmers state<sup>(3)</sup> that the infection "is more prevalent among people living along large rivers, according to Nakagawa and less so among people who use well-water."

The case above (recorded by Cilento and Backhouse in THE MEDICAL JOURNAL OF AUSTRALIA, January 15, 1927, page 79) is, so far as is known, the first found in the Pacific anywhere south of the equator and as a matter of fact the patient came from a village situated not far from the sea, upon a fresh water river rising on the slopes of Mount Taungi (latitude about 4:50° S., longitude about 152° E.).

The disease manifests itself in various ways. The onset is insidious and a chronic cough is common, usually most urgent on rising in the morning. There is rusty brown sputum which can be produced at will and the synonymic name "endemic hæmoptysis" serves to emphasize the irregular attacks of hæmoptysis to which the patient is liable. Broncho-pneumonia or bronchiectasis are sometimes seen, bronchitis and peribronchitis very commonly. Abdominal pain and diarrhoea often arise with a rigid abdominal muscular wall, while symptoms of cirrhosis of the liver, appendicitis, prostatitis, epididymitis and adenitis have been recorded.

Occasionally an aberrant collection of the parasites infests the brain, especially in children, causing a peculiar Jacksonian epilepsy with the possible accompaniment of hemiplegia, aphasia, visual disturbances, pareses or monoplegias of various degrees.

Generalized lymphadenitis (especially axillary and inguinal) occurs commonly in chronic cases and cutaneous lesions are also seen.

The course is prolonged and no means for expelling the parasite from the lungs has been discovered. Infections with tubercle bacilli are common, the damaged lung offering a favourable site for the implantation of the bacilli. General septicæmia or pyæmia may follow purulent foci in the lungs or other viscera.

It is doubtful whether spontaneous recovery ever occurs. If the lesions be not severe, life may not be unduly shortened, but the possibility of septic sequelæ must always be borne in mind. Acute cases with speedy death have been recorded. When complicated with tubercle the prognosis is bad and when the brain is affected, it is practically hopeless.<sup>(4)</sup>

The transmission of the disease has been studied by Japanese workers mainly, but their findings as yet are in dispute. The expectorated egg, it is claimed, falling into clean water, at a temperature between 15° and 37°C. produces a ciliated embryo in three to five weeks. It may remain viable and unhatched, however, for as long at least as twenty-three weeks. Workers claim that the intermediary hosts are firstly, certain fresh water snails of the *Melania* species especially *Melania libertina* and *Melania obliquegranosa* and secondly, various crabs and crayfish such as *Potamon obtusipes*, *Potamon dehaanii*, *Sesarma japonicum*, *Eriocheir japonicum*, *Astacus similis* and others.

The optimum definitive host is the pig, the infestation being practically limited among them to the lungs.

In this Territory the local molluscan genera and the crabs and crayfish have not to my knowledge been recorded in any readily available papers. It is obvious, however, as stated above, that if indeed these are the intermediary hosts, the species locally present must be capable in regard to transmission and must be infested to some considerable degree in the local sector from which this patient came, if not elsewhere.

This is a conjecture of a disturbing nature and is important not only for New Britain but for the whole of Melanesia.

It is hoped that members of Congress who are at work in western Samoa and other Polynesian islands, will endeavour to determine whether trematode infestations are locally present in order that measures may be introduced to combat what might otherwise become a menace.

#### References.

- <sup>(1)</sup> Clayton Lane and G. L. Low: "Trematode Infestations other than Hæmal"; Byam and Archibald's "Practice of Medicine in the Tropics," 1923. Volume III, chapter 80, page 1,788.  
<sup>(2)</sup> P. Manson-Bahr: "Manson's Tropical Diseases," eighth edition, 1925, page 550.  
<sup>(3)</sup> A. Castellani and A. K. Chalmers: "Manual of Tropical Medicine," third edition, 1919, page 1,585.  
<sup>(4)</sup> Clayton Lane and G. L. Low: *Opus citatum*, page 1,794.

#### YAWS.

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In the past practically no Samoan child reached the age of two years without contracting yaws and this disease was the cause, both direct and indirect, of much of the mortality occurring during the first few years of life.

That primary and secondary lesions are never seen in adults in Samoa indicates a long period of endemicity.

So universal was the condition in Samoa that the natives considered it a natural condition which must appear early in the life of the child or normal development would not occur. This belief often led to drastic measures being taken to "bring out the

disease" if it did not appear by the time the child was twelve to eighteen months old and from our experience during the past several years, there is no doubt that these measures helped to increase the death rate at that period of life.

This belief was so firmly rooted that when we commenced our intensive campaign in 1923, hardly a child with a primary frambœsoma was seen. The fact that injections of "Novarsenobillon" would quickly clear up the condition was well known to them, but they were afraid that unless the generalized secondary eruption was allowed to appear, the treatment would only "drive the disease in," to the detriment of the child's health. Patients with secondary and tertiary lesions were freely brought forward for treatment.

The natives had become acquainted with the value of arsenical preparations in the treatment of yaws, during the German and later the military occupations of Samoa, but no systematic work for the control of the condition was undertaken until 1923. During that year 32,366 injections of "Novarsenobillon" were given, in 1924 21,200, in 1925 12,000, and for the first six months of last year just over 4,000. Each year the whole of the area was investigated and the reduction in the number of treatments given is therefore due to a definite decrease in the number of cases. During August and September last year the most outlying district in the Territory was thoroughly inspected. The population of the area was 3,500 and the number of patients with yaws dealt with was 260, of whom only three were suffering from primary lesions, fifteen from secondary lesions and the remainder from tertiary manifestations.

Our method of procedure in our campaign is as follows: The district to be treated is divided into areas, each of a size, according to topography and population, which can be readily dealt with in five treatment days. Treatment is given at five selected points in the area and on Saturday the party retraces its steps to the point of commencement of treatment. Second and third injections are given at the same points during the second and third weeks. It will be seen that three weeks are spent in covering each area and three injections are given to each patient at intervals of a week. The party then passes on to the next area.

The work carried during 1923 and 1924 so impressed the natives that they agreed to the passing of stringent regulations for the control of this disease. It also had the result of weaning them from the belief that yaws was a necessary evil. The result is that at the present time the natives are as anxious as we are to see all patients treated as quickly as possible after the primary sore appears and although we shall have tertiary manifestations to treat for many years to come, the time cannot now be very far distant when primary and secondary yaws will be practically, if not absolutely, unknown in the Territory.

We do not claim that three injections will cure the condition, but experience has shown that the majority of primary and secondary lesions clear up

with three injections and the percentage of relapses in all stages of the disease is not great. Armstrong, who kept careful records over a period of three years in one district, found fifty-three relapses among 536 patients, a frequency of 10%; eight of these had been given less than the usual dosage owing to other conditions besides yaws being present.

At the present time, however, we are not particularly anxious to cure every patient. Such an aim would probably defeat itself. As all adult Samoans have had yaws in their early youth, they are immune from another attack. To treat them thoroughly for tertiary yaws would be to withdraw that immunity, and so to render them liable again to contracting the disease and this would make them look with disfavour on the treatment. Until such time as we have reduced the primary and secondary infections to a negligible number, the acquired immunity of the adult is better left alone. Meanwhile the thousands of children born year after year are growing up free of this condition and as 16% of our population is under four years of age, it will be seen that a fairly large and increasing proportion of our population is free of this disease.

Another consideration which renders us chary of interfering with the acquired immunity of adults is the relationship between yaws and syphilis. What the exact relationship is has not yet been determined, but it is, I think, significant that in the South Pacific, where yaws is rife, syphilis is practically unknown. It is impossible to believe that the early whalers, runaway sailors and convicts who were amongst the first white visitors to these islands, did not bring syphilis with them and so expose the native to risk of infection. We have never seen a case of syphilis in a Samoan and it is very rare in any of the Polynesian groups of islands. Why? Is it that yaws confers some immunity? The fact that syphilis has been given experimentally to a person suffering from yaws, does not prove that such occurs in Nature's laboratory. Under natural conditions such might occur, but the history of Samoa, where yaws was universal and where syphilis must have been introduced time and again, seems to indicate that yaws confers some immunity to syphilis.

If such be the case, then it would be tantamount to a crime to take away this immunity until such time as the more advanced communities in the Pacific have taken steps to eliminate this disease from amongst themselves.

As very few of the children born today contract yaws and as the natural increase in population is over 3% a year, it will not be long before the majority of the inhabitants of Samoa will be non-immune to yaws. By the time these children reach adolescence, the European races, it is to be hoped, will have managed to bring syphilis under control in their communities and at the same time the natives themselves will be more advanced and therefore under better control if such disease should happen to be introduced.

## SECTION I.—MEDICINE.

PROFESSOR C. WITHERINGTON STUMP read a paper on "Blood Formation, a Study of Myelogenesis." This article appears in the current issue of THE MEDICAL JOURNAL OF AUSTRALIA.

DR. S. V. SEWELL (Melbourne) asked Professor Stump how he recognized megaloblasts.

Professor Witherington Stump explained that the erythroblast stage was when both hæmoglobin and the wheel nucleus were apparent; it was a hesitating phase in the red cell series. This type was capable of rapid stimulation into activity.

## THE TREATMENT OF PERNICIOUS ANÆMIA.

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I AM afraid that there are few of us who can deny that at any rate until very recently we have approached our patients with pernicious anæmia with a sinking heart and a sense of futility, a feeling that there are certain things to be done and a possible hope of prolonging life; but beneath that feeling a stronger one that sooner or later the inevitable fatal end must come. I think the first essential in the treatment of pernicious anæmia is the abolition of this pessimism. It is unhealthy and not conducive to success in treatment. There is much work yet to be done before we can speak freely of actual cures, but there is no doubt that even in the light of our present knowledge we are fully justified in banishing the word incurable from its association with the disease.

The difficulty is in deciding what is a cure and what is a long remission. Here I would like to refer very briefly to the nature of the disease. It is neither desirable nor possible to discuss theories in the time at one's disposal, but I may emphasize these points, that pernicious anæmia is a condition of progressive blood destruction, that this destruction is the work of a hæmolytic toxin, that there is considerable evidence in favour of the view that this toxin is produced in the alimentary canal, though there is little evidence as to the causative organism, and that it is practically certain that the toxæmia causing the disease does not and cannot occur if free hydrochloric acid is secreted by the stomach, the rôle of the acid being that of destroying agent to the organism before it reaches that part of the intestinal canal in which, by its own efforts or by the breaking down of protein, it generates the toxins.

Accepting the evidence that achlorhydria is an essential part of pernicious anæmia, one must count a return of hydrochloric acid secretion in the stomach an essential factor before we may speak of cure.

M. E. Shaw, Medical Registrar of Guy's Hospital, in the Guy's Hospital Reports of July, 1926, details the case of a man suffering from pernicious anæmia, with a blood count of 800,000 red cells, a

colour index of 1.14, the typical cells of pernicious anæmia and a complete achlorhydria, who has remained perfectly well over a period of three years and has regained his normal hydrochloric acid secretion. I shall later quote the case of a patient of my own who has made an apparent recovery but I cannot give the most important statement as to his hydrochloric acid secretion, as the man has for some time been in England. But to my certain knowledge this man has remained perfectly well over a period of three years.

Apart from the hydrochloric acid question, we might ask in respect to this patient whether he has made a recovery or whether he is passing through the stage of a prolonged remission. Maitland Jones gives the average duration of remissions as six months. Figures given previously of anything from three months to four years are open to doubt, because they were made with insufficient data for diagnosis.

I would enumerate the principal forms of treatment as follows:

1. Administration of hydrochloric acid;
2. Treatment of focal sepsis;
3. Administration of arsenic;
4. Blood transfusion.

I propose to refer briefly to each of these measures. In my opinion I have stated them in the order of their importance. I have omitted any reference to rest, diet and hygienic measures not because of their unimportance, but because of time and I have not included splenectomy, because I have had no personal experience with regard to it in this disease and because I have very grave doubts as to its value in cases of true pernicious anæmia.

## Hydrochloric Acid Administration.

The administration of hydrochloric acid should be commenced as soon as the diagnosis is made. Achlorhydria occurs in every case. It is not the result, but occurs before the onset of this disease. Hurst, to whom with his fellow workers at Guy's Hospital we owe so much in connexion with the advances made in the study of this disease, has made a most valuable addition to his previous work in an article published in July of last year, in which he attempts to discover the relative frequency of constitutional *achylia gastrica* and acquired achlorhydria, that is to say, the achlorhydria of alcoholic gastritis, of gastric carcinoma, that following gastrectomy and that which occurs rarely after gastro-enterostomy through the neutralization of the gastric contents by the alkaline juices of the duodenum. The series of cases reported was numerically small. Of them 27% were definitely constitutional, 16% were acquired and the remainder uncertain. It is obvious that this matter is of the very greatest importance, in prognosis at least. One may reasonably assume that there is at least a chance of restoring function in the acquired cases, but one has considerably less hope in the case of congenital *achylia gastrica*.

As regards dosage it is generally agreed that to perform any useful service one must depart entirely