slightly infected. Dr. Lavertine's adoption of this measure leaves no doubt as to his belief in the communicability of the disease, which is all the more important as he has had several years' daily experience of it. The same is true of the other two medical men who have carried out these measures, and, further, they all agreed with me that the disease is entirely malarial in its origin and nature.

Dr. McIntyre, of the Mangaldai District, also writes to me that the moving of the recently-infected coolie lines on a garden he was in charge of has proved a success; but as he has since been transferred to a different part of the district, he has not been able to furnish me with any figures.

Thirdly, again I am indebted to Dr. Dodds Price, of the Nowgong District, for the following very instructive and conclusive figures, showing the good effect of moving out the healthy coolies from a very badly-infected line to a new one on a site about one-third of a mile away. As I saw this measure carried out myself, I can testify that the new lines were on a similarly-situated site to the old ones, and the surrounding and sanitary conditions were similar in the two cases, so that any result must be due solely to removal of the coolies out of the range of infection. I cannot do better than give Dr. Price's report verbatim.

In the Old Solona lines (the infected ones) there were 240 working souls, including boys and girls, and in the lower lines 60, the latter being free people (not under contract), having lived in these lines from time immemorial, figuratively speaking. Of the 240 souls in the old lines, I found 146 either suffering from kala-azar or with it in their houses (in other words, infected people). Of these we cancelled the contracts of 17 adults and cleared them out; the remainder we sent to the infected lines at Rangamati. The 94 healthy people we drafted into the new lines at Old Solona, and all new coolies as they arrived were sent there, so that yesterday (June, 1898) the population stood at 416 souls without a single kala-azar case among them. To begin with we had one or two doubtful cases among the old line coolies, but these were immediately sent over to the camp at Rangamati. To be accurate, there were 5 cases, 2 of which subsequently died; the other 3 recovered, and were kept at and are still at Rangamati. By acting promptly we thus kept the new lines free from kala-azar, and now fifteen months since their completion there has been no death from the disease. Now, as to the 60 coolies living in the lower lines. These, being old residents and free people, could not be interfered with, and refused to be saved from themselves. Kala-azar has spread to them, and accounted for 6 deaths up to the end of the year; 2 more deaths have taken place this half, and there are 10 cases now in the lines, several of which I consider will end fatally.

Of the 129 souls that we sent to the infected lines and houses in Rangamati 8 died, 10 had their contracts cancelled and were cleared out (all of them would have died), and 22 were yesterday still suffering either from the disease or from debility after a mild attack. These people are kept entirely to themselves, and are not allowed under any pretext into the lines on the Solona side of the manager's bungalow or in the new lines we have started towards Runggora.

From the above it will be seen that with the exception of the five cases which appeared shortly after the removal from the infected lines, and which had evidently contracted the disease before removal, there has not been one case of the epidemic disease among the 94 healthy coolies moved, although the lines in which they had lived before were so badly affected that more than half their entire population were either suffering from the fever, or had cases in their households, and over one-third of them subsequently suffered from the disease. Again nearly one-third of the old coolies living close to the infected lines suffered from the disease within 15 months of its spreading to them. The success of the measure adopted is evident, and will be very encouraging to those who have to face the suffering and loss which this epidemic has hitherto inevitably caused when once it has got a footing on a tea garden. It is also to be hoped that their success on tea gardens, where they can be easily carried out, will lead to more energetic steps being taken to afford the villages in the affected districts the benefits which the measures I have recommended will assuredly bring to them in exact proportion to the efficiency with which they are carried out, although the problem is admittedly a more difficult one in their case.

KALA-AZAR AND THE PLASMODIUM MALARIE.

Lastly, I wish to point out that the facts detailed in this paper afford strong support to my view that the infection in this epidemic malarial fever is an indirect one, by means of the passage through the soil of the plasmodium malarie which is constantly found in this disease. How the organism escapes from the body, whether by the aid of some living agent as the mosquito, or by passing out in one or more of the evacuations or secretions, or as I am disposed to believe by being breathed out from the lungs, it is impossible to say

at present. When this stage of the life-history of the organism is finally settled, then we may also hope for a solution of the mystery of the communicability of this decimating epidemic malarial fever of Assam.

REFERENCE.

¹ Report of an Investigation of the Epidemic of Malarial Fever of Assam or Kala-Azar. 1897.

REMARKS ON THE DEATH-RATE OF DYSENTERY AND ON DYSENTERY AND LIVER ABSCESS.

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THE CASE MORTALITY OF DYSENTERY.

On reading Dr. Manson's valuable book on *Tropical Diseases*, I find he quotes 37.0 per cent. as a case-death-rate from dysentery among natives, as also does Davidson. Such a death-rate can only have reference to natives admitted to public hospitals after days or weeks of self-neglect in their own homes; it certainly does not apply to dysentery treated promptly and efficiently.

In old days dysentery used to be the opprobrium of our Bengal prisons, but within recent years great improvement has taken place. In the years 1896-7, of 7,626 cases admitted to all gaol hospitals only 293 died; that is, only 3.8 per cent. of the cases—about one-tenth of the above-quoted percentage. Even in the extremely unhealthy malarious year, 1894, I find from the figures of certain prisons which I happen to have collected, that the death-rate from dysentery was only 9.0 per cent. Such figures include all forms of dysentery, from the mild to the chronic relapsing (non-amœbic) form, which in Bengal is too often the terminal episode in many cachectic conditions—malaria, tubercle, syphilis, famine, etc. Among Sepoys—picked men in the prime of life, and living under good sanitary conditions compared with the populace generally—the dysentery death-rate is also said to be about 3.0 per cent. The explanation of these low death-rates is that in regiments, as well as in gaols, a man who is ill, being unfit for work, is at once sent to hospital and treatment begins in time; in public hospitals natives often do not come till they are in the last stage of weakness and emaciation from this exhausting and anæmia-producing disease. For a similar reason, the prison death-rate from pneumonia in Bengal is only 12 to 14 per cent.—a very low figure for pneumonia among malaria-stricken people. (Sturges gives 19 per cent. for pneumonia in England.)

LIVER ABSCESS AND DYSENTERY.

In over six years' prison experience, in charge of over 1,200 prisoners daily, I have never seen in gaol a single case of liver abscess, while I have had abundance of dysentery (I refer to natives of India only). Few natives escape dysentery; hence in them a mere history of the fact of previous dysentery is worth little in the etiology of liver abscess. Nevertheless, some French and American authors write as if "amœbic dysentery" and "tropical dysentery" were synonymous terms, though they themselves have shown that liver-abscess follows "amœbic dysentery" in the proportion of 1 case in 4. I believe the *B. coli*, the *B. pyocyaneus*, etc., are more often the cause of dysentery than the much-talked-of amœba. "Everywhere," says Davidson, in Allbutt's *System*, "natives of tropical countries are less liable to liver abscess," and we may add that everywhere they are extremely liable to dysentery. If dysentery is so important a predisposing cause, how is the rarity of abscess of the liver to be explained among natives in the Straits Settlements, West Indies, among native Egyptians, at Zanzibar, in the Seychelles, and in Brazil and Cayenne? (v. Davidson's chapter, *op. cit.*). In most of these places malaria is common and in some very severe, and in all dysentery is common. Liver abscess of pyæmic origin is certainly not uncommon outside public hospitals in India, but I am here only concerned with the fact that while dysentery has been extremely common in Bengal prisons, liver abscess has been extremely rare. A medical subordinate of mine in this large central gaol (1,200 prisoners), who has served here for ten years, has seen many hundred

cases of dysentery and only one case of liver abscess (in gaols all cases which die are examined *post mortem*). This ounce of fact—the great rarity in natives of liver abscess contrasted with the abundance of dysentery—should be remembered in discussing the question.

AN EPIDEMIC OF MALARIA ON BOARD SHIP, WITH A RECORD OF BLOOD EXAMINATIONS.

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OUTBREAKS of malarial fever in ships at sea have been frequently recorded, but, so far as I am aware, in none of these has there been a systematic examination of the blood for the plasmodium. I thought, therefore, that an account of a ship epidemic in which such an examination was made might be worth recording. The ship in question—a steamer, with a mixed crew of Europeans and natives, numbering ninety-one in all—left Glasgow on August 4th, 1897, and arrived at Calcutta on September 3rd. She remained at this port, lying alongside the quay, for seventeen days. The weather all the time was extremely hot and oppressive. She started on the homeward voyage on September 20th, the health of the crew at this time being good. Water had been taken on board in Calcutta, and stored in the ordinary covered tanks. The first port touched at was Colombo, which was reached on September 25th. The ship remained here only a few hours, and was anchored just inside the breakwater, some 400 yards from the shore. A fresh supply of water was taken on here. The health of the crew was still good. Nine days after leaving Colombo, while the ship was in the Red Sea, one after another of the crew became affected with fever; the exact number of cases is not known, but there is a definite history that 22 men were laid up at this time; 3 of these were Europeans—namely, the second and third engineers, and 1 quartermaster; the remaining 19 being natives—namely 1 quartermaster, 1 saloon butler, 1 messroom boy, 1 chief cook, 1 barber, 1 Lascar, 1 deck boy, 1 Lascar cook, 5 firemen, 1 coal trimmer. The sick were treated by the ship's surgeon; some apparently recovered quickly, some suffered a relapse after about six days, and some were sick during the rest of the voyage. The ship reached London on October 25th.

CASE I.

The above account is not so complete as could be wished, but unfortunately I have been unable to communicate with the ship's surgeon, and consequently I have been obliged to

rely on the ship's officers and the patient's themselves for these details. Four of the crew were admitted to this hospital under the care of Dr. Manson. The following is a brief summary from the notes of each case.

CASE 1.—J. M. A., quartermaster, aged 27, a Scotchman, had been at sea for fourteen years, but never had malaria or any other illness before. He went on shore at Calcutta on one occasion only for an hour and a half. He did not land at Colombo. His first attack of fever occurred on the ninth day after leaving Colombo, and he suffered with attacks off and on during the rest of the voyage. He was admitted on October 27th. Temperature 105° F., sweating, and anæmic; spleen enlarged and tender; the other abdominal viscera normal; thoracic viscera normal. Blood examination revealed a double benign tertian infection, one group of the parasites being in the early non-pigmented stage, and the other group being in the large pigmented intracorpuscular stage, and occupying about two-thirds of the red corpuscle. The subsequent clinical features of the case were those of a typical double benign tertian ague.

His temperature chart demonstrates very well the double character of the fever. Thus on October 27th and 29th rigor occurred at noon, and the temperature rose approximately to 105°, whereas on October 28th and 30th rigor occurred between 2 and 3 P.M. approximately, and the temperature rose to 103.2°. Quinine was given on October 29th during the sweating stage. It was interesting to observe that the drug destroyed the plasmodia liberated on that day, and which otherwise would have matured and caused a paroxysm on the 31st; whereas it failed to affect the half-grown parasites born on the 28th; these matured on the 30th, the rigor occurring at the expected time. Blood examination on the 30th, before rigor, revealed a single infection only. No relapse took place, and the patient was discharged as convalescent on November 4th. His blood was free from parasites and spleen much reduced in size.

CASE II. D. B., quartermaster, an Indian, had been at sea all his life. He stated that he had suffered from fever before, but not during the last eighteen months. He went ashore repeatedly at Calcutta, but not at all at Colombo. The first attack of fever occurred on the ninth day after leaving Colombo. He had daily bouts of fever on the next six consecutive days. He was treated by the ship's surgeon, and remained free from fever until two days before admission. He came to the hospital on October 26th, looking very ill, with staggering gait, sweating, and vomiting bilious material. The temperature was 103.6°. He was cachectic, the spleen was enlarged and tender, and the liver was enlarged. Blood examination revealed many small ring parasites; doubly infected red corpuscles were frequently met with; brassy bodies and pigmented leucocytes were also observed, but at that period of illness no crescent bodies. Antipyrin was given to relieve his distress. He had a rise of temperature on the next two days, but no definite chill occurred. Quinine was given

CASE II.

on October 30th, and the fever did not recur. The blood was examined daily. Crescent bodies first appeared on the fifth day after admission, that is on the seventh day from the onset of the last attack of fever. The crescents subsequently became very numerous, four or five being present in each field. Exflagellation took place with great readiness, occurring in five minutes if the slide was breathed upon, or if the droplet of blood was exposed on the finger for 20 to 30 seconds. He was discharged by his own wish on November 16th much improved, a few crescents being still present in his blood.

CASE III.—A. B., a Lascar, was admitted on October 29th. No reliable history as to dates could be obtained, but the native quartermaster testified to the fact that he was laid up with the rest of the crew in the Red Sea. The temperature was 102°; he was sweating and anæmic; the spleen enlarged. Blood examination revealed a large number of small ring parasites, and some pigmented leucocytes; no crescents found. On