A TOUR OF INVESTIGATION AS TO THE PREVALENCE OF "KALA-AZAR" IN KASSALA AND BLUE NILE DISTRICTS, SUDAN, FROM JANUARY 12TH TO MAY 16TH, 1909.¹

By Captain L. Bousfield.

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This tour lasted from January 12th to May 16th, 1909, and was restricted mainly to the investigation of the prevalence of kala-azar in the parts visited, as but little time could be employed in attempting to solve the important problem as to the method of the transmission of the disease.

In 124 days some 1,300 miles had to be traversed, 900 of which were by camel, and this restricted the stay in many places to thirty-six or forty-eight hours. Further, quite half of the available time had to be spent in general medical work, for there are no doctors or hospitals except at Kassala, Gedarif, and Singa.

The time at my disposal was totally inadequate to form even a really reliable estimate of the amount of kala-azar in the smaller towns and villages, since in nearly every place it was extremely difficult to get the natives to come willingly for medical advice and treatment, or to obtain information of those sick in their tukils.

It takes some time to gain the confidence of the people, a thing almost impossible in a stay of a day or two, and it is also an undoubted fact that it is extremely difficult to diagnose early cases of kala-azar, unless observations are continued for some days.

Prior to starting on the tour notices were sent to inspectors, mamours, omdahs, and sheikhs, asking for information on the disease, and any suspicious cases to be ready for me on my arrival.

In all places where English or Egyptian officials are stationed, except Sennar, much useful information and help was afforded, but the notices sent to the sheikhs were a complete failure, and only at Softi had any attempt been made to get the required information ready for me.

Instructions on the signs and symptoms of this disease, together with preventive measures, had been prepared in Arabic for the sheikhs, &c., but in a very short time I desisted from distributing them, owing to the illiterate condition of the sheikhs, and the fact

¹ Final Report.
that most of those who could read seemed quite unable to grasp the meaning of the notices.

The following places were visited in order: Kassala, Tomat, Sofi, Wad Helewa, Gedarif, Shesheina, Abu Galud, Gallabat, Tukelein, Seraf Saylied, Doka, Kom Shetta, Matna, Galel el Nahl, Wad Shusha, Mafaza, Luciesa, Singa, Abdin, Sennar, and Costi.

Methods of Procedures.

In places where there were hospitals and doctors much information was at hand and the patients were seen in hospital; however, it must be kept in mind that even in stations where there are permanent hospitals probably less than a third of the sick come for treatment, and the remainder are probably unknown to the medical authorities. In most cases troops, police, and schools were inspected.

In villages sheiks were summoned and told to bring those who were sick for treatment, and were informed that any who were seriously ill would be visited in their houses.

In nearly every instance the sheikh at first replied that there were no people ill, and it was often necessary to send them out twice to find those who were ill, and in some cases even then none came for treatment. The sheikh was then informed that a house-to-house inspection would be made, and he would be punished if any people seriously ill were found. This usually had the desired effect, and after a few had been seen others readily came for treatment; but to insure seeing all, several days at least at each village are required.

At Gallabat a tukl was used as an inspection room, and the natives readily came until I insisted on the isolation of a woman with acute kala-azar. From that day onwards I saw no new cases, so in other stations I did not insist on isolation until just before my departure, as, had I done so, I should have seen no more of the sick inhabitants. At Mafaza and Sennar a house-to-house inspection was carried out in company with the mamour, sheikhs, and sanitary barber.

I am quite sure that the natives have only to be visited a few times in this way by a doctor to obtain their confidence and their ready acquiescence in medical inspection and treatment.

Since the stay in a village was often so short, it was considered advisable to go direct for the definite diagnosis by the surest method — i.e., spleen puncture — and the method employed is described in detail further on.
A preliminary report was submitted on May 18th, 1909, dealing with the disease in general, together with measures recommended to combat the spread of the disease.

This further report requires more time to elaborate and deals more fully with the disease from a medical and pathological standpoint. The number of cases and some of the information in this report differ slightly from those of the first owing to further information and work; thus four new cases are added, which are as follows:

1. A case considered suspiciously like "kala-azar" died at Singa, and on further search through the films typical parasites were found.

2. A case contracted at Singa was found in Military Hospital, Khartoum, on my return, and the parasites had been demonstrated at the Gordon College Laboratories.

3. In a suspected case in the Military Hospital, Khartoum, I found the Leishman bodies; the disease was contracted at Keili.

4. Bimbashi Archibald found typical parasites in the blood of the official from Sennar, whose servants had been found to be badly infected with the disease.

In the table on the next page are given:

1. The towns.
2. Number of patients treated.
3. Cases of "kala-azar" subdivided into three classes: (a) Those proved by finding the parasite; (b) those clinically certain; (c) those which raised very grave suspicions of the disease.

It will be thus seen that the total number of cases proved and suspected is fifty-seven, and of these in twenty-three the typical parasite was found.

As pointed out in the preliminary report, the condition found on the Blue Nile is serious, for only three places were visited, Sennar, Abdin, and Singa—and yet these three have produced ten cases definitely diagnosed—and the Blue Nile is now known to have supplied twenty-three proved or suspected cases; or twenty-five if the two police, who went to Mafaza for two months in 1907 reallycontracted the disease at Singa before going to Mafaza.

As far as I can ascertain, there have now been forty-two proved cases of "kala-azar" in the Sudan, and of these fifteen at least contracted the disease on the Blue Nile, and it is all the more striking since much less investigation and work with regard to this disease has been carried out in this district than in Kassala Province.

Of these forty-two cases, forty-one have been diagnosed since
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May, 1907, and have been contracted either on the Blue Nile or in Kassala Province.

These facts force one to believe that, firstly, the Blue Nile is the most extensively infected district, and, secondly, that the disease is in all probability a new arrival.

<table>
<thead>
<tr>
<th>Province</th>
<th>Place</th>
<th>Number of patients treated</th>
<th>Proved</th>
<th>Clinically certain</th>
<th>Highly suspected</th>
<th>Total proved and suspected</th>
</tr>
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<tr>
<td>Kassala</td>
<td>Hospital</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td></td>
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<tr>
<td>Tomat</td>
<td>12</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
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<tr>
<td>Sofi</td>
<td>12</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
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</tr>
<tr>
<td>Wad Heleiwa</td>
<td>7</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td></td>
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<tr>
<td>Gedafir</td>
<td>Hospital</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>5</td>
<td></td>
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<tr>
<td>Sheheima</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
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<td>21</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
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<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td></td>
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<td>Gallabat</td>
<td>161</td>
<td>3</td>
<td>4</td>
<td>3</td>
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<td>-</td>
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<td>1</td>
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</tr>
<tr>
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<td>-</td>
<td>-</td>
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<tr>
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<td>-</td>
<td>-</td>
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<tr>
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<td>-</td>
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<td>-</td>
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<tr>
<td>Wad Shusha</td>
<td>None could be induced to attend for treatment</td>
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<td></td>
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<td>153</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>5</td>
<td></td>
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<tr>
<td>Keili</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td></td>
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<tr>
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<td>9</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td></td>
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<td>Singa</td>
<td>Hospital</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>10</td>
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<td>25</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td></td>
</tr>
<tr>
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<td>6</td>
<td>2</td>
<td>5</td>
<td></td>
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<tr>
<td>White Nile</td>
<td>Costi</td>
<td>6</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Total | 627 | 23 | 17 | 17 | 57 |

So far the disease has been found mainly amongst Government officials and employees, a fact not remarkable when one considers their opportunities and desire for medical treatment.

The places so far known to be considerably infected are Kassala, Gallabat, and Mafaza in the Kassala Province, and Singa, Abdin, and Sennar on the Blue Nile.

The map shows the distribution of the cases proved and suspected, and an attempt has been made to piece together all available information, so that the map is a composite of all known cases in these stations and does not represent the numbers seen on this tour.
The Sudan area (dotted tint) may be considered to be practically free, except from imported cases.

**Key—**

- **P** = Definitely proved cases.
- **S** = Suspected cases.

To these cases must be added—

1. From White Nile (one).
2. Late Dr. Pirrie.
3. From Kaili (one).
4. From Senga (one).
The shaded area may be considered practically free from the disease, since of those discovered in this region—

1. The three at Gedaref did not contract the disease there, and both the suspected cases came from elsewhere;

2. The case at Galel el Nahl almost certainly contracted it at Mafaza, and an inspection of the whole population showed no others likely to be suffering from "kala-azar";

3. The two cases at Abu Galud and the one at Doka cannot be accounted for, but only one was definitely proved by finding the parasite;

4. The case at Seraf Sayeid was an old woman, who may possibly have been suffering from malignant disease and was seen but once.

Thus it seems probable that, as in India, the disease tends to cling to river banks, but it is to be noted that in none of these places was I able to stay longer than two days, a time totally insufficient to gain a very reliable knowledge as to the existence of cases. However, it can be definitely stated that the disease exists to no large extent in these towns and villages at present. Stops extending to a week or more were made only at Gallabat, Mafaza, Singa, and Sennar.

The main centres of the disease among the places visited are Kassala, Gallabat, Mafaza, Singa, and Sennar. It is a remarkable fact that most of these places are visited by Abyssinians. Kassala has a large permanent population of this race. Gallabat is absolutely on the Abyssinian-Sudan frontier, and is one of the main trade routes between these two countries. This race may have introduced the disease into Mafaza, for early in 1908 I found one of them severely infected and who appeared to have had it some considerable time; however, there is the possibility of its having been introduced by two policemen from Singa on the Blue Nile. There are a certain number of Abyssinians in Singa and Sennar, but I understand their number is not great.

In Kassala province during 1908 Abyssinians supplied 37 per cent. of the cases, which is remarkable when one considers their comparatively small numbers with regard to the other inhabitants; but during this tour only three were found, and none were definitely diagnosed. Further, it seems probable that the small epidemic at Sennar was started by an Abyssinian syce. This point, however, must still be considered to be sub judice.

It is of the utmost importance to find out whether this is the beginning of the disease in a new country, or whether these are but
cases left behind in the track of a previous epidemic. Considerable
time and trouble have been spent in trying to elucidate this point,
and the imperfect and unreliable information obtained makes
one conclude that probably the disease is a new arrival amongst
a previously uninfected people, and therefore much more liable to
take on an epidemic character.

The earliest reference to these parts that I can find is in Sir
Samuel Baker's "The Nile Tributaries of Abyssinia," written in
1861. In Chapter VIII. he states that at least 50 per cent. of the
population had a permanent enlargement of the spleen, which
could be felt by a slight pressure of the hand, frequently as large
as an orange. This is of no great value, since the observation
was made during the khareef (rainy season) and no reference is
made to a great mortality, but I am certain that now nothing
like 50 per cent. of the inhabitants show permanent enlarge­
ment of the spleen, and I doubt very much if malarial conditions
have improved in this town. Further, the enlargement to the size
of an orange means a very much enlarged spleen, especially when
thus observed by a layman. Along the Atbara I have been surprised
to find that, excluding Gallabat, it is the exception rather than the
rule to find a palpable spleen.

I have questioned many old men and old sheikhs on the
prevalence of such a fever during the Mahdi's and Khalifa's time,
but could gain no definite news, except that they could not
remember it and were almost certain there was no great mortality
from such a fever.

Sheikh Adam Idris of Abdin informed me that ten years ago he
visited Lueisa and that the fever there was very severe and very
fatal; however, he could give me no description of the disease.
This is interesting, as it was in this village that I found the
most chronic case of "kala-azar" I have seen in the Sudan,
a case of over five years' duration in a man who had been in Lueisa
for the previous seven years.

Referring now to more reliable sources, I must thank Sagh
Mohammed Eff Niklawi for much information on this subject.
He was at Omdurman Hospital early in 1899 and remembers a
large number of Egyptian soldiers, perhaps fifty, returning from the
Blue Nile suffering from fever, which in many cases did not react
to quinine, which was sometimes administered in 30-grain doses,
and one showed marked enlargement of spleen and liver with great
wasting. He believes many died, and recollects four or five such
deaths in his wards.
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This information is suggestive of “kala-azar,” but Niklawi Eff was not very definite, the lapse of time—ten years—making it almost impossible to obtain definite facts.

In answer to a letter asking for information on this subject, Dr. Abdel Latiff Eff Ahmed, late Yousbashi Medical Corps, who was at Sennar at the end of 1898 and the beginning of 1899, and again in 1901 and 1902, very kindly supplied me with these statements:

1. The fever was serious and often fatal in forty-eight hours to one week. Patients who did well took ten to fifteen days to recover, but were liable to relapses.
2. Quinine was very effective.
3. Average number deaths from fever in 1898 and 1899 at Sennar and Karkoj was 7 to 10 per cent.
4. About 90 per cent. were ill with fever. If the fever became chronic it lasted usually six months, and the patients became debilitated and died.
5. Many natives with prominent abdomens, large spleens and livers were seen. In some cases the spleen filled the abdomen, and the natives called such cases “patients from the son of fever.” This condition had always been accompanied by very severe debility, but it was very rare amongst the troops.
6. Fever patients did not suffer from diarrhoea, but rather from constipation.

It has to be remembered that these statements may not be strictly correct, since they are based on recollections of events ten years ago and not on actual notes made at the time; but they tend to uphold the view that the vast majority of cases were malarial, and not “kala-azar.”

On return to Khartoum I examined the medical reports of 1898 and 1899.

In the annual report from the Blue Nile in 1898 it is stated “The stations on the Blue Nile are exceedingly unhealthy, and often fatal to Europeans. They are the home of malaria in its worst forms, including intermittent, remittent, and malignant types. So unhealthy are they that the Sirdar has decided to withdraw most of the troops towards the close of the rainy season, leaving only scanty garrisons until the danger is over, which is, roughly, at the end of November.”

El Kaim R. H. Penton Bey in the Annual Return, Omdurman District, 1898, states:

“Invalids from the Blue Nile are bloodless, emaciated, and
thoroughly broken down. Convalescence is slow and frequently interrupted with attacks of fever. Change of air for restoration to health is imperative.

"Invalids from the White Nile are not so thoroughly broken down, and therefore recover more quickly. Sennar, Karkoj, and Rosaires on the Blue Nile are quite unfit for human habitation during and after the rainy season. This applies to the Europeans and Egyptians especially, though the blacks also suffer and are only exempt, as a rule, from severe and fatal attacks. At no time of the year does the Blue Nile appear to be exempt from malaria. A cursory examination of the inhabitants will show that it cannot be otherwise than unhealthy, and malarial cachexia is apparent in every village. . . . The expenditure of quinine in this district has been 41 lb. in five months and 8,000 pills of 5 grains and 3 grains each."

On referring to the number of troops in this district it was found that the 3rd Battalion (Egyptian) 30th Camel Corps and 10th Sudanese Battalion were stationed on the Blue Nile, and the 12th Sudanese and 25th Camel Corps at Gedarif, the total being probably less than 2,500, so that the amount of quinine used was considerable, especially when one considers that two out of the three battalions were Sudanese.

An extract from this report reads as follows:—

"By no means a small proportion of these [fever cases] have been due to recrudescence of fever contracted in 1898."

Amongst the deaths are mentioned fourteen from intermittent fever, and six from remittent. "Debility" caused 374 admissions, and of these 222 were invalided north, and 108 invalided from the service.

The extreme importance of trying to find out if "kala-azar" was present at this period has caused the inclusion of all these statements, for the prognosis from an epidemic point of view depends largely on the fact whether this is a new disease or not. The most hopeful points in these reports to my mind are:—

(1) Invalids from the Blue Nile were bloodless, emaciated, and thoroughly broken down.

(2) Invalids from the White Nile, an equally malarial district, compared very favourably with those from the Blue Nile.

(3) Malarial cachexia is apparent in every village on cursory examination. This undoubtedly is not a fact now at Sennar, Singa, Abdin, and Wad Medani, and such cases have to be most carefully sought for, and, further, "malarial cachexia," was the term
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nearly always applied in India to cases now known to be "kala-azar," before this disease was separated from the malarial fevers.

(4) In spite of large quantities of quinine, the troops suffered badly from fever; practically two-thirds of these troops were Sudanese, who are much less liable to fever than the Egyptians.

(5) The percentage of those invalided from the Service for "debility" seems extremely high, if from pure malaria which had been treated thoroughly with quinine.

Further, as far as my knowledge goes, judging from the present day, malignant malaria is not very common on the Blue Nile, and therefore presumably was not very common at that date. It has been quite impossible to trace what happened to the invalided men.

On considering these reports it was thought advisable to write and ask Lieutenant-Colonel Penton for his opinion on the condition, viewed in the light of our present knowledge of the disease, but so far no reply has been received.

In no place was the disease in any way evident, and cases had to be found by careful inquiry and examination. The following facts are cited to show that in some cases the disease is epidemic to a limited degree even at the present time, though in the vast majority of cases I could only find single individuals attacked, the other members of the family or compound showing no signs of the disease.

(1) On arrival at Sennar two servants of an official were found to be seriously ill with "kala-azar"; one died on May 4th, 1909, and the other was in a dying condition. On inquiry it was found that of the other servants an Abyssinian syce had been ill with fever for two months, was very emaciated, had a large spleen, and died in Khartoum early in 1908. The safragi (personal servant) had been ill with fever several months, was wasted, had a prominent abdomen and large spleen, went to Khartoum at the same time, and died there.

A marmiton, a Sudanese boy, lived in the same tukls for two months, but being discontented with his pay returned home to the Mustamareen, near Singa, and shortly afterwards became very ill with fever, which lasted a few months and ended fatally.

On my return to Khartoum inquiries were made about these two servants, who were reported to have died early in 1908, but it was found they did not die in hospital.

Dr. Squires, of the Soudan Medical Department, very kindly supplied me with the following information:—The Abyssinian syce,
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aged 15, was admitted on January 7th, 1908, with fever and enlarged spleen, and discharged on February 9th, 1908. Re-admitted February 16th, 1908, when malarial parasites were found in the blood. Temperature was 102° to 99° for two weeks, and then fell to normal. Leishman-Donovan bodies were looked for but not found and he was discharged on March 8th, 1908.

The safragi, a Dinka, aged 17, was admitted November 23rd, 1907, with intermittent fever and enlarged spleen. There was high fever for five days, but after hypodermic injections of quinine the temperature fell to normal in three days. No malarial parasites were found, and he was discharged on December 5th, 1907.

The Mudir of Khartoum was asked to supply information as to the death registration of these cases, and very kindly made inquiries, but could not find any record of these deaths. Thus, it is uncertain whether they died, but several informants at Sennar were very definite in their statements that these two had died in Khartoum.

The official was known to have been slightly ill off and on with fever, and his peripheral blood was examined at Khartoum by Bimbashi Archibald at the Research Laboratories, and he reported the presence of typical Leishman-Donovan bodies.

(2) At Mafaza the disease has been more or less epidemic, since it is now known that of those who have inhabited the police lines between August 27th, 1907, and April 8th, 1909, eight have died of this disease, while another policeman, the sub-mamour and his two servants almost certainly succumbed to "kala-azar."

(3) At Abdin two brothers were found, one suffering from definite "kala-azar," while the other had been ill for two years with fever, and had a spleen reaching to the umbilicus.

Another case in this village had been ill, according to his statement, only fifteen days, and the peripheral blood was examined, supposing it to be a case of malaria, but typical Leishman parasites were found.

(4) The possible infection of the Third Company of the Arab Battalion is dealt with in detail later on. There was practically no time available to study this point, but the following facts were forced on one's mind:

(a) Bed bugs are extremely common; quite 75 per cent. of the native angareebs harbour them;

(b) Angareebs in places away from the river banks seem to harbour bugs just as frequently as those in places situated on the rivers.

The following facts, with reference to the presence or absence of bugs, were ascertained in 20 cases of "kala-azar":—
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(1) Live bed bugs found in 8 instances;
(2) Fresh eggs, but no live bed bugs found in 4 instances;
(3) No signs of bugs or their eggs in 4 instances;
(4) Those who did not use angareebs or had not used them in the place were obviously ill in 4 instances.

All the bugs examined were believed to be *Cimex lectularius*, owing to their presenting distinctly flattened or concave edges on the dorsal aspect of the pro-thorax.

So far, *Cimex rotundatus*, which is held to convey the disease in India, has not been found in the Soudan, though Mr. King, the Entomologist at the Gordon College, informs me they have been found on Yemenese pilgrims at Port Sudan and Suakim. The disease in the Sudan certainly seems to spread in some cases through the members of a household or compound, and suggests that the disease may be conveyed by the bed bug; but against this view, however, is the striking fact that in the Sudan, as in India, the disease appears to cling to river banks and yet bed bugs are equally common in places on and away from the river, and infected persons must frequently be visiting these places off the river. Further, in the Sudan, the villages off the river are at a very slightly greater altitude than those on the banks, and I doubt if the temperature or humidity of air or soil is greater; for where a village is, there of necessity must be water, either at hand or very adjacent.

On the angareebs of patients chicken ticks were noted on three occasions, and camel ticks and cockroaches in many instances. One point was observed and is worth mentioning; the popular belief, which I have often heard expressed, that angareebs strung with strips of hide do not harbour bugs is quite fallacious, as many such angareebs were seen teeming with these pests. In view of the possibility of the disease being carried from domestic animals to human beings, the animals kept in the tukls or hooshes of those suffering from "kala-azar" were noted, and in no instances were animals, evidently ill, discovered.

The following were found: Dogs in six instances; chickens in seven instances; sheep in one instance; goats in two instances. Camels were never found in the hooshes, and apparently none of the cases were intimately associated with these animals.

Special attention was paid to dogs, but those living with the patients did not appear in any way ill, and the only parasites noted on them were ticks—fleas were never seen. Two dogs were killed and examined, and the results are given later on: one, a very healthy

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looking animal, presented structures very similar to "kala-azar" parasites.

Trade, habits, and food seemed in no way connected with the transmission of the disease, but it still has to be determined whether river water or the eating of fish may not be a means of conveying the disease in the Sudan, a possibility in view of the tendency of the disease to cling to river-side villages.

The disease runs in many cases a very severe and rapid course, and of those diagnosed on this tour eight are known to be already dead. The average duration of the illness, according to the statements of the various patients, who, however, are not by any means entirely to be relied upon, was twenty-one and a half weeks, while five terminated fatally in thirteen weeks. Nine cases gave a history of illness of less than three months, while five more stated the disease lasted five months or less. The most rapid case was that of a woman aged about 18, at Kassala; she and her husband were most definite in their assertions that she had been ill only twenty days before admission to hospital in an extremely serious condition, where she died six days later.

A boy, aged about 16, at Abdin had a spleen enlarged to within an inch of the umbilicus, and looked seriously ill; he very positively declared he had been ill only fifteen days and had no previous attacks of fever. Peripheral blood was taken with the expectation of finding malignant tertian parasites, but no malaria was found, while typical Leishman bodies were discovered. About ten days later Bimbashi Drew, Medical Corps, saw the man and informed me he considered the case was rapidly going downhill and he thought the man would not live long.

Chronic cases were seldom seen; three, however, gave histories of five years (Lueisa), three years (Abdin), and two years (Abu Galud) respectively.

The following points make one inclined to the view that the disease is a new arrival amongst a previously uninfected people: (1) The virulent character; (2) the comparatively few chronic cases observed (this, in my opinion, is a very suggestive fact); (3) the epidemic character the disease has assumed at Mafaza and Sennar; (4) the absence of history of a past epidemic, though this is naturally extremely difficult to determine owing to the ever-present malaria after the rainy season both near and away from the rivers; (5) the failure of medical recognition, though it must be kept in mind that the disease has been but comparatively recently separated from malaria and many medical men are still ignorant of it.
Investigation into Prevalence of "Kala-azar"

If the disease is a recent arrival, then, considering its extremely insidious onset amongst a population, it behoves the Government to take most energetic steps to prevent it getting a large hold on the people and to prevent an extensive epidemic in the near future.

No information was obtained as to the incubation period of the disease, though much attention was paid to this point.

A boy with "kala-azar" at Galel el Nahl, where the disease appears to have been unknown and where all the other inhabitants showed no signs of disease, went to Mafaza, where the disease is well known to exist, stayed there two days, returned, taking two days over the journey, and fourteen days later became ill with severe fever. I could find no cases in the hoosh where he stayed at Mafaza, but, if contracted there, the incubation was sixteen to eighteen days.

The incidence of the disease appears to favour the months of July, December, and January, which correspond to the commencement of the cool and rainy season and the few months following the end of that season. It is often quite impossible to obtain definite information from a native about the date of onset, but the following table gives the approximate months of onset of all the cases, proved or suspected, that I have been able to follow:

<table>
<thead>
<tr>
<th>Month</th>
<th>Proved</th>
<th>Suspected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>5</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>February</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>March</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>April</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>May</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>6</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>August</td>
<td></td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>September</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>October</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>November</td>
<td></td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>December</td>
<td>5</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

Many described their illness as starting during the khareef (rainy season), but gave no definite information. The number is too small to allow any reliable deductions, but it seems to point to the onset being during the rainy or cool season, or the few months following it which are also cool; possibly the cases occurring during July and August are those infected at the end of the previous cool weather, the disease lying dormant during the ensuing hot months. The objection may naturally be raised that suspicious cases should not be included in this report and in the above table, but this appears to me justifiable when the fact is considered that thirteen cases were thought to be suspiciously like "kala-azar" at the end
of 1907 and at the beginning of 1908 in Kasala Province, and in July of that year nine of these had succumbed. This, to my mind, largely upholds the diagnosis, especially as they all had considerable quinine treatment and spleno-medullary leucocythemia is out of court, and indeed is scarcely ever seen in the Sudan.

A point to be carefully remembered in the Sudan is that it is quite common for a "kala-azar" patient to have had malaria and to give a history of fever every alternate day, probably recognising the malarial paroxysms while failing to recognise the fever on the intermediate days.

The average age of those affected was about 18 years, the eldest being about 40, and the youngest about 6. These figures are only approximate, as the ages had of course to be judged on appearance and medical examination.

Nineteen out of the twenty-two were males, the three females being extremely ill, and, in fact, manifestly moribund, when seen.

This great preponderance of males over females only illustrates the difficulty a doctor experiences in seeing the female population of a Mohammedan community; and though in some cases a house-to-house inspection was made, yet it is quite easy to hide or remove any sick female, so that they escape observation.

Probably the disease attacks sexes equally in the Sudan, and if carried by the bed bug one would expect the females to be more infected than the males, owing to their being more occupied in the tukls.

There seemed to be no special selection with regard to nationality or tribe. The Arabs, being the most numerous, naturally supplied most cases, and other tribes were represented, such as Beniama, Jaalin, Bagara, Shaagi, &c. Many were of mixed blood, usually Arab father and slave Sudani mother.

The attached table gives the nationality:

<table>
<thead>
<tr>
<th>Nationality</th>
<th>Kala-azar</th>
<th>Suspected Kala-azar</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arab</td>
<td>13</td>
<td>20</td>
<td>33</td>
</tr>
<tr>
<td>Sudani</td>
<td>5</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Mixed origin</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Egyptian</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Abyssinian</td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

It is also worthy of note that four Englishmen have been reported as contracting the disease in the Sudan.

Full dependence cannot be placed on the registration of deaths, since the information is gained from sheikhs, sanitary barbers, &c.;
Investigation into Prevalence of "Kala-azar"

however, they are more to be depended upon than the registration of births.

The following table gives the registration of deaths at some of the bigger centres:

<table>
<thead>
<tr>
<th>Station</th>
<th>1906</th>
<th>1907</th>
<th>1908</th>
<th>1909 (end of March)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kassala</td>
<td>183</td>
<td>209</td>
<td>180</td>
<td>—</td>
</tr>
<tr>
<td>Gallabat</td>
<td>25</td>
<td>137</td>
<td>81</td>
<td>—</td>
</tr>
<tr>
<td>Gedarif</td>
<td>311</td>
<td>254</td>
<td>293</td>
<td>—</td>
</tr>
<tr>
<td>Mafaza</td>
<td>53</td>
<td>104</td>
<td>118</td>
<td>—</td>
</tr>
<tr>
<td>Singa</td>
<td>—</td>
<td>224</td>
<td>361</td>
<td>109</td>
</tr>
<tr>
<td>Sennar</td>
<td>—</td>
<td>162</td>
<td>120</td>
<td>44</td>
</tr>
</tbody>
</table>

Thus it would appear that the death-rate is rising considerably in Singa, Gallabat, and Mafaza, especially in the first-named town. The fallacies are that the populations of these towns vary greatly, often year by year, and, further, every year probably sees an improvement in the number registered.

However, I believe the death-rate at Singa is increasing in a greater ratio than is the population; it is to be noted that 109 deaths were registered up to the end of March, and if this be kept up for the three remaining quarters, then the total for 1909 will be 436. The death-rate is usually greater in the latter half—i.e., during the rains and subsequently feverish period—than in the first half of the year, so that probably this total will be exceeded and the death-rate will have more than doubled in three years.

The onset was either by short attacks of fever, frequently repeated, or by a serious continuous attack.

No prolonged and continuous observations could be made on the type of fever, since the patients were seldom seen on more than two or three occasions. In three cases which were observed for some days, two, acute cases, showed a double remittent fever, and in the third, a subacute case, which had lasted nearly a year, there was only a single rise during the twenty-four hours. Most of the cases seen within a few days of death had a normal or sub-normal temperature.

The chronic case of five years' duration had a normal temperature, and one of three years' duration had a temperature of 99° F.

Wasting was marked, especially in the chronic and very acute cases (see photographs II., III., and VI.). Many of the subacute type showed but slight signs of emaciation, and this renders the diagnosis more difficult, since it is not easy to determine whether some Arabs, who are naturally thin, are wasted, especially as many are poor, and therefore badly fed. Emaciation was marked in eleven cases, slight in eight, and not evident in three.

Weakness was noticeable in all cases, but especially in the very acute, while in the subacute it was not very evident.
Protuberance of the Abdomen.—In thirteen out of the twenty-two cases the abdomen was not prominent, while in several cases it was actually the reverse. Those who had large abdomens were the chronic cases, and the average duration of these cases, when seen, worked out to nineteen months.

The fact that 59 per cent. showed no protuberance is, to my mind, highly suggestive of a new disease, likely to take on an epidemic character. No chronic case was seen without some protuberance of the abdomen, a condition probably essential, and due to nature making accommodation for the greatly enlarged spleen and the enlarged liver.

Enlargement of the Spleen.—In nineteen cases out of the twenty-two the spleen was enlarged to within an inch of the umbilicus or to a greater extent. In the remaining three the spleen was palpable or extended one inch below the costal margin. Many cases complained of slight but lasting attacks of pain in the splenic region. In all cases the enlargement was regular, the edge definite; tenderness on palpation was complained of in three cases.

The diagram shows the various degrees of enlargement of the spleen and liver as noted during this investigation.
Very large spleens were always and only found in chronic cases; the very acute having but comparatively slight enlargement of this organ.

*Enlargement of the Liver.*—In seventeen out of the twenty-two cases the liver was distinctly enlarged, though in most cases to no great degree. The largest extended downwards to the level of the umbilicus and the liver dulness was increased upwards one costal space. In no case was it noted to be smaller than normal. The surface was invariably smooth, edge well defined, and tenderness on palpation was not noted.

In two suspected cases the spleen was not enlarged beyond the costal margin, and liver puncture was performed with negative results.

*Jaundice* was found in two cases, but in neither to a marked degree.

*The conjunctive* were distinctly of a yellowish tinge in seven of the twenty-two cases; but this point is often difficult to determine owing to the natural pigmented condition and yellowish coloration of the conjunctive often seen amongst the Sudanese.

*Pigmentation* was only once seen, and then it was doubtful if it was due to "kala-azar."

The patient, an Egyptian, was seriously ill with fever and presented a curious bronzing of his face, which was not noted on any other part of his body; this bronzing appeared quite different in type to that usually seen due to the action of the sun. *Anaemia* was marked in nine cases, slight in eight, and not appreciable in five.

In three cases the peripheral blood on withdrawal appeared to the naked eye like slightly turbid serum. There were no special changes noted in skin, hair, or nails, and the nervous system appeared normal in most cases.

Mental depression was very marked in four cases, but all were acutely ill; one case was extremely deaf (no quinine had been taken), the power of speech was greatly impaired, and there was marked mental dulness. This condition had been present about fourteen days and lasted till the day of death, which occurred seven days later. No malignant tertian parasites were found in this case.

*Diarrhoea* was a very marked and serious complication in twelve out of the twenty-two cases. It was often, according to accounts, accompanied by the passage of blood and slime in the stools.

Undoubtedly several cases started their disease with attacks of diarrhoea, and my belief is that the majority had this complication early in the course of the disease.
The type of patients one had to deal with renders the taking of a careful history most difficult and often almost impossible, especially when the patient will on every opportunity refer to an “afrite” (evil spirit); but my firm conviction is that nearly all cases will be found to suffer from diarrhœa, and that usually at the commencement, or in the early stage of the disease as found in the Sudan. In the vast majority of cases the tongue was clean except in the very acute and moribund cases. Sordes on the lips were seen in virulent cases. Two presented marked tenderness over the colon, one presenting some thickening of this structure, and may possibly have been complicated by true dysentery. However, as far as my small experience goes, the diarrhœa is easily combatted by drugs, such as opium and bismuth, but readily reappears on the cessation of treatment.

The frequency of diarrhœa, accompanied by the passage of blood and slime in the stools, naturally suggests the possibility of infection through the alimentary track, and is a point that should be carefully investigated in the Sudan, unless the diarrhœa and blood be due to venous congestion due to the enlarged liver; but dilated veins on the abdomen were never noted, and ascites to a slight degree was seen in one instance only.

Edema of the legs was noted five times, one patient presenting œdema of legs, face, and a slight effusion into the peritoneal cavity, while another showed œdema of legs and face. In the few cases where the urine was examined no trace of albumin or bile could be found.

Suppurative processes were practically absent. Only one proved case showed some boils scattered over his legs, and one suspicious case had a suppurative condition of the scalp; this is no greater percentage than would be found amongst the general population.

Pain was never a marked symptom, though several complained of attacks of pain over the splenic region, these attacks apparently lasting several days and due, possibly, to sudden enlargement of the organ.

Headache, pains in the lumbar region and in the shins were sometimes encountered, but invariably accompanied by fairly high fever.

Epistaxis was troublesome in one case, and bleeding gums were encountered on several occasions.

Hæmoptysis was complained of by one patient, who showed no physical signs of phthisis, and there was no available sputum for examination when the patient was seen.
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Hypostatic congestion of the lungs was seen in several moribund cases, when the circulation was evidently giving out.

It is much to be regretted that no post-mortem examinations were made, but this was next to impossible owing to there being no available place, the tuki being usually in a compound occupied by many other people. Further, the prejudice amongst the natives against such a proceeding is so extremely intense that the performing of an autopsy would ruin all chance of further medical work and would destroy all confidence in a doctor visiting that village for a very long time to come.

The following photographs illustrate various types of the disease as met with in the Sudan:—

1. — A subacute case.
2. — Comparison between chronic malarial and kala-azar patients.
3. — Extremely acute case of "kala-azar."
4. and 5. — A doubtful chronic case of "kala-azar."

Case 1.

Boy, aged about 9, at Gallabat. Ill probably six months. Limits of spleen and liver delineated in white paint. Emaciation marked. Died March 27, 1909.
Case 2.—Two cases at Singa. "A"—Boy with "kala-azar." Ill eleven months. Died May 28, 1909. "B"—Girl from same house, but suffering from profound malarial infection; the spleen blood contained many benign tertian rosettes, though no malarial parasites were found in peripheral blood. This photograph shows plainly the difference in wasting and in the prominence of the abdomen.

Case 3.—A very severe and acute case at Gallabat. Duration three months. Died March 23, 1909. Diagnosed at first as dysentery; marked diarrhoea, with much blood and slime in stools. Descending colon very tender. High fever. Marked wasting, and weakness very pronounced. Enormous number of parasites in spleen blood. Peripheral blood like serum. No malarial parasites found. Spleen not very greatly enlarged.
Photographs of same patient. Gallabat. An Abyssinian ill two years. Typical parasites could not be found in spleen blood, though three punctures were performed and seven hours spent over microscopic examination. Weakness and wasting not marked. No malarial parasites in peripheral blood. Liver and spleen enlarged. Wife ill with fever for five months.
One serious point calls for notice—viz., that out of the twenty-three cases only twelve were lying up in bed, and of these four were Government employees, who, I think, had they not had the right to medical treatment in hospital, would have been out and about; thus eleven infected people were walking about and visiting other tukls and mixing with the general population and probably conveying the disease amongst them.

Further, the more seriously ill the case, the greater the tendency of relations and friends to gather in the tukl, and I have frequently seen five or more people in the tukl of a patient very ill with "kala-azar"; often two or more sitting on the angareeb of the patient.

Such a state of things is natural, but it is brought forward to show that the extension of the disease among these people is far more easy than amongst a more civilised population.

(To be continued.)