

On kala azar, malaria and malarial cachexia / by S.P. James.

Contributors

James, S. P. 1870-1946.

Publication/Creation

Calcutta : Office of the Superintendent of Government Printing, India, 1905.

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SCIENTIFIC MEMOIRS

BY
OFFICERS OF THE MEDICAL AND SANITARY DEPARTMENTS

OF THE
ON KALA AZAR, MALARIA AND MALARIAL CACHEXIA
GOVERNMENT OF INDIA.


S. P. James

KALA AZAR, MALARIA AND MALARIAL CACHEXIA

Scientific Memoirs of the Officers
of the Medical & Sanitary Depts.

No. 19

1905.




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SCIENTIFIC MEMOIRS

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OFFICERS OF THE MEDICAL AND SANITARY DEPARTMENTS

OF THE

GOVERNMENT OF INDIA.

ON KALA AZAR, MALARIA AND MALARIAL CACHEXIA.

BY

CAPTAIN S. P. JAMES, M.B., I.M.S.

ISSUED UNDER THE AUTHORITY OF THE GOVERNMENT OF INDIA
BY THE SANITARY COMMISSIONER WITH THE GOVERNMENT
OF INDIA, SIMLA.



CALCUTTA :

OFFICE OF THE SUPERINTENDENT OF GOVERNMENT PRINTING, INDIA.

1905.



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ON KALA AZAR, MALARIA AND MALARIAL CACHEXIA.

I

THE disease long known to natives of Assam by the name *kala azar* has been studied by medical men in India so frequently, and has occasioned so much controversy in the medical journals, that one cannot but feel some diffidence in adding, however slightly, to its already voluminous literature. For this reason I propose to present the facts I have observed regarding the disease as briefly as possible.

I shall deal first with the following important problem :

Is kala azar a form of malarial fever ?

I have attempted to solve this problem by employing a mode of investigation which, being based upon the following considerations, is essentially different from those adopted by previous workers.

All observers agree that *kala azar* is a very severe and, in the great majority of cases, fatal, disease. If it be a form of malarial fever, it must therefore be a very severe and fatal form such as would occur only in intensely malarious places. It follows that if we find *kala azar* to be prevalent in places where there is very little malaria, and especially if it is prevalent in a place where malarial fever is not present, we may conclude that *kala azar* is not a form of malarial fever.

The following are the results of some of my investigations in this connection :—

1. GAUHATI IN THE DISTRICT OF KAMRUP IN ASSAM.—My investigation was carried out with regard to the inhabitants of the town of Gauhati and with regard to the inhabitants of a small village (Ulloobari) about two miles distant from the town.

Prevalence of kala azar in Gauhati town.—There can be no doubt that *kala azar* is prevalent in this town. On the first and second mornings after my arrival I attended at the local dispensary and found five cases of the disease among out-patients who were residents of the town, and four among residents of Ulloobari village. On every subsequent visit to the dispensary I was able to find at least one case among the out-patients, and I came to regard the town dispensary as one of the most favourable places in Assam for studying *kala azar*. The prevalence of the disease could have been ascertained more accurately by a house-to-house inspection, but it may be taken for granted that the number of *kala azar* patients seen at the dispensary represented only a small proportion of the total number of sufferers resident in the town ; and even if we suppose that only one new patient suffering from the disease attended at the dispensary each week (an estimate I believe to be far below the true number), there is ample justification for the statement that *kala azar* is prevalent in the town.

Prevalence of malaria in Gauhati town.—Although *kala asar* was so common among the out-patients attending at the dispensary that one or more cases could be obtained at every visit, I found to my surprise—for reading previous reports had given me the impression that Assam is intensely malarious—that cases of malarial fever were quite rare. I examined the peripheral blood of a large number of out-patients, but found malaria parasites in only two during my stay in Gauhati. Both patients were suffering from mild Quartan fever. From the rarity with which malaria parasites were found in slides obtained from patients attending at the dispensary, I soon gained the impression that, in spite of the prevalence of *kala asar*, malarial fever was by no means common in Gauhati. In order to ascertain whether this impression was correct or not, I examined and took slides of finger-blood from 35 young native children living in the centre of the town. Only one of these children had an enlarged spleen and in only two were malaria parasites found. The spleen-rate of the children was therefore 2·8 per cent., and the parasite-rate per cent. (*i.e.*, the malarial endemic index) was 5·7.

Conclusion.—A disease known to the natives by the name *kala asar* is prevalent in Gauhati town. Malarial fever is rare, and such cases as occur are not severe.

2. ULLOOBARI VILLAGE, ABOUT 2 MILES FROM GAUHATI TOWN.—The prevalence of *kala asar* in this village was estimated by a house-to-house inspection of the inhabitants with the following result:—

| House-number. | Number of people living in the house. | Number of cases of <i>kala asar</i> among these people. | Number of deaths from <i>kala asar</i> within the last year. |
|---------------|---------------------------------------|---|--|
| 1 | 12 | 0 | 0 |
| 2 | 2 | 1 | 0 |
| 3 | 10 | 2 | 0 |
| 4 | 9 | 0 | 0 |
| 5 | 4 | 1 | 0 |
| 6 | 4 | 0 | 0 |
| 7 | 3 | 0 | 0 |
| 8 | 16 | 3 | 1 |
| 9 | 5 | 1 | 1 |
| 10 | 6 | 4 | 1 |
| 11 | 6 | 0 | 0 |
| 12 | 4 | 1 | 1 |
| 13 | 5 | 0 | 0 |
| 14 | 7 | 2 | 1 |
| 15 | 5 | 1 | 0 |
| 16 | 3 | 1 | 1 |
| 17 | 10 | 2 | 1 |
| 18 | 5 | 1 | 0 |
| 19 | 4 | 1 | 0 |
| 20 | 3 | 0 | 0 |
| 20 | 123 | 21* | 7 |

* This number includes only cases which, being in an advanced stage, could be diagnosed as *kala asar* without prolonged examination. It was obvious that a large proportion of the sufferers had but a short time more to live. The true number of *kala asar* patients (including all early cases) would be considerably greater than the number given here.

The sick-rate from *kala azar* in this village at the time of examination was therefore 17 per cent. of the population examined, and the death-rate for the previous year was 5·6 per cent.

Prevalence of malaria in Ulloobari village.—This was estimated by an examination of children, with the following result :—

| Number of children under 10 years of age examined. | Spleen rate per cent. | Malarial parasite-rate per cent. (endemic index). | Varieties of parasites found. |
|--|-----------------------|---|--|
| 40 | 32·5 | 12·5 | Three cases of Simple Tertian infection; two cases of Quartan infection. |

Conclusion.—Out of a total of 123 people examined, at least 21 were suffering from a deadly disease known as *kala azar*. The village in which this disease occurred was so slightly malarious that only about 12 per cent. of the young children were infected with malaria parasites.

3. TEZPUR IN THE DISTRICT OF DARRANG IN ASSAM.—It was seldom possible to walk through this town without meeting several persons suffering from *kala azar*, and in a later part of this report I shall give particulars of a number of cases studied at the local dispensary. By far the greater number of patients attending at this institution on account of fever and enlargement of the spleen were suffering, not from malaria, but from *kala azar*, the former disease being so uncommon that often several days elapsed without a single characteristic case being seen. During one of my walks through the town I was able to examine and take slides of finger blood from 15 young children living in the neighbourhood of houses occupied by persons suffering from *kala azar*. No one of the children had an enlarged spleen, and in no slide were malaria parasites found. Experience in other parts of India has taught us that, if this neighbourhood had been at all malarious, it would have been impossible to examine the blood of 15 young native children without finding malaria parasites in at least two or three, and we are forced to conclude that, as in other instances, *kala azar* existed here in a place which was only very slightly, if at all, malarious.

4. KOHBARI VILLAGE NEAR TEZPUR.—This small isolated village, situated on a bank of the river Brahmaputra near Tezpur, afforded an even better example of a place where *kala azar* existed in the absence of malarial fever.

The Civil Surgeon of Tezpur informed me that the village had always held the reputation of being heavily infected with *kala azar*, and during a walk through it I saw several cases in an advanced stage. With the assistance of the Civil Surgeon I was able to examine and obtain slides of finger blood from 25 young children. The results of this investigation were as follows:—

| Number of children examined. | Number with enlarged spleens. | Spleen-rate per cent. | Number with malarial parasites in their blood. | Parasite-rate per cent. (endemic index.) |
|------------------------------|-------------------------------|-----------------------|--|--|
| 25 | 6 | 24 | 0 | 0 |

One of the six children with enlarged spleens was suffering from *kala azar*, and it is very probable that the remaining five were ill from the same disease: at any rate, very careful examination of the slides of peripheral blood showed that the malarial endemic index of the village was *nil*, and in the light afforded by this method of investigation, Kohbari village must be regarded as an example of a place where *kala azar* exists in the complete absence of malarial fever.

The places cited above were not selected; they were among the first I visited in Assam, and it was therefore established very early in my investigations not only that *kala azar* often exists in places which are only very slightly—and sometimes not at all—malarious, but that the opinion of previous workers that Assam as a whole is intensely malarious needs to be modified considerably. Indeed, it was not until I reached the tea-gardens of Salonah, near Nowgong, that I came to a place which, as regards the prevalence of malaria, was at all comparable to those parts of the Darjeeling Duars that were examined in 1901.

An investigation carried out upon the native inhabitants of villages situated in the tea-gardens just referred to afforded an opportunity of comparing the amount of *kala azar* in a place only slightly malarious and in a place intensely so. The village of Ulloobari, already referred to, will serve as an example of a slightly malarious place and the village of Old Salonah, on the Salonah tea estate near Nowgong, as an example of an intensely malarious one. I have already shown that in Ulloobari at least 17 per cent. of the inhabitants were suffering from *kala azar*, and that the malarial endemic index of the village was 12.5. Previous to my arrival at Salonah, Dr. Dodds Price had satisfied himself, by very careful examinations of all the inhabitants, that no case of *kala azar* existed in Old Salonah village. With his assistance I examined 25 young children resident in the village with the object of finding out the prevalence of malaria. The results were as follows:—

| No. | Age. | Condition of spleen. | Result of examination of slides of finger blood. |
|-----|-----------|---|--|
| 1 | 4 years | 1 hand's breadth below costal margin. | Positive. Simple Tertian parasites. |
| 2 | 4 " | 3 fingers' breadth below costal margin. | Negative. |
| 3 | 3 " | Palpable | Positive. Quartan parasites. |
| 4 | 4 " | 1 hand's breadth below costal margin. | Negative. |
| 5 | 4 " | Ditto | Positive. Malignant Tertian rings. |
| 6 | 3 " | Ditto | Positive. Quartan parasites. |
| 7 | 3 " | 3 fingers' breadth below costal margin. | Ditto. Ditto. |
| 8 | 3 " | 1 hand's breadth below costal margin. | Positive. Simple Tertian parasites. |
| 9 | 2 " | Ditto | Positive. Quartan parasites. |
| 10 | 4 " | No enlargement detected | Ditto. Ditto. |
| 11 | 4 " | Palpable | Ditto. Ditto. |
| 12 | 3 " | 3 fingers' breadth below costal margin. | Positive. Crescents. |
| 13 | 4 " | No enlargement detected | Negative. |
| 14 | 2 " | Palpable | Positive. Crescents and Quartan parasites. |
| 15 | 10 months | To umbilicus | Positive. Quartan parasites. |
| 16 | 1½ years | Palpable | Positive. Malignant Tertian rings and crescents. |
| 17 | 5 months | 1 finger's breadth below costal margin. | Positive. Malignant Tertian rings. |
| 18 | 2 years | 2 fingers' breadth below costal margin. | Positive. Quartan parasites. |
| 19 | 15 months | Ditto | Positive. Malignant Tertian rings. |
| 20 | 2 years | Ditto | Positive. Quartan parasites. |
| 21 | 15 months | No enlargement detected | Positive. Simple Tertian parasites. |
| 22 | 5 " | 1 finger's breadth below costal margin. | Positive. Simple Tertian parasites. |
| 23 | 5 " | Not enlarged | Negative. |
| 24 | 9 " | 2 fingers' breadth below costal margin. | Positive. Simple Tertian parasites. |
| 25 | 2 years | Ditto | Negative. |

Among the children of this village the spleen-rate per cent. was therefore 84 and the malarial endemic index was 80. It is interesting to note also that Malignant Tertian parasites were present in 4 of the 20 positive findings. If *kala asar* has any connection whatever with malaria, this is the kind of village in which it should be especially prevalent.

We may now compare the results of the investigations in Ulloobari and Old Salonah villages thus:—

| Place. | Prevalence of <i>kala azar</i> . | Spleen-rate per cent. of children. | Malarial endemic index. | Species of malarial parasites present. |
|-------------------|--|------------------------------------|-------------------------|--|
| Ulloobari . . . | 17 per cent. of the inhabitants examined were suffering from this disease. | 32.5 | 12.5 | Quartan and Simple Tertian parasites. |
| Old Salonah . . . | <i>Nil</i> | 84 | 80 | Quartan, Simple Tertian and Malignant Tertian parasites. |

In case any doubt as to the correctness of my argument still remains, I shall now compare the relative prevalence of *kala azar* and of malarial fever in two villages which, being inhabited by the same class of people and being situated only a short distance apart, are under similar conditions. For this purpose I shall select the villages of Old Salonah and New Salonah, both situated on the Salonah tea estate near Nowgong. The results of my investigation in Old Salonah village have already been given. New Salonah village contained, at the time of my visit, about 450 inhabitants, and careful inspections showed that there were 12 advanced cases of *kala azar* among these people. The disease was endemic in the village and new cases frequently occurred.

The prevalence of malaria is shown by the results of my examination of children as follows:—

| No. | Age. | Condition of spleen. | Result of examination of slides of finger blood. |
|-----|----------|-----------------------------------|--|
| 1 | 3 years | Enlarged | Positive. Quartan parasites. |
| 2 | 6 " | Not enlarged | Negative. |
| 3 | 4 " | Enlarged | Positive. Quartan and Simple Tertian parasites. |
| 4 | 3 " | Ditto | Positive. Quartan parasites. |
| 5 | 2 " | Ditto | Negative. |
| 6 | 3 " | Ditto | Positive. Simple Tertian parasites. |
| 7 | 8 " | Not enlarged | Negative. |
| 8 | 5 " | Ditto | Ditto. |
| 9 | 2 " | Enlarged | Positive. Simple Tertian parasites. |
| 10 | 4 " | Ditto | Ditto. Ditto. |
| 11 | 1 year | Ditto | Negative. |
| 12 | 1 " | Not enlarged | Ditto. |
| 13 | 1 " | Enlarged | Positive. Simple Tertian parasites. |
| 14 | 2 years | Ditto | Ditto. Ditto. |
| 15 | 3 " | Not enlarged | Negative. |
| 16 | 1 year | Ditto | Ditto. |
| 17 | 8 months | Enlarged | Positive. Simple Tertian parasites. |
| 18 | 3 years | Ditto | Ditto. Ditto. |
| 19 | 8 months | Ditto | Positive. Pigmented leucocytes. |
| 20 | 2 years | No enlargement detected | Positive. Simple Tertian parasites. |
| 21 | 3 " | Enlarged | Positive. Quartan parasites. |
| 22 | 2 " | Ditto | Ditto. Ditto. |
| 23 | 1 year | Ditto | Positive. Simple Tertian parasites. |

Among the children of this village the spleen-rate per cent. was therefore 69 and the malarial endemic index was 65.

The prevalence of *kala azar* and of malarial fever in the two villages referred to may now be compared as follows :—

| Place. | Prevalence of <i>kala azar</i> . | Spleen-rate per cent. | Malarial endemic index. | Species of malarial parasites found. |
|-------------------|--|-----------------------|-------------------------|--|
| Old Salonah . . . | <i>Nil</i> | 84 | 80 | Quartan, Simple Tertian and Malignant Tertian. |
| New Salonah . . . | 12 cases among 450 inhabitants = 2·6 per cent. | 69 | 65 | Quartan and Simple Tertian. |

New Salonah is very malarious, and if the investigation had been carried out only in this village, it might have been supposed that the prevalence of *kala azar* was due to this fact; but when it is found that in the much more malarious village of Old Salonah *kala azar* does not exist, such a supposition is at once shown to be untenable.

The evidence detailed above may now be summarized :

(1) In Gauhati, Ulloobari, Tezpur, and Kohbari, *kala azar* is prevalent, but malarial fever is rare or absent.

(2) Old Salonah is an intensely malarious place, but *kala azar* does not occur there.

(3) Ulloobari is a slightly malarious place, Old Salonah an intensely malarious one: 17 per cent. of the residents in Ulloobari were suffering from *kala azar*, but the disease was not present in Old Salonah.

(4) Old and New Salonah are under similar conditions: both are very malarious; but this, where *kala azar* exists, is less so than that, where *kala azar* does not occur.

In my opinion, this evidence is sufficient to warrant the conclusions that *kala azar* is not a form of malarial fever and that its presence depends upon conditions other than those necessary for the presence of this disease; but there is yet one more argument, to which brief reference may be made, inasmuch as, whilst not being essential for our proof, it serves to emphasize the justness of our conclusions.

On reading the reports of previous investigators of *kala azar*, one's attention is arrested, amidst a number of conflicting statements and views, by the agreement which exists regarding the opinion that natives who have lived all their lives on the same tea-garden are quite as liable to the disease as are new-comers. There is no reason to doubt the correctness of this opinion, but it is difficult to understand how any one can hold it and yet believe that *kala azar* is a form of malarial

fever. In a previous memoir* I have shown that in very malarious places the native of India acquires an immunity to malarial fever: for example, among the *syces* and their families who had lived all their lives in Mian Mir the immunity of the adults was very marked: while 63 per cent. of children between 0 and 10 years of age had enlarged spleens due to malaria, among people between 11 and 25 years of age the percentage with enlarged spleens was only 23, and among people between 26 and 40 years of age it was only 8. The percentage of people with malarial parasites in their blood diminished at advancing age-periods in a similar manner. Now, the people of all ages were equally exposed to malarial infection, and it is beyond dispute that the absence of enlarged spleens and of parasites among the adults was due to their having acquired, by repeated attacks in early life, an immunity to malarial infection.

This rule, that natives who have resided during a number of years in a malarious place acquire an immunity to malarial fever, has been found to hold good in several places in India besides Mian Mir, and the following tables will show that it holds good also in malarious places in Assam:—

| Place. | Age-period of people examined. | Number of people examined. | Percentage of people with enlarged spleens. |
|----------------------------------|---------------------------------|----------------------------|---|
| Old Salonah (Nowgong district) . | Between 0 and 5 years | 34 | 85 |
| | „ 5 and 10 „ | 40 | 65 |
| | „ 10 and 15 „ | 35 | 57 |
| | „ 15 and 20 „ | 76 | 39 |
| | 20 years and over | 164 | 15 |

| Place. | Age of people examined. | Number examined. | Percentage of people with malarial parasites or pigment in their blood. |
|-----------------------|-------------------------|------------------|---|
| Old Salonah | Under 5 years | 25 | 80 |
| | Over 25 years | 25 | 0 |

* "Malaria in India": Scientific Memoirs, New Series, No. 2.

From these results we are justified in concluding that a native who is born on the Salonah tea estate will acquire almost complete immunity to malarial fever by the time adult age is reached, and it is obvious that if such a native, after reaching the age of 25—30 years, begins to suffer severely from a disease characterised by fever and enlargement of the spleen, it is in the highest degree probable that this disease is malaria.

PREVIOUS INVESTIGATIONS.—The present work was undertaken in the preceding section by comparing the clinical signs and symptoms of cases diagnosed as *hala sear* by medical men in Assam, with the clinical signs and symptoms which they believed to be characteristic of malarial fever. But before any one is entitled to use this method for the purpose stated, he must prove the truth of two suppositions: one is that in Assam cases of *hala sear* are diagnosed accurately; the other that he knows nothing more to learn regarding the signs and symptoms of malarial fever as it occurs among natives of India. And even if the method is not condemned by the difficulty of comparing these two suppositions here, still, it must be admitted that, for the purpose of following the nature of a disease presumably new to science, the comparison of its clinical signs and symptoms with those of diseases already known, is a method of investigation to be avoided, for it is obvious that the signs and symptoms of two entirely different diseases may be exceedingly similar. In employing the method of investigation described in the preceding section, it was unnecessary to be able to diagnose cases of the disease known to natives of Assam by the term *hala sear*, nor was it necessary to know the signs and symptoms of malarial fever as it occurs among natives of that country: it was necessary only to select certain places in which the presence of a disease known as *hala sear* was established, and certain other places in which a disease known by this name did not occur, and to ascertain whether these places were, or were not, malarious. From the results of the investigation carried out on these lines I was convinced that, whatever the disease known as *hala sear* is, it is not a form of malarial fever.

That by us was able to proceed without studying individual cases. But it would that we may be in a position to form an opinion as to what the disease is, rather than what it is not, a study of individual cases is necessary; and for this purpose we must be able to diagnose these accurately. To this matter, therefore, I propose to devote the present section.

If *hala sear* is not a form of malarial fever, it is evident that in India there are two chief diseases (namely, malarial fever and *hala sear*) in which fever and enlargement of the spleen are prominent signs. In the Punjab I could find only one of these diseases (namely, malarial fever)* but the results to be detailed in this section will show that in Assam both occur. The apparent difficulty of distinguishing between them is to be explained, I believe, by the truth that

* The Scientific Memoirs by Officers of the Medical and Sanitary Department of the Government of India, New Series, No. 12. C

II

PREVIOUS observers attempted to solve the problem set forth in the preceding section by comparing the clinical signs and symptoms of cases diagnosed as *kala azar* by medical men in Assam, with the clinical signs and symptoms which they believed to be characteristic of malarial fever. But before any one is entitled to use this method for the purpose stated, he must prove the truth of two suppositions: one is that in Assam cases of *kala azar* are diagnosed accurately; the other that he has nothing more to learn regarding the signs and symptoms of malarial fever as it occurs among natives of India. And even if the method is not condemned by the difficulty of converting these two suppositions into truths, it must be admitted that, for the purpose of fathoming the nature of a disease presumably new to science, the comparison of its clinical signs and symptoms with those of diseases already known, is a method of investigation to be avoided; for it is obvious that the signs and symptoms of two entirely different diseases may be exceedingly similar. In employing the method of investigation described in the preceding section, it was unnecessary to be able to diagnose cases of the disease known to natives of Assam by the term *kala azar*, nor was it necessary to know the signs and symptoms of malarial fever as it occurs among natives of that country: it was necessary only to select certain places in which the presence of a disease known as *kala azar* was established, and certain other places in which a disease known by this name did not occur, and to ascertain whether these places were, or were not, malarious. From the results of the investigation carried out on these lines I was convinced that, whatever the disease known as *kala azar* is, it is not a form of malarial fever.

Thus far we were able to proceed without studying individual cases. But in order that we may be in a position to form an opinion as to what the disease is, rather than what it is not, a study of individual cases is necessary; and for this purpose we must be able to diagnose them accurately. To this matter, therefore, I propose to devote the present section.

If *kala azar* is not a form of malarial fever, it is evident that in India there are two chief diseases (namely, malarial fever and *kala azar*) in which fever and enlargement of the spleen are prominent signs. In the Punjab I could find only one of these diseases (namely, malarial fever),* but the results to be detailed in this section will show that in Assam both occur. The apparent difficulty of distinguishing between them is to be explained, I believe, by the truth that

* See Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India, New Series, No. 13.

previous observers, having confused cases of *kala azar* with cases of malarial fever, recorded many signs and symptoms characteristic of that disease as being present in this. So great, indeed, has been the confusion of the two diseases that it is no exaggeration to say that the symptomatology of *kala azar* has yet to be written, and some erroneous notions regarding the signs and symptoms of malarial fever as it occurs among natives of India have yet to be corrected. I do not propose to deal fully with so large a subject in this paper; it is sufficient for my present purpose to say that, inasmuch as previous observers often described cases of malarial fever in the belief that they were describing cases of *kala azar*, and cases of *kala azar* in the belief that they were describing cases of malarial fever, we must admit that in investigating *kala azar* we have to deal with a disease the symptomatology of which is not accurately known, and which, therefore, at present can be recognized only by a process of exclusion. And, fortunately, the only disease which presents any difficulty in this connection is malarial fever: the accuracy with which we shall be able to diagnose cases of *kala azar* will depend upon the accuracy with which we can diagnose, and therefore exclude, cases of malarial fever.

I conjecture that the correct explanation of the *cause* of confusion between *kala azar* and malarial fever lies not so much in the truth that the method of investigation hitherto employed was a bad one, as in the supposition that the notions hitherto held with regard to the signs and symptoms of malarial fever as it occurs among natives of India were erroneous; and therefore, so far as my experience enables me to do so, it will be my chief object to give an account of the signs, symptoms, and method of diagnosis of this disease: for if I succeed in presenting a clear clinical picture of malarial fever as it occurs among natives of India, it will be easy for others to note the many points in which it differs from *kala azar* and to diagnose cases of this disease.

I shall begin my remarks upon malarial fever with the statement that I intend to deal only with the subject of long-continued chronic infections such as would be diagnosed correctly under the term "malarial cachexia." To this I shall confine myself not only because the subject of recent malarial infections has been frequently dealt with by others, but also because it has been thoroughly established that the signs, symptoms, and temperature-curves observed in patients suffering from a recently-acquired infection are so definite and characteristic that it would be well nigh impossible for any one willing to investigate such cases carefully to confuse them with cases of any other disease. I am aware, of course, that this view is not held by all medical officers in India; for, that many medical officers of long experience have very rarely seen typical charts of Simple Tertian or Quartan malarial fever, and that the opinion is widely prevalent that the signs and symptoms of the malarial fevers of India are very indefinite, are matters of common

knowledge. But however much we may regret that some medical officers still hold such views—and the more so if, like a former investigator of *kala asar*, they do not hesitate to express them in their writings*—it is not incumbent upon us, in the light of the truth that at the present time such views are not held by any one who has taken pains to study the matter carefully, to attempt to controvert them.

Without further prelude I shall therefore pass on to the subject of chronic malarial fevers as they occur among natives of India.

In a former memoir I described very briefly some cases of infection with Simple Tertian and Quartan malaria parasites. Although in several of these patients the disease had lasted for many months and the condition present would be correctly termed "malarial cachexia," the temperature charts were so characteristic that, even in the absence of a blood examination, no other diagnosis than that of malarial fever was possible: it was obvious that in many cases of infection with Simple Tertian or Quartan parasites, even when the patients presented all the signs and symptoms of advanced "malarial cachexia," the characteristic periodicity of the fever enabled a correct diagnosis to be made with ease. This was a new rule and one of some importance from the point of view of diagnosis, for at that time the opinion was generally prevalent that the fever-curve in advanced cases of malaria was very irregular, and that for this reason the diagnosis of such cases was very difficult.

Since those were described I have had opportunities of examining cases of chronic malaria during long periods, and it is chiefly upon the results of this investigation that I shall base my remarks concerning the signs, symptoms, and diagnosis of "malarial cachexia."

First I shall describe three cases of chronic malaria, one of which resulted from an infection with Simple Tertian parasites, another from an infection with Malignant Tertian parasites, and the third from a mixed infection with Simple and Malignant Tertian parasites. After pointing out the chief signs and symptoms and the mode of diagnosis by clinical and by microscopical methods in each, I shall sum up such conclusions regarding "malarial cachexia" as appear to be justifiable from their study: then, by giving notes of other cases, I shall attempt to ascertain how far these conclusions are applicable to all cases of true "malarial cachexia," in so far, that is, as such a term is applicable to the condition which arises in natives of India as a consequence of long-continued malarial infection.†

* On pages 160 and 161 of the second edition of "A Handbook of Mosquitoes" by Lieutenant-Colonel G. M. Giles, published in 1902, will be found the following statements: "little else than the æstivo—autumnal fever is to be met with in India" and "never in India have I met with cases exhibiting the absolutely classical malarial paroxysm....."

† Whether the condition is rightly designated by the term "cachexia" must be left to the reader to decide.

1st Case.—HIRA ; aged 14 years ; seen in Mian Mir at the beginning of April 1902. He had come to Mian Mir in the previous year with his father, who was a *syce* in one of the cavalry regiments. When first examined, he stated that he had had a severe attack of fever in the previous October, and that he had suffered from attacks at irregular intervals since that time. He said that during the attacks the fever usually came on every night, but on some nights it was not so bad as on others. He was suffering from an attack at the time when I saw him. His spleen was enlarged nearly to the umbilicus and he was very anæmic, but the fever did not incapacitate him from work. Many Simple Tertian parasites were found in his blood on April 4th. By the middle of April his spleen was enlarged one inch beyond the level of the umbilicus. During the summer months he improved considerably, and the fever came on only in short relapses occurring at long intervals. Several examinations of his blood in June did not reveal the presence of parasites or pigment. On the 1st of November a few Simple Tertian parasites were found in his blood, and systematic examinations and records of temperature were commenced on the 4th. The temperature chart for nearly three months from this date is reproduced here (*chart I*).^{*} With the help of my Hospital Assistant, who undertook to remain in the patient's house for several nights during the relapse of fever which began about the 31st of December, I was able to obtain a two-hour chart of the temperature during this period (see *chart II*).

The results of blood examinations and the variations in the size of the spleen are given below. The blood examinations refer in all cases to slides of peripheral blood :—

| | | | |
|----------|---|---|--|
| 1-11-02 | . | . | Spleen enlarged to umbilicus. A few large Simple Tertian parasites found. |
| 4-11-02 | . | . | No parasites, but many pigmented leucocytes. |
| 7-11-02 | . | . | One Simple Tertian ring form found after long search. |
| 9-11-02 | . | . | One ring form and several pigmented leucocytes. |
| 11-11-02 | . | . | No parasites nor pigment after long search. |
| 14-11-02 | . | . | Ditto ditto. |
| 17-11-02 | . | . | Spleen to umbilicus. No parasites nor pigment after long search. |
| 19-11-02 | . | . | One pigmented leucocyte found after long search. |
| 22-11-02 | . | . | No parasites nor pigment after long search. |
| 28-11-02 | . | . | The spleen is reduced in size ; its edge is nearly an inch to the left of the umbilicus. No parasites nor pigment after long search. |
| 1-12-02 | . | . | Edge of spleen one inch to the left of the umbilicus. No parasites nor pigment after long search. |
| 7-12-02 | . | . | One thick pigmented Simple Tertian ring. |
| 9-12-02 | . | . | Spleen nearly to umbilicus. No parasites nor pigment after long search. |
| 11-12-02 | . | . | No parasites nor pigment after long search. |
| 15-12-02 | . | . | Ditto ditto. |
| 20-12-02 | . | . | Ditto ditto. |

* The charts are bound together at the end of the paper.

- 28-12-02 . . . Spleen much reduced ; its edge is two inches to the left of the umbilicus. No parasites nor pigment after long search.
- 2-1-03 . . . Four Simple Tertian parasites—two being rings and two being large forms.
- 3-1-03 . . . One ring form and several pigmented leucocytes.
- 5-1-03 . . . Spleen to umbilicus. Slides taken every four hours.
8 A.M. Only one Simple Tertian ring form found after long search.
12 noon. Two pigmented leucocytes ; no parasites.
4 P.M. One nearly full-grown Simple Tertian parasite and one pigmented leucocyte.
12 P.M. No parasites nor pigment after long search.
- 6-1-03 . . . 4 A.M. One pigmented leucocyte only.
12 noon. Two large Simple Tertian parasites.
4 P.M. One large Simple Tertian ring form ; several pigmented leucocytes.
- 7-1-03 . . . 8 A.M. Two pigmented leucocytes ; no parasites.
6 P.M. One pigmented leucocyte ; no parasites.
- 8-1-03 . . . 10 A.M. Several pigmented leucocytes ; no parasites.
- 10-1-03 . . . Temp. 98°. No parasites nor pigment after long search.

The blood examinations were continued every other day until the 16th of January, but parasites or pigment were not found again.

A careful examination made on the 8th of January showed that the boy's spleen was enlarged one inch beyond the umbilicus, his liver was just palpable beneath the ribs, and his feet were slightly œdematous. He had remained in his house for two days during the relapse of fever which occurred about this time, but from the 10th of the month he began to recover his usual health very rapidly, and in the month of March 1903, when he was last examined, beyond the fact that his spleen was still enlarged nearly a hand's breadth below the ribs, there was little or no evidence that he had ever suffered from malaria.

Signs and symptoms ; diagnosis by clinical methods.—At the beginning of November 1902 this boy had suffered for at least a year from an entirely untreated infection with Simple Tertian malaria parasites, and I think it will be admitted readily that during the period of the systematic examinations made from November 1902 until January 1903 he was in the condition usually diagnosed in India as "malarial cachexia with enlargement of the spleen." On inspecting the temperature chart we note that it is divided definitely into periods of pyrexia and periods of apyrexia ; at no period does it present any sign of the "long-continued irregular type of fever" usually described in text-books as being characteristic of the condition termed "malarial cachexia."

The pyrexial periods were as follows :—

November 1st (?) to November 10th. . . .
November 15th to November 22nd. . . .
December 5th to December 6th. . . .
December 15th to December 17th. . . .
December 31st to January 8th. . . .

During one of these periods the temperatures shown on the chart are not higher than 99° —a temperature which, as a rule, may be regarded as normal—but because the temperatures were taken only twice daily, and because throughout the greater part of the period of examination they were consistently low, I have regarded this slight rise as indicating a period of pyrexia.

The apyrexial intervals were as follows:—

| | |
|---------------|-------------------|
| November 11th | to November 14th. |
| November 23rd | to December 4th. |
| December 7th | to December 14th. |
| December 18th | to December 30th. |
| January 9th | to |

Freedom from symptoms was a prominent feature throughout the whole period of examination, but this character was especially apparent during the apyrexial intervals. Physical examination during such intervals revealed no sign, excepting the splenic enlargement, by which a diagnosis could be made. From a non-medical point of view the boy was quite well; he complained of no symptom and his enlarged spleen troubled him not at all.

During periods of fever the symptoms were more marked: he recognised that he had fever and sometimes was incapacitated from work; he complained of loss of appetite and of occasional vomiting. The paroxysms frequently began with a feeling of chilliness and shivering, but “cold,” “hot,” and “sweating” stages were not definitely apparent.

On the whole, we must conclude that an illness which incapacitates a person from work for only one or two days in a month is not a very serious one.

In order to make a diagnosis by clinical methods during the apyrexial periods, we should have had to rely chiefly upon negative signs: the patient had an enlarged spleen and was anæmic, but he complained of no symptom; he was not incapacitated from work; he was not emaciated; he had no fever: all these point towards a diagnosis of malaria—the disease which by years of experience the native of India has learnt to regard, if not with contempt, at any rate with equanimity, “because it does not kill.”*

During a relapse of fever (pyrexial period) our diagnosis by clinical methods can be made on surer grounds; we can take careful records of the temperature and ascertain if the chart with results shows characters known to be associated only with malarial fever. The application of this method is illustrated in

* The point of view from which the native of Assam regards malarial fever and *kala asar* respectively is well illustrated in the account quoted by Surgeon-Major Giles, I.M.S., of an interview which Dr. Dobson had with a native woman suffering from fever and enlargement of the spleen. When asked why she did not apply for treatment at a hospital, she replied to the following effect: “If I have got malarial fever I shall get well sooner or later anyhow, but if I have *kala asar*, nothing can cure me, so what is the good of bothering me with medicine?”—(A report on the diseases known in Assam as *kala asar* and *heri-beri*. Assam Secretariat Press, 1890, page 14.)

the present case, but on inspecting the charts we see that in order to derive information of value from it the temperature must be recorded very frequently—at least every four hours and, preferably, every two hours. It will be noticed that the chart of temperatures taken only twice daily during the relapse of fever which began on the 31st of December does not enable us to diagnose the disease; like so many of the charts seen in Indian hospitals, it shows merely a few days of "irregular" fever. But when we turn to the two-hour chart of the same period, we see at once that the fever-curve is not irregular at all, but is most definite: it is obvious that we have to do with a case of malarial fever. Moreover, the chart enables us to state that we have to do with a case in which at least two groups of Simple Tertian parasites are present; for corresponding rises of temperature presumably caused by one group are to be noted at 6 P.M. on the 4th, 6th, and 8th, and by another at 12 P.M. on the 5th and at 12 P.M. on the 7th. Possibly the rise to 102° at 6 P.M. on the 5th and to 101.4° at 6 P.M. on the 7th indicates the presence of a third group.

Diagnosis by microscopical methods.—The record given on pages 13 and 14 shows the dates on which evidence of malaria was obtained and the dates on which the result of the blood examination was negative. Despite the fact that the patient had never been treated with quinine, the results of blood examination were negative on 16 out of 33 occasions. It is to be noted also that often when a positive result was recorded, so few parasites or pigmented leucocytes were found that it is reasonable to conclude that if careful and long examination had not been made they might have been missed. Other observers have recorded the fact that in advanced cases of malaria, such as the one under discussion, parasites are extremely scanty, and often (as judged by the examination of one or two slides) absent. It is important to remember that this may be the case even when the temperature is high and the chart typical. Although, on the 5th and 6th of January, slides were examined every four hours, parasites were rarely found. On comparing the results of blood examinations with the temperature chart, we note that evidence of malaria was obtained only during pyrexial periods—never during the apyrexial intervals. From the results obtained in this instance it would seem that examinations of the blood do not aid us in a case like this at the time when aid is most needed (*i.e.*, during apyrexial periods), and that at all times a positive result is of far greater importance than a negative one. The latter is the rule during apyrexial periods, and even during periods of fever a negative result is of significance only if it is obtained at repeated very careful examinations made on several successive days.

On the whole, we must admit that for the purposes of diagnosis in this case the microscopical method was inferior to the clinical.

And here I may be permitted to digress for a moment to point an obvious

lesson arising from this conclusion. It is well known that some medical officers in India and in other countries are of opinion that unless provided with microscopes they cannot be expected to diagnose malarial fevers accurately. To such as hold this opinion I would commend a study of the facts of this case. The value of microscopical methods in diagnosis, no less than that of bacteriological ones, depends entirely upon the skill and experience of the observer, and the prevailing notion that if one possesses a microscope and a few of the ready-made "bacteriological tests" one can dispense almost, if not entirely, with clinical methods, cannot be condemned too strongly. It cannot be denied that, so far as the diseases of India are concerned, the use—perhaps I should say more correctly the misuse—of microscopical and so-called bacteriological methods has hindered rather than hastened the discrimination of the various forms of fever present in this country. No better example of this truth is needed than is afforded by the history of *kala azar*—a disease long recognised by clinicians of experience to be distinct, but repeatedly pronounced by microscopists and bacteriologists to be one or other of the diseases already known. The consideration of an example such as this suggests to us that in future we should pay greater attention to those accurate, yet easily carried out, clinical methods of investigation which sometimes we are apt to regard as of minor importance.

2nd Case.—BAGHAN; aged 10 years. This boy was examined for the first time on the 10th of April 1902. His parents volunteered the information that he had suffered from fever "off and on" for about five months. He was fat and cheerful and did not appear ill; but careful examination showed that he was very anæmic and that his spleen was enlarged three inches below the costal margin. His temperature on the evening of the 10th of April was 101° F., and in a film of finger blood obtained on this day a considerable number of crescents and a few pigmented leucocytes were found. On the 1st of May his spleen was still three inches below the ribs; only one crescent was found in a film of blood. During June his blood was examined on two occasions, but neither parasites nor pigment were found. At the end of this month his spleen was only one inch below the ribs. On the 28th of July his spleen was still one inch below the ribs, but neither parasites nor pigment were found in a slide of finger blood. He was not examined again until the 1st of November, when his mother said he had been suffering from fever for about three days. The spleen was enlarged two inches below the costal margin; no enlargement of the liver was detected. A systematic record of the temperature, which is reproduced here (*charts III and IV*), was begun from this date. The first attack of fever shown on chart IV ended on the 8th of November; similar attacks occurred at irregular intervals for several months.

With the aid of my Hospital Assistant I was able to obtain a two-hour chart (*chart III*) of the attack which commenced about the 1st of January.

The results of blood examinations and the variations in the size of the spleen were as follows:—

| | | | |
|----------|---|---|--|
| 1-11-02 | . | . | A few Malignant Tertian rings. Spleen 2 inches below the ribs. |
| 4-11-02 | . | . | Two Malignant Tertian rings and four crescents after a short examination. |
| 7-11-02 | . | . | Many rings, crescents and pigmented leucocytes. |
| 11-11-02 | . | . | One crescent, no rings, one pigmented leucocyte after a fairly long examination. |
| 13-11-02 | . | . | One crescent only; no rings. |
| 15-11-02 | . | . | A few crescents; no rings. Spleen 2 inches below the ribs. |
| 1-12-02 | . | . | A few Malignant Tertian rings; a few crescents. Spleen 3 inches below the ribs. |
| 3-12-02 | . | . | No rings; two crescents. |
| 15-12-02 | . | . | Scanty rings and crescents. |
| 19-12-02 | . | . | One crescent; no rings after long search. |
| 30-12-02 | . | . | Two rings; no crescents. |
| 2-1-03 | . | . | A fair number of Malignant Tertian rings; no crescents. |
| 3-1-03 | . | . | Scanty rings only. |
| 4-1-03 | . | . | No parasites nor pigment after long search. |
| 5-1-03 | . | . | Ditto ditto. |
| 6-1-03 | . | . | 12 P.M. A few Malignant Tertian rings. |
| 7-1-03 | . | . | 12 noon. Very scanty rings. |
| | | | 4 P.M. Very scanty rings. |
| | | | 8 P.M. Only two rings found. |
| | | | 12 P.M. Three rings; one crescent. |
| 8-1-03 | . | . | 4 A.M. One pigmented ring only found. |
| | | | 12 noon. A fair number of rings. |
| | | | 8 P.M. Two rings only. |
| 9-1-03 | . | . | 6 A.M. A fair number of rings. |
| 11-1-03 | . | . | One ring only found. Spleen 3 inches below the ribs. |
| 20-1-03 | . | . | One ring; one crescent. |
| 23-1-03 | . | . | No parasites nor pigment after long search. |
| 25-1-03 | . | . | Ditto ditto. |
| 26-1-03 | . | . | Ditto ditto. |
| 3-2-03 | . | . | One ring after long search. |
| 11-2-03 | . | . | One crescent; no rings. |
| 21-2-03 | . | . | One crescent. |
| 8-3-03 | . | . | One ring after long search. Spleen 2 inches below the ribs. |

Signs and symptoms; diagnosis by clinical methods.—At the time when the systematic examinations in November were begun, it was known that this child had suffered from an entirely untreated infection with Malignant Tertian malarial parasites for seven months, and from the mother's account it was probable that the infection had lasted considerably longer than this. If we admit that the

results of long-continued untreated malarial fever as described in text-books are applicable to the native of India, the case was one in which serious symptoms and well-marked pathological changes should have been present. But this was not so. On inspecting the temperature chart, we note that long-continued irregular fever was absent; like that of the previous case, the chart is divided definitely into periods of apyrexia and periods of pyrexia. Freedom from symptoms was a prominent feature during apyrexial periods, and the child played with other children of the village as though perfectly well; he was not emaciated, and, practically speaking, the presence of an enlarged spleen was the only sign which suggested a diagnosis of malaria. During periods of fever, however, the child was obviously ill and suffered much from vomiting and diarrhœa. But the illness lasted only a short time; it ceased with the disappearance of the fever, and within a few hours the child was as bright and cheerful as if in the best of health.

As regards the problem of diagnosis by clinical methods during apyrexial periods, I have nothing to add to the remarks already made on this portion of my subject in the previous case. During a relapse of fever we can apply the same method as was carried out in that case; its application is shown in the two-hour chart reproduced. It will be noted that, although the ordinary morning and evening temperature chart of the attack which began about the 1st of January does not reveal characters by which a diagnosis of the disease can be made, the true fever-curve, as exhibited on the two-hour chart, is quite as characteristic, in its own way, as that met with in Simple Tertian infections. As often happens in Malignant Tertian infections, there are daily paroxysms of fever. In the paroxysm on the 4th the temperature has risen to $100\cdot8^{\circ}$ at 4 P.M.: it then drops to 99° at 6 P.M., but rises again to a point higher than the first rise, *vis.*, to $101\cdot4^{\circ}$, at 10 P.M. This is the typical Malignant Tertian fever-curve described by Marchiafava and Bignami—initial rise, pseudocrisis, precritical elevation, and true crisis. We note that on subsequent days the chart shows precisely similar characters, and I am sure it will readily be admitted that these characters are such as are not met with in any other disease than malaria.

Diagnosis by microscopical methods.—The great majority of blood examinations yielded positive results, and it is probable that during almost any period a diagnosis could have been made by this method if very careful long examinations had been undertaken. An inspection of the record of blood findings shows that the greater frequency of positive results in this case than in the case of Hira was probably due to the presence of crescents, which persisted in the peripheral blood throughout the apyrexial periods; for we note that as regards asexual forms negative results were fairly frequent, and that as regards these forms a negative result was the rule during apyrexial periods. Towards the end of

December, parasites were evidently becoming far less numerous, and they were found only with difficulty. Their scantiness during the relapse which lasted from about the 1st to the 12th of January is especially noteworthy, and if the patient had attended hospital for the first time during this period it is possible that a diagnosis could have been made more easily by the clinical method indicated above than by blood examinations: at any rate, the finding of parasites at a single examination of the blood would have been a very fortunate circumstance.

3rd Case.—**MAN SINGH**; aged 12 years. As in the two cases already described, malarial parasites were found in the blood of this boy in April 1902. At this time his spleen was enlarged to the level of the umbilicus. The infection was with Simple Tertian forms. During the summer his spleen decreased considerably in size, and on November 1st, when systematic examinations were begun, it was only three fingers' breadths below the costal margin. About this time he must have contracted an infection with Malignant Tertian parasites, for on the 1st of November, when he was brought to me with a temperature of 102.6°, I found two Malignant Tertian ring forms, but no Simple Tertian parasites. Until the beginning of December the infection appeared, from the results of blood examinations, to be an unmixed one, but on the 5th of this month Simple Tertian parasites were again found, and from this date the case must be considered as a mixed infection with Simple and Malignant Tertian parasites.

The results of blood examinations and the variations in the size of the spleen were as follows:—

| | | | |
|----------|---|---|--|
| 1-11-02 | . | . | Two Malignant Tertian ring forms found. Spleen 3 fingers' breadths below the costal margin. |
| 4-11-02 | . | . | One crescent; numerous pigmented leucocytes; no rings. |
| 7-11-02 | . | . | Numerous young crescents; many pigmented leucocytes; no rings. |
| 9-11-02 | . | . | Numerous crescents; one pigmented leucocyte. |
| 11-11-02 | . | . | A good many Malignant Tertian rings; many crescents. |
| 12-11-02 | . | . | Many rings, pigmented leucocytes and crescents. |
| 15-11-02 | . | . | Many rings, crescents and pigmented leucocytes. In a fresh preparation flagellated bodies were seen. |
| 17-11-02 | . | . | Many crescents and pigmented leucocytes; only one ring after prolonged search. |
| 20-11-02 | . | . | Many crescents; a few rings. Spleen 3½ inches below costal margin. |
| 23-11-02 | . | . | Many crescents; no rings seen. Spleen 3½ inches below costal margin. |
| 29-11-02 | . | . | A few crescents; two rings after long search. |
| 1-12-02 | . | . | Two crescents; no rings. |
| 3-12-02 | . | . | One ring; one crescent. |
| 5-12-02 | . | . | A few rings; a fair number of crescents; one young Simple Tertian parasite. Spleen 3 inches below the costal margin. |

- 15-12-02 . . . A few medium-sized Simple Tertian parasites ; a good many crescents.
- 19-12-02 . . . A few young Simple Tertian parasites ; a few crescents.
- 23-12-02 . . . Crescents only found. Spleen 2 inches below the costal margin.
- 26-12-02 . . . Crescents ; pigmented leucocytes ; a few very young rings (? S. T.)
- 28-12-02 . . . Crescents ; pigmented leucocytes ; rings and large Simple Tertian parasites.
- 30-12-02 . . . Crescents ; a few young rings ; a good many medium-sized Simple Tertian parasites.
- 2-1-03 . . . Many young Simple and Malignant Tertian rings ; a few large Simple Tertian parasites ; crescents.
- 4-1-03 . . . A good many large Simple Tertian parasites ; a few Malignant Tertian rings ; a good many crescents.
- 6-1-03 . . . 12 noon. Temp. 103°. Many crescents ; several pigmented leucocytes : no rings seen.
7 P.M. Temp. 102.4°. Many crescents ; numerous heavily pigmented leucocytes ; one segmenting Malignant Tertian parasite ; no rings seen.
10-45 P.M. Temp. 103°. Crescents and pigmented leucocytes ; two rings after long search.
- 7-1-03 . . . 2-30 A.M. Temp. 103.2°. Many crescents and pigmented leucocytes ; two rings.
8-30 A.M. Many crescents and pigmented leucocytes ; no rings found.
4 P.M. Ditto ditto.
8 P.M. Ditto ditto.
12 P.M. Ditto ditto.
- 9-1-03 . . . Crescents only found. Spleen 3½ inches below costal margin.
- 12-1-03 . . . Ditto ditto.
- 19-1-03 . . . Crescents still present in fair numbers ; no other parasites found.
- 28-1-03 . . . A few medium sized Simple Tertian parasites ; crescents still present.
- 8-2-03 . . . One Malignant Tertian ring form ; two Simple Tertian parasites in stippled cells.
- 16-2-03 . . . One ring only found after long search.
- 24-2-03 . . . Crescents present in fair numbers. Spleen 3 inches below costal margin.

Signs and symptoms ; diagnosis by clinical methods.—Although the infection with Malignant Tertian parasites found in November was probably a new one, it was known that the patient had suffered from an untreated infection with Simple Tertian parasites since the previous April, and throughout the summer his spleen had been enlarged nearly to the umbilicus ; so that a diagnosis of " malarial cachexia " was justifiable. Despite the severe infection there is nothing of note to record regarding the symptoms. As in the other cases, the illness consisted of a series of attacks of fever, during which the boy was obviously ill, separated by intervals of apyrexia, during which he recovered. On the whole, he appeared no

worse at the termination of the systematic examinations in February 1903 than he was at their commencement in November 1902. On the contrary, there was evidence that the attacks of fever were being felt with much less severity, and that he was rapidly acquiring an immunity against malarial infection. As regards diagnosis by clinical methods, I need refer only to the diagnosis during pyrexial periods. In spite of the fact that the infection was a mixed one, chart V shows that during most of the relapses even the taking of temperatures only twice daily would have sufficed to enable a diagnosis of malaria to be made; but while on inspecting such a chart we should have had no doubt that the case was one of malaria, we should have been much puzzled to state what type of parasite was present. Seeing that throughout the period of examination no other parasites than Simple and Malignant Tertian were present, it is remarkable that the chart so frequently showed a *Quartan* type of fever. This is seen during more than one period between December 8th and January 14th, but nowhere so plainly as between January 7th and January 14th. This portion of the chart is typical of a double *Quartan* infection. Had the two-hour chart (*chart VI*) been carried beyond the 8th of January, this curious coincidence might have been explained more easily.

Diagnosis by microscopical methods.—The record of blood examinations shows that probably at any time a diagnosis by this method could have been made easily: at the same time we must remember that the infection with Malignant Tertian parasites was probably a recent one, and that, had there remained only the old-standing Simple Tertian infection, the difficulties might have been somewhat similar to those present in the case of Hira.

So far as a study of these three cases enables us to form an opinion, we may sum up the signs, symptoms, and method of diagnosis of "malarial cachexia," as it occurs among natives of India, somewhat as follows:—

(1) Enlargement of the spleen and anæmia are the most evident physical signs.

(2) As a rule serious symptoms are absent.

(3) The illness is not a continuous one; periods of fever and illness alternate with periods of apyrexia and recovery. The patient becomes anæmic and his spleen becomes enlarged, but he does not go from bad to worse; on the contrary, there is evidence to show that each relapse of fever is felt with less severity than the one which preceded it, and that finally he acquires a relative immunity to malarial infection.

(4) The temperature chart shows definite pyrexial and apyrexial periods; long-continued "irregular" fever is not present, and there is no indication of the presence of fever resembling the *fièvre symptomatique* described by Kelsch and Kiener.

(5) For the purposes of diagnosis during an apyrexial period we must rely chiefly upon negative signs and symptoms: the patient does not complain of being ill; he is not incapacitated from doing his work; as a rule, he is not emaciated; he has no fever; repeated blood examinations may yield entirely negative results.

(6) During a relapse of fever (pyrexial period) the temperature chart is definite and characteristic, and we are able to make a diagnosis by inspecting such a chart. Blood examinations are an important aid if positive results are obtained, but we cannot place reliance upon them if negative.

Nearly all these characters of "malarial cachexia" are very different from those described in text-books as being present in this condition, and it therefore behoves us to ascertain if they are applicable to a number of examples. This we may now proceed to do.

The following case is similar to many seen in military hospitals for native troops:—

AMIR KHAN, sepoy; aged 25; seen in 1901 in the regimental hospital at Alipore near Calcutta. The patient had been admitted into hospital on the 28th of April suffering from fever and enlargement of the spleen. On his medical history sheet two previous admissions for "ague" were recorded. His temperature chart from the 28th of April, as recorded by the hospital authorities, is reproduced here (*chart VIII*). I saw the patient for the first time on July the 2nd, that is, when he had been in hospital a little more than two months. His spleen was enlarged nearly to the level of the umbilicus, and his liver could be felt two fingers' breadths below the ribs. He was very anæmic, and the conjunctivæ were very yellow, but he was not markedly emaciated. It was said that quinine had been administered to him "off and on" since his admission, but it is doubtful whether the drug really had been well tried. As the patient was not improving, the medical officer had decided to send him upon sick leave.

On inspecting the temperature chart, we see that it closely resembles those of cases already described: it is divided into periods of pyrexia and periods of apyrexia. The first attack shown on the chart lasted from the 28th of April until the 10th of May and evidently was a severe one; it was followed by an apyrexial interval of seven days' duration. The second attack lasted from the 18th until the 31st of May; it was followed by an apyrexial interval lasting only four days. The third attack was a mild one lasting five days; it was followed by an apyrexial interval lasting nineteen days;—and so on. Examinations of the peripheral blood made on the 2nd and 3rd of July did not reveal the presence of malarial parasites or pigmented leucocytes, and with the medical officer's permission quinine treatment was discontinued.

Blood examinations were made again on the 10th, 12th, and 17th of July,

but no malarial parasites were found. On the 18th, however, a few Malignant Tertian ring forms were found in a slide of finger blood and many ring forms and one crescent in a slide of splenic blood. On the evening of this day arrangements were made to have the temperature taken every two hours, and the chart reproduced here (*chart VII*) is the result. On the 20th a good many crescents and a few ring forms were found in a slide of finger blood; on the 21st many crescents but only one ring form; on the 22nd no ring forms after long search. Crescents were found in considerable numbers until the 27th, when the examinations were discontinued.

This case differs in no important respect from the case of Malignant Tertian fever previously described, and although at the time when I saw him the patient was in the condition usually diagnosed in India as "malarial cachexia with enlargement of the spleen," an accurate diagnosis could have been made during any of the fever periods by inspecting a carefully recorded temperature chart. Also the signs and symptoms present were very similar to those which characterised the case of Baghan. The illness was not sufficiently severe to necessitate confinement to bed, and if the patient had been a civilian, I do not doubt that, during the periods when he was free from fever, he would have carried on his usual occupation.

The following are some more cases of "malarial cachexia" illustrating the signs and symptoms observed when patients suffering from this condition are admitted into hospital during pyrexial periods:—

ABDUL GAFUR; aged 16 years; seen at Gauhati in Assam. At the time when I saw him he had been in hospital for about a week; but before his admission he had been treated as an out-patient for some days. The case is of especial interest in that it was shown to me as being, in the medical officer's opinion, a case of *kala asar*. At the time of my first examination the patient complained chiefly of dysentery, but stated that he had suffered from fever "off and on" for about two years. Possibly as a result of the dysentery he was very weak, but he was not emaciated, and not more anæmic than are many apparently healthy coolies in Assam.* The spleen was enlarged nearly to the level of the umbilicus. His temperature had been taken twice daily since his admission, and the chart showed evening rises of temperature to between 100° and 101°. He was being treated with a mixture containing quinine. At my request the medical officer ordered this treatment to be discontinued and the temperature to be taken every four hours throughout the day and night. The examination of a slide of finger blood taken on the 22nd of May—the date when I saw the patient first—was negative. For two or three days the temperature chart was somewhat irregular,

* On account of the prevalence of *ankylostomiasis* the value of anæmia as a diagnostic sign in Assam is very small.

but from the 25th to the 30th it showed the typical characters of Quartan fever. On the 27th, Quartan parasites in considerable number were found in a slide of finger blood and, on the same day, in slides of splenic blood many Quartan parasites and blocks of malarial pigment were found, but no "Leishman" or other parasites were seen. Adequate doses of quinine were administered to the patient on the 30th and subsequent days, and the fever quickly disappeared.

RAJIA; aged 40; an in-patient of the dispensary at Soneput near Delhi. The patient stated that he had suffered for more than a year from occasional attacks of fever similar to the one for which he was admitted. His spleen was enlarged two inches beyond the level of the umbilicus; no enlargement of the liver was detected. He was not emaciated nor weak, and complained only of fever. His temperature was taken every four hours, and the chart exhibited typical Tertian periodicity. In a slide of finger blood a few Simple Tertian parasites were found, and two similar parasites were seen in a slide of splenic blood. No other parasites were found. Quinine was administered to the patient, and in a few days the fever disappeared, when, being of opinion that he was cured, he requested to be discharged from hospital. His spleen was still enlarged beyond the level of the umbilicus.

TULSA; aged 25; seen in the Civil Hospital at Delhi. The patient had been admitted for fever, and quinine had been administered to him from the date of his admission. I saw him on the fifth day after admission, by which time his fever had ceased. The lower edge of the spleen reached to a point midway between the umbilicus and pubes, and the liver was enlarged two inches below the costal margin. A temperature chart had not been kept systematically, but I was informed that his temperature was 102° at the time of his admission and that it had risen to between 100° and 101° each evening on the three first days. From the date when I saw him it did not rise above normal during the remainder of his stay in hospital. He remained some time for the treatment of a chronic ulcer on the leg, but when this was healed he left. His spleen and liver were in much the same condition as at the time of his admission. I found no malarial parasites nor pigment and no "Leishman" parasites.

These two cases illustrate the freedom from severe symptoms which, as I have already pointed out, is characteristic of native patients suffering from true "malarial cachexia," as well as the shortness of the periods during which fever is present, the amenability of the fever to quinine treatment, and, above all, the lack of heed which the patients pay to the fact that their spleens are enlarged, regarding themselves as quite well and able to carry on their usual occupations as soon as the attack of fever has passed.

Finally, I shall give some instances of cases of "malarial cachexia" examined during apyretic intervals. In hospital practice among natives of India such

cases unaccompanied by fever are seen commonly only in patients who seek treatment on account of other affections such as ulcers or dysentery, for, as a rule, the native of India who suffers from chronic malaria does not attend hospital unless he has an attack of fever; but when one carries out an investigation upon the inhabitants of a village, it is usual to find numerous cases.

P—A—: seen in 1901 in the surgical ward of the General Hospital in Calcutta. The patient had been admitted to have an operation performed. It was found that his spleen was enlarged beyond the level of the umbilicus, and on being questioned he said he had had occasional attacks of fever during the previous two years. He reported that generally the attacks lasted only a few days and did not trouble him much. He had noticed that his spleen was enlarged, but did not consider it of importance, and said he had not come to hospital for the treatment of fever, but for a surgical affection. For some time after his admission his temperature remained normal and no parasites nor pigment were found by repeated examination of his blood. On the 22nd of July he developed a typical attack of ague; he had a severe rigor and his temperature rose to 105°F. Quinine was not administered. On the 23rd and 24th his temperature did not rise above normal, but on the 25th he had another typical paroxysm, his temperature rising to 103°. Quinine was then given and he suffered from no more attacks during his stay in hospital. On the 24th, 25th and 26th his blood was examined and a fair number of Quartan parasites were found on each day. On the 27th only two parasites were found after long search, and on the 28th no parasites nor pigment were seen. When the patient left the hospital, his spleen was about the same size as at the time of his admission.

This case, in which the diagnosis of "malarial cachexia" was certainly justifiable, illustrates nearly all the characters of this condition previously summarized: the presence of a greatly enlarged spleen unaccompanied by fever or any other important symptom; the fact that during the apyrexial period the patient felt quite well; the negative results of blood examinations during this period; the definite character of the temperature chart during the relapse of fever; the positive results of blood examinations during this period; the fact that the illness caused by the relapse was very temporary, the patient leaving hospital before his spleen was appreciably reduced in size.

MOLAR; aged 40; an in-patient of the dispensary at Soneput. He gave a history of having had attacks of fever at irregular intervals for 1½ years, but stated that the last attack had ended some months ago, and that he sought admission into hospital not on account of fever, but for the treatment of a chronic ulcer on his leg. His spleen was enlarged one inch beyond the level of the umbilicus. His temperature did not rise above normal during his stay in hospital. No malarial parasites nor pigment and no "Leishman" or other parasites were found.

When the ulcer was healed, the patient left the hospital, his spleen being enlarged to the same extent as at the time of his admission.

In a previous memoir dealing with Oriental or Delhi Sore * I gave brief notes of 28 cases in many of which the condition was similar to that of this patient—a condition which I believe to be similar also to that of Hira, Baghan and Man Singh during the intervals between their relapses of fever. I propose now to add a further series of similar cases examined in Assam.

| No. | Place. | Name and age. | Condition of spleen. | Other particulars of the case. | Result of examination of blood. |
|-----|---|-------------------|--------------------------------|---|---|
| 1 | Nongpoh (about half-way between Gauhati and Shillong). | Gokhal; 30 years. | To umbilicus . | Has had attacks of fever at irregular intervals for several years. The last attack, of 11 days' duration, occurred a month ago. He is a police constable and is not incapacitated from carrying out his duties efficiently. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |
| 2 | " | Munshi; 24 years. | One inch beyond the umbilicus. | Has had attacks of fever "off and on" for 6 months. He states that he gets an attack about every 15—20 days, but that between the attacks he is able to do his work. At the time of examination his temperature was 101°; he said that he had been suffering from fever for four days. He had taken no quinine. | <i>Finger blood.</i> Many Simple Tertian malaria parasites; no other parasites. <i>Spleen blood.</i> A few Simple Tertian ring forms; a fair number of pigmented leucocytes; no other parasites. |
| 3 | " | Bera; 15 years. | To umbilicus . | Said to have had fever "off and on" for 3 months: at first it was of continued type; after two weeks it ceased and he was free from fever for 3 weeks; it then came on every other day for a month. At the time of examination he was free from fever. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |

* Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India, New Series, No. 13.

| No. | Place. | Name and age. | Condition of spleen. | Other particulars of the case. | Results of examination of blood. |
|-----|---------------------------------|---------------------------|---|---|---|
| 4 | Moriaputty (Golaghat district). | Hait Ali; 9 years. | Beyond the umbilicus. | Has suffered from occasional attacks of fever for a year; has been free from fever for nearly 2 months. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |
| 5 | " | Haru Aya; 16 years. | Four inches below the costal margin. | Liver palpable. She stated that she had an attack of continued fever, which lasted 20 days, 6 months ago. Afterwards she was well for 2 months. Since then she has had fever occasionally. No fever at time of examination. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |
| 6 | " | Dalnoor; 28 years. | To umbilicus | The patient stated that he had had attacks of fever for about 6 months; in the first attack, which lasted about 2 months, the fever came on every other day. He noticed that his spleen was enlarging. He was doing his work and had no fever at the time of examination. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |
| 7 | " | Gopin; 18 years. | To umbilicus | A history of occasional attacks of fever for a year. Lately it has come on almost every day. The patient is well-nourished and not markedly anæmic. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> One large Simple Tertian parasite in a stippled cell (Romanowsky's stain) found. No other parasites. |
| 8 | " | Lakshman Singh; 25 years. | Beyond the umbilicus. | Liver one inch below the costal margin. It is stated that the patient has had fever "off and on" for a year. The fever comes on at intervals and often he is free from it for a month or more. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |
| 9 | " | Thorpor; 30 years. | One hand's breadth below the costal margin. | A history of fever nearly every day for two months. The patient is very anæmic. He is attending hospital and is taking a "spleen mixture" which contains small doses of quinine. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |

| No. | Place. | Name and age. | Condition of spleen. | Other particulars of the case. | Result of examination of blood. |
|-----|--|-----------------------|---|--|--|
| 10 | Moiraputty (Golaghat district) — <i>contd.</i> | Lepton; 20 years. | To umbilicus . | A history of occasional attacks of intermittent fever for 1½ years. He has no fever now and is doing work. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |
| 11 | " | Jumratti; 25 years. | One hand's breadth below the costal margin. | A history of attacks of fever for 2 months. Temperature at the time of examination 101°. | <i>Finger blood.</i> Numerous Malignant Tertian ring parasites; no other parasites. <i>Spleen blood.</i> Many Malignant Tertian ring parasites; no other parasites. |
| 12 | Kacharihat (Golaghat district). | Amir Chand; 18 years. | To umbilicus . | The patient stated that he had had fever "now and then" for a year. He is doing work. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |
| 13 | " | Methai; 15 years. | 1½ hands' breadths below costal margin. | A history of occasional attacks of fever for 6 months. No fever at the time of examination. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |
| 14 | " | Tor Singh; 35 years. | Nearly to pubes | Liver 3 inches below the ribs. A history of occasional attacks of fever for 3 years. The patient had slight œdema of the legs at the time of examination, but was free from fever and was carrying on his occupation of cultivator. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |
| 15 | " | Pya Ram; 14 years. | Beyond the umbilicus. | A history of occasional attacks of intermittent fever for 9 months. The patient was anæmic and weak at the time of examination, but had no fever. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |

| No. | Place. | Name and age. | Condition of spleen. | Other particulars of the case. | Result of examination of blood. |
|-----|---|-------------------------------|--------------------------|--|---|
| 16 | Kacharihat (Golaghat district) —conold. | Basiruddin; 30 years. | To umbilicus . | Liver 2 inches below the costal margin. A history of occasional attacks of fever for a year. At the time of examination he stated that he had been almost free from fever for 2 months. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |
| 17 | " | Pharmude; 13 years. | Nearly to the umbilicus. | A history of attacks of intermittent fever for 6 months. | <i>Finger blood.</i> Two Simple Tertian malaria parasites found; no other parasites. <i>Spleen blood.</i> A few pigmented leucocytes, but no malaria parasites seen; no other parasites. |
| 18 | Nadi'kaner . | Mohamed khan; 28 years. | To umbilicus . | It was said that the patient had suffered from fever "off and on" for two years, but during the last year only very occasionally. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |
| 19 | Golaghat . | Burghaon; 22 years. | To umbilicus . | The patient was seen in the Golaghat hospital. He had been admitted for diarrhoea. He had a sore, which was said to be a "Naga Sore," on his leg. | <i>Finger blood.</i> One pigmented large mononuclear leucocyte; no parasites seen. <i>Spleen blood.</i> A fair number of pigmented large mononuclear leucocytes; no parasites found. |
| 20 | " | Lal Mahomed; 25 years. | Nearly to the umbilicus. | Admitted into hospital for the treatment of a "Naga Sore." Has no fever. | <i>Finger blood.</i> No malaria parasites; no pigment; no other parasites. <i>Spleen blood.</i> No malaria parasites; no pigment; no other parasites. |

I have now placed before the reader a considerable number of cases, all, I believe, due to malaria and all having a certain group of signs and symptoms in common. This group—of which the three most important features are (1) enlargement of the spleen, (2) a temperature-curve which shows definite pyrexial and apyrexial periods and during the pyrexial periods shows characters met with only in cases of malarial fever, and (3) absence of serious symptoms throughout the period during which the condition lasts, but especially so during apyrexial intervals—recurs again and again in successive cases of chronic malaria amongst natives of India; and, therefore, upon it we are justified in building up an imaginary picture, or type, of the condition ("malarial

cachexia") which results to the native of India as a consequence of long-continued untreated infection with malaria parasites. The three characteristic or typical features of the condition have just been given, and it will be seen that they are very different from those which characterise the "malarial cachexia" of the text-books. But it must be remembered that I am dealing only with the results of malarial infection in natives of India, whilst what we may call the text-book view of "malarial cachexia" was derived largely, if not entirely, from a study of cases which occurred among Europeans. Moreover, even the writers of text-books are not infallible, and, having regard to recent important additions to our knowledge, it is plainly their duty to ascertain whether their views upon "malarial cachexia"—even when the term is applied only to the condition as seen in Europeans—are or are not correct.

If my readers are prepared to agree with what I have written thus far, they will agree also that upon the subject of the diagnosis of *kala azar* but little need be said. For purposes of comparison I reproduce here the temperature charts of some cases of this disease: it will be seen how very different they are from the charts of cases of "malarial cachexia." In my experience charts with characters similar to those in the cases of Bongi, Sindhoo, and Toolsa (*charts IX, X, XI*) are most frequently observed in patients suffering only from *kala azar*; but charts like those of Mohisa Mal and Sunkopaha (*XIII and XVI*) are also very common; they recall to one's mind irresistibly Kelsch and Kiener's charts illustrating the malarial *fièvre symptomatique* described by them. In his report on *kala azar* Major Ross also drew attention to this similarity and used it as evidence in favour of the view, which he then held, that *kala azar* is a form of post-malarial cachexia; but we have seen that in true "malarial cachexia" among natives of India, fever of this nature does not occur, and it is not improbable that the patients in whom Kelsch and Kiener observed it were suffering not from malaria, but from some other disease, perhaps, indeed, from *kala azar*. Whoever undertakes the difficult task of writing the symptomatology of *kala azar* will need, when drawing inferences regarding the character of the fever in this disease, to be very careful to ascertain that it is the only disease present: for perhaps in no other disease is the character of the fever-curve so easily altered by the concomitant presence of other diseases. Thus the fever-curve of the patient named Jettoo (*chart XV*) is characteristic only of the disease, pneumonia, from which he died: and the fever-curve of the patient named Dookhawa (*chart XIV*), who was suffering from malaria as well as from *kala azar*, shows chiefly, if not entirely, the characters seen in charts of that disease. In this case we should be correct in making, in the first place, a diagnosis of malaria: at the same time we should conjecture that the signs and symptoms present were too serious to be accounted for by malaria alone; and afterwards, when we had cured the

malaria by adequate quinine treatment, our conjecture would be verified. Such a case would present little or no difficulty to the clinician with a sound knowledge of the signs and symptoms of malarial fever as it occurs among natives of India, and it is chiefly with the object of aiding those who desire to gain this knowledge that I have written the present section. I have shown that as regards the native of India the notion that untreated malarial infections result in a condition characterised by the presence of long-continued irregular fever and, as the text-books say, "by the reduction of the patient to a most distressing condition of emaciation and weakness in which he is a prey to any secondary infection," is incorrect; and that, in short, malarial fever as it occurs among natives of this country is a disease which, even in the stage termed "malarial cachexia," presents very definite characters by the study of which it can be diagnosed without difficulty. Thus we are able to exclude the only disease which, so far as at present we know, is liable to be confused with *kala azar*; and I do not doubt that if those whose duty it is to diagnose cases of this disease keep constantly in mind the conclusions I have attempted to summarize in this section, they will find the problem as easy as it has seemed to myself to be.

III

I SHALL now give the results of my examinations of the blood of 68 patients who suffered from *kala azar* in different parts of Assam and Bengal. The method by which a diagnosis of *kala azar* was arrived at in these cases has been described in the preceding section.

Assam.

| | Result of examination of finger blood. | Result of examination of splenic blood. |
|---|--|---|
| GAUHATI AND ULLOOBARI. | | |
| <p><i>Case 1.</i>—Elizabeth, a female child, aged 4 years; seen in her mother's house at Gauhati; has been suffering from fever almost daily for 11 months; is extremely emaciated; has had several attacks of dysentery and is now suffering from diarrhoea and cough. It appears to me that she cannot live at the most more than a month or two longer. Spleen enlarged to umbilicus. Liver enlarged 1 inch below costal margin.</p> | No malaria parasites; no pigment; no other parasites. | A large number of "Leishman" parasites both free and enclosed in mononuclear cells; no malaria parasites; no pigment. |
| <p><i>Case 2.</i>—Hudoo, native boy, aged 13 years; an out-patient at Gauhati dispensary; has been ill for 2 years; is very emaciated and anæmic, but walks about. Spleen enlarged to umbilicus. No enlargement of liver detected.</p> | No malaria parasites; no pigment; no other parasites. | A large number of "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 3.</i>—Seban, girl, aged 13 years; an out-patient at Gauhati dispensary; has been ill 6 months; gets fever every day; is very anæmic, but not markedly emaciated.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 4.</i>—Jadoo, man, aged 24 years; seen in his house at Ulloobari village; is extremely emaciated and too weak to stand. It appears to me that he cannot live more than a week or two longer. Spleen and liver greatly enlarged; they stand out prominently as large tumours under the stretched skin of his sunken abdomen.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 5.</i>—Durrang Singh, boy, aged 14 years; seen at Ulloobari village; is walking about, but has high fever; his father says that he is rapidly losing flesh and he is greatly emaciated now. Spleen enlarged beyond the umbilicus, liver 2 inches below the ribs.</p> | Many Simple Tertian malaria parasites; no other parasites. | Numerous "Leishman" parasites, a few pigmented large mononuclear cells, but no malaria parasites seen. |
| <p><i>Case 6.</i>—Coonkee, sister of previous patient; gets fever occasionally and is very weak and thin. Spleen enlarged to umbilicus. Liver 1 inch below ribs.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |

| | Result of examination of finger blood. | Result of examination of splenic blood. |
|---|--|---|
| <i>GAUHATI AND ULLOOBARI—contd.</i> | | |
| <p><i>Case 7.</i>—Foola Ram, man, aged 28 years; an out-patient at Gauhati dispensary; has had fever every day for the last 2 months in spite of vigorous treatment; is losing flesh rapidly. Spleen $1\frac{1}{2}$ hands' breadth below costal margin. No enlargement of liver detected.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 8.</i>—Hera, boy, aged 12 years; seen at Ulloobari, has been ill 1 year; is emaciated and weak, but can walk about. Spleen $1\frac{1}{2}$ hands' breadths below costal margin. Liver 1 inch below costal margin.</p> | No malaria parasites; no pigment; no other parasites. | A few "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 9.</i>—Mangu, man, in-patient of Gauhati dispensary, aged 38 years; says his illness began 2 months ago with fever, diarrhoea and wasting; his spleen enlarged rapidly. It is difficult to understand how anyone could be so emaciated and yet remain alive—his bones are covered with little more than skin and his spleen stands out as a huge tumour. He has constant watery diarrhoea. He died 4 days after admission. Temperature chart XVII. At an examination made after death innumerable ulcers were found in the intestine from the ileo-cæcal valve to the rectum. Some had nearly perforated the intestinal wall. On the duodenum and jejunum patches of congestion were found, but no ulcer. No anchylostomes were present. The spleen was 10 inches long and $7\frac{1}{2}$ inches broad.</p> | No malaria parasites; no pigment; a few "Leishman" parasites found enclosed in polymorphonuclear leucocytes. | An enormous number of "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 10.</i>—Haresa, boy, aged 8 years; an out-patient of Gauhati dispensary; has been ill for 7 months with fever; great weakness and wasting. Spleen 1 hand's breadth below costal margin. No enlargement of liver detected.</p> | Two Simple Tertian malaria parasites found; no other parasites. | Numerous "Leishman" parasites; one pigmented leucocyte; no malaria parasites. |
| <p><i>Case 11.</i>—Taimool, boy, aged 9 years; seen at Ulloobari village; extremely emaciated; no fever at time of examination. Spleen enlarged beyond the umbilicus. Liver 4 inches below costal margin. The liver and spleen are in close contact with each other.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 12.</i>—Tairin, male, aged 16 years; seen at Ulloobari village; is too weak to stand; has been ill about a year; has slight œdema of legs; temperature at the time of examination 98.6°. Spleen and liver greatly enlarged.</p> | No malaria parasites; no pigment; no other parasites. | Numerous "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 13.</i>—Panchkourie, man, aged 35 years; in-patient of Gauhati dispensary; illness commenced 2 months ago with fever and enlargement of the spleen; he has no fever at present, but is very emaciated and weak. Spleen enlarged to umbilicus. No enlargement of liver detected.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |

| | Result of examination of finger blood. | Result of examination of splenic blood. |
|---|---|---|
| GAUHATI AND ULLOOBARI—concl'd. | | |
| <p><i>Case 14.</i>—Asanadi, boy, aged 12 years; seen at Ulloobari village; has been ill for one year, is very emaciated and weak, but can walk about; no fever at time of examination. Spleen $1\frac{1}{2}$ hands' breadth below costal margin. No enlargement of liver detected.</p> | No malaria parasites; no pigment; no other parasites. | A few "Leishman" parasites; no malaria parasites; no pigment. |
| TEZPUR AND THE SURROUNDING DISTRICT. | | |
| <p><i>Case 15.</i>—Godhala, man, aged 28 years. Admitted into hospital on 8th May 1904. His illness began 6 months ago with an attack of fever of continued type which lasted about a month; then the fever left him for about 3 weeks; then it came on again and has not left him for more than two or three days at a time since. His spleen is now enlarged beyond the median line; no enlargement of liver detected; he is very weak and has the characteristic dull, <i>anxious</i> expression so frequently seen in cases of <i>kala asar</i>. He remained in hospital until—mainly, I believe, as a result of good feeding—he recovered. Temperature chart XII.</p> | No malaria parasites; no pigment; no other parasites. | At the time of his admission numerous "Leishman" parasites; no malaria parasites, nor pigment; at the time of his discharge no parasites nor pigment of any kind. |
| <p><i>Case 16.</i>—Jettoo, a hospital servant, aged 26 years; formerly a tea-garden cooly. Admitted into the hospital five years ago for debility; he recovered and became a hospital servant; for the last nine months he has suffered from occasional attacks of fever and his spleen has become enlarged; he is also losing flesh rapidly. On 3rd June 1904 he took to his bed with a severe attack of pneumonia, from which he died on 12th June 1904. Temperature chart XV. At an examination made after death the spleen was found to weigh 3 lbs. 13 ozs., and the liver 4 lbs. 12 ozs. The right lung weighed 2 lbs. 2 ozs. and the left 2 lbs. 8½ ozs. No ulcer was found in the intestines.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 17.</i>—Chanahia, aged 10 years; an out-patient at Tezpur dispensary; illness began 4 months ago with remittent fever and enlarged spleen; is very anæmic and weak and the muscles of arms and legs are very wasted; face and feet oedematous. Temperature at time of examination 99°2'. Spleen beyond umbilicus. Liver 1 inch below costal margin.</p> | No malaria parasites; no pigment; no other parasites. | Numerous "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 18.</i>—Sunavaram, aged 20 years; an out-patient at Tezpur dispensary; illness began 4 months ago, the fever being intermittent at first, but afterwards almost continuous; he is very emaciated. Spleen to umbilicus. Liver 2 inches below costal margin.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |

| | Result of examination of finger blood. | Result of examination of splenic blood. |
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| TEZPUR AND THE SURROUNDING DISTRICT—contd. | | |
| <p><i>Case 19.</i>—Mohesa, girl, aged 11 years; an out-patient of Tezpur dispensary; has been ill 1½ years and is very emaciated and anæmic. Temperature normal at time of examination. Spleen extends completely across the abdomen; the edge of the liver cannot be felt as distinct from that of the spleen.</p> | No malaria parasites; no pigment; no other parasites. | A considerable number of "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 20.</i>—Nidhia, boy, aged 17 years; admitted into Tezpur hospital 30th June 1904; his first attack of fever began 9 months ago, since then he has had very frequent attacks; now has very severe dysentery, from which he died three days after admission. Spleen 1½ hands' breadth below costal margin. No enlargement of liver detected. At an examination made after death the spleen was found to weigh 2 lbs. 11 ozs. and the liver 4 lbs. 9 ozs. Two large ulcers, one of which had perforated the intestinal wall, were found in the colon. The small intestines appeared normal, but contained many round worms. No anchylostomes were found.</p> | No malaria parasites; no pigment; no other parasites. | A fair number of "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 21.</i>—Kiramata Ali, aged 21 years; seen in Tezpur town, has been ill one year. He is able to walk about, but has constant fever; is exceedingly emaciated and has œdema of the feet; he has the characteristic anxious expression of <i>kala asar</i> patients; there is a chronic ulcer on his left foot. Spleen beyond umbilicus. No enlargement of liver detected.</p> | No malaria parasites; no pigment; no other parasites. | Numerous "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 22.</i>—Anandi Ram, aged 15 years; seen in Parbatia village; has been ill for 7 months with fever, enlarged spleen and wasting. Temperature at time of examination 99.6°. Spleen beyond umbilicus; liver 2 inches below ribs.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 23.</i>—Oosman, boy, aged 12 years; brother of Kiramat Ali (case 21); seen in Tezpur town; has been ill 6 months; has <i>cancreum oris</i> and is too weak to leave his bed. Spleen beyond umbilicus. Liver 2 inches below costal margin.</p> | No malaria parasites; no pigment; no other parasites. | A large number of "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 24.</i>—Abu, girl, aged 15 years; seen in Tezpur town; has been ill 9 months; says she caught the disease at Mangaldai; is very anæmic, weak and emaciated. Spleen beyond umbilicus. Liver palpable.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 25.</i>—Mohisa Mal, aged 35 years; an inmate of the Tezpur Lunatic Asylum. In March 1904 he began to get fever every day, the temperature ranging between 100° and 104°; his spleen and liver enlarged rapidly and he became very emaciated; early in June he began to suffer from severe diarrhœa from which he died on June 14th. Temperature chart XIII.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |

| | Result of examination of finger blood. | Result of examination of splenic blood. |
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| TEZPUR AND THE SURROUNDING DISTRICT—concl'd. | | |
| <p><i>Case 26.</i>—Sankopaha, aged 26 years; an inmate of Tezpur Lunatic Asylum. He gets an attack of acute mania about twice a year. His present disease was discovered at the end of May; he is losing weight very rapidly and his spleen and liver are greatly enlarged. The temperature has ranged between 99° and 101° for the past month. Spleen beyond umbilicus. Liver 2 inches below the ribs. Temperature chart XVI.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 27.</i>—Ramkooar, woman, aged 35 years; seen in the hospital of the Bootiachang tea garden; has been in hospital 2 months suffering from fever and enlargement of the spleen; quinine has been given daily without effect. Temperature 102.4°. Spleen to umbilicus. Liver 1 inch below ribs.</p> | No malaria parasites; no pigment; no other parasites. | A few "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 28.</i>—Hiradhan, son of previous patient; seen in the hospital of the Bootiachang tea garden; has been ill about 8 months; suffers much from dysentery. Temperature 99.2°. Spleen to umbilicus. No enlargement of liver detected.</p> | No malaria parasites; no pigment; no other parasites. | Numerous "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 29.</i>—Fudnee, woman; seen in the hospital of the Bootiachang tea garden; has had fever off and on for a year. Spleen 3 fingers' breadth below costal margin. Liver more than 1 hand's breadth below costal margin.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 30.</i>—Seboo, a tea-garden cooly, aged 30 years; seen at the Sonajuli hospital of the Takibari tea gardens; admitted for fever and anæmia on 8th April 1904; is a typical case of <i>kala asar</i>.*</p> | No malaria parasites; no pigment; no other parasites. | Numerous "Leishman" parasites; no malaria parasites; no pigment. |
| SALONAH DISTRICT NEAR NOWGONG. | | |
| <p><i>Case 31.</i>—Sindhoo, a tea-garden cooly, aged about 30 years; seen in the hospital of Salonah new lines. In 1898 he was placed in the segregation camp for 18 months as a case of <i>kala asar</i>, and while resident in the camp his wife and daughter died of the disease. At the end of that time he was discharged as cured and enjoyed good health for 3 years. He has now been suffering from constant low fever for 90 days. Spleen enlarged to umbilicus. No enlargement of liver detected. Temperature chart X.</p> | No malaria parasites; no pigment; no other parasites. | Numerous "Leishman" parasites; no malaria parasites; no pigment. |

* During my visit to Borjulia I saw a large number of characteristic cases of *kala asar* among the tea-garden coolies. In the spleen-blood of all cases which I should have diagnosed as *kala asar* Dr. Bentley had already found "Leishman" parasites. For this reason I did not think it necessary to examine their blood again and they are not entered here.

| | Result of examination of finger blood. | Result of examination of splenic blood. |
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| SALONAH DISTRICT NEAR NOWGONG— <i>contd.</i> | | |
| <p><i>Case 32.</i>—Koondi, woman, a tea-garden cooly; seen in the above hospital; her illness dates from 6 months ago; since April she has had several attacks of dysentery and is much emaciated. In 1900 her sister died of <i>kala asar</i>, and her husband and three other members of her family are now suffering from chronic fever. Spleen enlarged to umbilicus. Liver 1 inch below costal margin.</p> | No malaria parasites; no pigment; no other parasites. | Numerous "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 33.</i>—Toolsa, tea-garden cooly; seen in the above hospital; was quite well until six weeks ago, when she developed remittent fever and her spleen began to enlarge. The fever and enlargement of the spleen have continued in spite of vigorous treatment with quinine. In 1903 two of her relations died of <i>kala asar</i>. Spleen 2 fingers' breadth below the costal margin. Liver not enlarged. Temperature chart XI.</p> | No malaria parasites; no pigment; no other parasites. | A few "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 34.</i>—Keora, woman, a tea-garden cooly; seen in the above hospital; has been ill for 2 months; her illness commenced with dysentery and fever; she now has considerable oedema of the feet and legs and a greatly enlarged spleen.</p> | No malaria parasites; no pigment; no other parasites. | A moderate number of "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 35.</i>—Bongi, woman, a tea-garden cooly; seen in the above hospital. In March 1904 she had an attack of pneumonia and her present illness dates from that time. In May she suffered severely from dysentery. It is said that she contracted the disease from her mother, who died of fever and <i>cancreum oris</i>. Spleen nearly to umbilicus. No enlargement of liver detected. Temperature chart IX.</p> | No malaria parasites; no pigment; no other parasites. | A few "Leishman" parasites; no malaria parasites; no pigment. |
| <p><i>Case 36.</i>—Dookahwa, boy, aged 13 years; seen in the above hospital; has been ill 5 months; has improved considerably since admission to hospital. Spleen to umbilicus. Liver 1 inch below ribs. Temperature chart XIV.</p> | One Quartan malaria parasite; no other parasites. | Many "Leishman" parasites; two Quartan malaria parasites. |
| <p><i>Case 37.</i>—Raymuti, woman, tea-garden cooly; seen in above hospital; is not emaciated, but has constant fever, which is not influenced by quinine. Spleen and liver enlarged.</p> | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |

| | Result of examination of finger blood. | Result of examination of splenic blood. |
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| SALONAH DISTRICT NEAR NOWGONG—concl'd. | | |
| Case 38.—Mohan, aged about 30 years; horse-keeper working at Salonah. I was informed that he had suffered very severely from <i>kala asar</i> , but that he had now recovered and was rapidly regaining weight and strength. He has no fever now and looks fairly robust, but his spleen is still enlarged to the level of the umbilicus. | No malaria parasites; no pigment; no other parasites. | No "Leishman" parasites; no malaria parasites; no pigment. |
| Case 39.—Sarasati, a tea-garden cooly; seen in the hospital of one of the tea-gardens between Salonah and Silghat. Several of his relatives have died of <i>kala asar</i> and he now suffers almost daily from fever; his spleen is enlarged nearly to the level of the umbilicus. | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| SYLHET DISTRICT. | | |
| Case 40.—Maya Ram; seen in the village of Panchgaon; has been ill for 8 months. Spleen enlarged beyond the umbilicus. | No malaria parasites; no pigment; no other parasites. | Numerous "Leishman" parasites; no malaria parasites; no pigment. |
| Case 41.—Ayaj Khan; seen in the village of Panchgaon; has been ill for 6 months. Spleen to umbilicus. | Many crescents, rings and pigmented leucocytes. | Numerous "Leishman" parasites; a few crescents and two pigmented leucocytes. |
| Case 42.—Lob Mali; seen in the village of Panchgaon; has been ill for 4 months; temperature at time of examination 104°. Spleen 1½ hands' breadth below costal margin. | No malaria parasites; no pigment; no other parasites. | Numerous "Leishman" parasites; no malaria parasites; no pigment. |
| Case 43.—Sharo Deb; seen in the village of Panchgaon; has been ill one year. Spleen beyond umbilicus. Liver 2 inches below ribs. | Two "Leishman" parasites in polynuclear leucocytes; no malaria parasites; no pigment. | Very numerous "Leishman" parasites; no malaria parasites; no pigment. |
| Case 44.—Jasu Nath; seen in the village of Panchgaon; has been ill for 2 years. Spleen midway between umbilicus and pubes. Liver 1 hand's breadth below ribs. | No malaria parasites; no pigment; no other parasites. | Scanty "Leishman" parasites; no malaria parasites; no pigment. |
| Case 45.—Anoor Mahomed; seen in the village of Panchgaon; has been ill 4 months. Spleen 1 hand's breadth below costal margin. No enlargement of liver detected. | No malaria parasites; no pigment; no other parasites. | Very numerous "Leishman" parasites; no malaria parasites; no pigment. |
| Case 46.—Arfan Mia; seen in the village of Panchgaon; has been ill 6 months. Spleen to umbilicus. Liver 1 inch below ribs. | No malaria parasites; no pigment; no other parasites. | Numerous "Leishman" parasites; no malaria parasites; no pigment. |
| Case 47.—Suraj Mia; seen in the village of Panchgaon; has been ill 6 months. Spleen beyond umbilicus. Liver 2 inches below costal margin. | One pigmented leucocyte; no parasites. | Many "Leishman" parasites; one Malignant Tertian ring parasite and two pigmented leucocytes. |

| | Result of examination of finger blood. | Result of examination of splenic blood. |
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| SYLHET DISTRICT—contd. | | |
| <i>Case 48.</i> —Mountaj; seen in the village of Panchgaon; has been ill 1 year. Spleen beyond umbilicus. Liver 1 inch below costal margin. | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| <i>Case 49.</i> —Abi Ram; seen in the village of Panchgaon; has been ill 1 year. Spleen midway between umbilicus and pubes. Liver 1 inch below costal margin. | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| <i>Case 50.</i> —Dinai; seen in the village of Panchgaon; has been ill 6 months. Spleen 1 hand's breadth below costal margin. | No malaria parasites; no pigment; no other parasites. | Numerous "Leishman" parasites; no malaria parasites; no pigment. |
| <i>Case 51.</i> —Khuki; seen in the village of Panchgaon; has been ill 7 months. Spleen beyond umbilicus. Liver not examined. | No malaria parasites; no pigment; no other parasites. | Scanty "Leishman" parasites; no malaria parasites; no pigment. |
| <i>Case 52.</i> —Hem Dyal; seen in the village of Panchgaon; has been ill 8 months; has <i>cancrem oris</i> . Spleen nearly to pubes. Liver more than 1 hand's breadth below ribs. | One full-grown Quartan malaria parasite; no other parasites. | Very numerous "Leishman" parasites; scanty malarial pigment, but no malaria parasites found. |
| <i>Case 53.</i> —Jamini; seen in the village of Panchgaon; has been ill 4 months. Spleen 1 hand's breadth below costal margin. No enlargement of liver detected. | No malaria parasites; no pigment; no other parasites. | Scanty "Leishman" parasites; no malaria parasites; no pigment. |
| <i>Case 54.</i> —Bipin Bihari, aged 15 years; an inhabitant of Jaintia; both his parents and two brothers have died of <i>kala asar</i> within the last two years; has been ill about a year; at first he had remittent fever for about 3 weeks followed by relapses at irregular intervals. He is very emaciated and his gums bleed on slight pressure; he has a chronic ulcer on the leg. Spleen enlarged beyond umbilicus. Liver 2 inches below ribs. | No malaria parasites; no pigment; no other parasites. | Numerous "Leishman" parasites; no malaria parasites; no pigment. |
| <i>Case 55.</i> —Rahim Khan, aged 30 years; seen in the village of Kolapara; has suffered from irregular fever for 1½ years. He is very emaciated and the enlarged spleen stands out as an enormous tumour. He is profoundly anæmic. Spleen enlarged to the crest of the ilium. Liver 1 hand's breadth below ribs. | No malaria parasites; no pigment; no other parasites. | Very numerous "Leishman" parasites; no malaria parasites; no pigment. |
| <i>Case 56.</i> —Nojibulla, aged 24 years; seen in the village of Kolapara; has been ill 6 months. Spleen to umbilicus. No enlargement of liver detected. | No malaria parasites; no pigment; no other parasites. | Numerous "Leishman" parasites; no malaria parasites; no pigment. |

| | Result of examination of finger blood. | Result of examination of splenic blood. |
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| SYLHET DISTRICT—concl'd. | | |
| <i>Case 57.</i> —Sarat; seen in the village of Kolapara; has been ill 1 year. Spleen and liver enlarged. | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| <i>Cases 58 to 61.</i> —Idatulla, Satyavama, Fagoo and Robia. I can find only the finger blood and spleen blood slides of these patients, and beyond the notes on the slides, <i>vis.</i> , "Sylhet," "typical case," I have no particulars regarding them. | None of the finger blood slides contain malaria or other parasites or malarial pigment. | In all the spleen blood slides "Leishman" parasites, in greater or less numbers, are present; no malaria parasites, nor pigment. |
| DHUBRI. | | |
| * <i>Case 62.</i> —Apeswari; aged 10 years. Said to have been ill 1½ years. Spleen enlarged beyond the umbilicus. Liver 1 inch below the ribs. | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| * <i>Case 63.</i> —Jagat Mohan, female; said to have died from bursting of an aneurism. Spleen and liver greatly enlarged. | Not examined . . . | Many "Leishman" parasites; no malaria parasites; no pigment. |
| * <i>Case 64.</i> —Pashin, said to be a typical case; died. Spleen much enlarged. | Not examined . . . | Many "Leishman" parasites; no malaria parasites; no pigment. |

Bengal.

| DISTRICT OF DACCA. | | |
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| <i>Case 65.</i> —Behari, aged 8 years; seen at the village of Kharipagla; has been getting fever almost continuously for 4 months. Spleen to umbilicus. No enlargement of liver detected. | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |
| <i>Case 66.</i> —Jogesh, aged 13 years; seen in the village of Kumarbhoga; suffered from intermittent fever five months ago in the Bogra district. The fever lasted about 3 weeks, after which he was well for a month, then remittent fever for 3 weeks followed by daily low fever to present time; is very anæmic. Spleen beyond umbilicus. Liver 1 inch below ribs. | A few Simple Tertian malaria parasites; no other parasites. | Numerous "Leishman" parasites; some malaria pigment, but no malaria parasites seen. |
| <i>Case 67.</i> —Bose; seen in the village of Kharipagla. He is an inhabitant of Kalna in the Burdwan district, where he contracted his disease two years ago; is very weak and anæmic, but says he has improved greatly of late. Spleen nearly to umbilicus; liver not enlarged. | No malaria parasites; no pigment; no other parasites. | Very scanty "Leishman" parasites; no malaria parasites; no pigment. |
| <i>Case 68.</i> —Umeshori, formerly an inhabitant of the Burdwan district, where he suffered severely from "Burdwan fever." He now has considerable œdema of the legs and face, and his spleen and liver are greatly enlarged. | No malaria parasites; no pigment; no other parasites. | Many "Leishman" parasites; no malaria parasites; no pigment. |

* The diagnosis in these cases was made by the Civil Surgeon of Dhubri.

The results of the blood examinations made in this series of cases may be tabulated thus :—

| Number of cases of <i>kala azar</i> examined. | Number in which the so-called Leishman-Donovan parasites were found | Number in which evidence of malaria was found. |
|---|---|--|
| 68 | 67 | 7 |

Now, these 68 cases had been diagnosed as *kala azar* before blood examinations were made, and I have no doubt that all were true cases of the disease. I believe, therefore, we are justified in concluding that the disease known as *kala azar* is always associated with the presence of the so-called Leishman-Donovan parasites. Sometimes (according to the above results in about 10 per cent. of cases)* it is associated in addition with the presence of malaria parasites or pigment, and very often it is associated in addition with the presence of ankylostomes: doubtless other parasites are also present in many cases.

The problem for solution is, which of these parasites, if any, is the cause of *kala azar*?

It will be remembered that some years ago one observer, who found ankylostomes in every case examined, regarded this parasite as the cause of the disease; and a few years later another observer, who found evidence of malaria in every case examined, thought that the malaria parasite must be the cause: so now that in the disease yet another parasite has been found, it behoves us to examine with some care the evidence concerning its causal relationship. The finding of the Leishman-Donovan parasite in a number of cases—and this, I believe, is the sole ground upon which many observers base their opinion that this parasite is the cause of the disease—is in itself, of course, no more a proof of its causal relationship to the disease than is, let us say, the finding of ankylostomes or of malaria parasites in a number of cases a proof that the disease is due to either of these organisms. In a country like Assam, where a large proportion of the population harbour parasites of several kinds, the finding of any particular one in a patient suffering from some disease affords at the most a probability that it bears a relation to some of the signs and symptoms present.

But there are other reasons than its presence in every case for the opinion that the Leishman-Donovan parasite is the cause of *kala azar*, and, so far as my experience enables me to do so, I shall summarize them as follows :—

(1) *Kala azar* is not due to the presence of the *Ankylostomum duodenale*. This is agreed upon by all observers.

* Nearly all the patients seen in hospitals had been treated more or less vigorously with quinine; if they are excluded, the percentage is between 14 and 15.

(2) It is not due to malaria. This has been proved in Section I of the present report.

(3) It is invariably associated with the presence of the Leishman-Donovan parasite in the spleen and some other organs of the body.

(4) I failed to find this parasite in the splenic and finger blood of forty-eight cases of the disease I have described under the term "malarial cachexia," the signs and symptoms of which are very different from those of *kala azar*.

(5) The recovery of patients suffering from *kala azar* is coincident with the disappearance of the parasite from their spleens (? and from other organs). This was well illustrated in the patient named Godhala (case 15), and we may assume that it was exemplified also in the patient named Mohan (case 38).

(6) The parasite is present in parts of Assam where *kala azar* is prevalent, and apparently it is absent from parts where this disease is unknown (e.g., the Golaghat district: pages 28 to 30).

This group of facts affords evidence sufficient, one would imagine, to justify the belief that the Leishman-Donovan parasite is the cause of *kala azar*: but the proof is not complete, any more than was the proof of the causal relationship of the malaria parasite to malarial fever until the developmental cycle of the parasite in the mosquito was established and the experimental infection of man by the bite of this insect effected. And, in the absence of the conclusive proof afforded by the experimental production of *kala azar*, there are certain facts which require explanation before all doubt that the Leishman-Donovan parasite is the cause of the disease can be removed from our minds. Perhaps the most important of these is the presence of the parasite (or of one which in appearance is indistinguishable from it) in the disease known as Oriental or Delhi Sore. In a previous memoir* I have drawn attention to the following facts: (1) a parasite indistinguishable from the Leishman-Donovan parasite is present in the great majority of ulcers known in India as Oriental or Delhi Sores; (2) the sores and the parasites in them occur in the Punjab where I was unable to find a single case of *kala azar*; (3) *kala azar* and the parasites found in it occur in Assam where I was unable to find a single case of Oriental Sore. Now, if the parasite found in Oriental Sore is identical with that found in *kala azar*, it will be obvious from these results that two conclusions are justifiable: one is that some other factor than the mere presence of the parasite in a district is necessary for the production of *kala azar*, the other that something more than the presence of the parasite in the tissues of the skin is necessary for the production of this disease.

Again, if the parasites found in Oriental Sore and in *kala azar* are identical, there is, secondly, the fact that in most cases of Oriental Sore, even though the number of parasites present in the sores may be very great, fever is absent.

* Oriental or Delhi Sore: Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India, New Series, No. 13.

Some months ago I saw a European on whose body and limbs there were no fewer than 35 Frontier Sores. In films made from five of the sores (all that were examined) the parasites were found, and it is reasonable to suppose that they were present in all, and that the total number of parasites present in the tissues of this patient was enormous. Yet the patient, although many of the sores had been present for six months, had not suffered from fever, his spleen was not enlarged, and the only constitutional symptoms complained of were attributable to the anxiety and worry caused by the presence of the sores. I advised him to take two months' leave and gave him careful instructions regarding the treatment of the sores by local applications. At the end of the two months he wrote to inform me that all the sores were healed, and that he was feeling perfectly well. Now, *kala azar* is a disease characterised by almost constant fever and very severe constitutional symptoms; but a parasite indistinguishable from that which is said to be the cause of this disease does not produce fever when present in cases of Oriental Sore: is there any reason to suppose that a protozoal parasite which is incapable of producing fever when present in the skin is capable of doing so when present in the spleen?

The simplest way of getting over these difficulties is to say that the parasites found in Delhi Sores and those found in *kala azar*, although indistinguishable in appearance, are, in reality, distinct, because their geographical distribution is not the same, and because they produce entirely different pathological effects; but are these reasons sufficient?

Finally, in addition to the difficulties arising out of a study of the parasites of Oriental Sore, there is a point of some importance in connection with *kala azar* and the parasites found in it that is not easy to understand. It is that the fever met with in cases of *kala azar* bears no relation whatever either to the number of parasites present in the spleen or to their condition. I was particularly struck with this in the patients Hudoo (case 2), Elizabeth (case 1), Mangu (case 9) and others. In the splenic blood of Hudoo the parasites were present in enormous numbers, and I marked out the case for special study on account of the large number of dividing forms of the parasite present. Yet the temperature carefully taken thrice daily for 33 days only rose above normal on five occasions: on three occasions it rose to 99° , on one to 101.4° , and on the fifth to 99.8° . Similar facts were observed in the cases of Elizabeth and Mangu. On the other hand, I have records of cases in which the temperature remained continuously high for a long period, yet in which extremely few parasites were present in the spleen. These facts raise the suspicion that the fever met with at some time or other in all cases of *kala azar* is not due to the presence of the parasite under discussion; and if it does not cause the fever, may we not reasonably doubt that it causes any of the other signs and symptoms?

So far as my experience enables me to do so, I may therefore summarize the evidence against the Leishman-Donovan parasite being the cause of *kala azar* somewhat as follows:—

(1) Although I found the Leishman-Donovan parasite in 67 out of 68 cases of *kala azar*, this finding, taken alone, affords no proof that the parasite is the cause of the disease. Let us suppose, for the purpose of illustrating this truth, that I had found the malaria parasite in 50 successive cases—and it is possible that, if one were permitted to select the cases carefully, such a result could be obtained—it would afford no proof that the malaria parasite is the cause of the disease, because by methods which are unimpeachable I have shown that *kala azar* is not due to this parasite. (See Section I.)

(2) Although the Leishman-Donovan parasite is present in every case of *kala azar*—a disease in which enlargement of the spleen, fever, and wasting are prominent features—it (or a parasite indistinguishable from it) is also present in every case of Oriental Sore—a mild local disease in which constitutional signs and symptoms are absent.

(3) Although the parasite is abundantly present in parts of India where *kala azar* is prevalent, it (or a parasite indistinguishable from it) is also present in parts of India where this disease is unknown. If it produces *kala azar* in one part of India, why not in another? Obviously some other factor than the parasite is necessary for the production of this disease.

(4) Even when enormous numbers of parasites indistinguishable from the Leishman-Donovan parasite are present for many months in ulcers on the bodies of persons, no disease like *kala azar* results.

(5) There is no evidence to prove that the fever observed in cases of *kala azar* is due to the presence of the parasites; the fever in *kala azar* bears no relation either to the number or condition of the parasites present: and there is evidence that parasites indistinguishable from the Leishman-Donovan parasites (namely, the parasites of Oriental Sore) are incapable of producing fever. If the parasites found in *kala azar* do not cause one of the chief, and earliest, signs of the disease, is it not reasonable to assume that they do not cause the other signs and symptoms present?

(6) Until *kala azar* has been produced experimentally by some form or other of the parasite, it will be necessary, before the causal relationship of the parasite to the disease is established on sure grounds, to prove that every other kind of parasite which has been found in the past, or may be found in the future, in patients suffering from *kala azar* has no causal relationship to the disease. This has already been done with regard to the malaria parasite and the *Ankylostomum duodenale*, but it is not impossible that other parasites, not yet discovered, may have some share in the production of the disease. So far as

I am aware, the recently-discovered fluke *Schistosomum cattoi** has not yet been looked for in patients suffering from *kala azar*, and it is daily becoming more evident that our knowledge regarding even mammalian blood parasites is not yet complete.

(7) Although I consider that the finding of the Leishman-Donovan parasite in 67 out of 68 cases of *kala azar* justifies me in saying that in all probability the parasite is present at some period or other in every case of this disease, the number of cases examined is, after all, comparatively small, and it seems to me not impossible that cases of *kala azar* may be found in which the parasite is not present. When some able clinician gives us a complete account of the symptomatology of *kala azar*, this problem can be studied more easily.

It is not with any idea of attempting to minimize the great importance of the Leishman-Donovan parasite that I bring forward these objections, the answers to some at least of which are possibly not far to seek, but rather because, in these days of rapid discovery and hasty deduction, it behoves some of us, at any rate, to be cautious; and therefore, at the risk of being considered unnecessarily so, I would express the opinion that until proof more conclusive than has yet been adduced is forthcoming, we shall be wise if, while we agree that the Leishman-Donovan parasite is present in every case of *kala azar*, we suspend our judgment concerning its causal relationship to the disease.

* The symptoms of the disease produced by this parasite are said to be : enlargement of the liver and spleen, morbid appetite, diarrhoea, fever, anæmia, cachexia, ascites, etc.

IV

THE following are some opinions I have formed as a result of the work described in this paper and in my previous paper upon Oriental Sore:—

1. *Kala azar* is a disease distinct from every other. Its symptomatology requires to be re-written.

2. It has no connection with malaria, and its presence and spread depend upon conditions different from those requisite for the presence and spread of that disease. It exists in some places where malaria is not present, and is absent from some places where malaria is intensely prevalent.

3. Its geographical distribution in India is more limited than that of malaria. Subject to correction as a result of further study, I would say at present that it is confined to low-lying, more or less water-logged districts where the rainfall is heavy. I was unable to find a case in the Punjab. As regards Assam, it appears to be most prevalent at present in the Sylhet district, but it is common in the Goalpara, Kamrup, Darrang, and Nowgong districts, and perhaps in some others that I did not visit. I believe that it does not occur in the Golaghat and some other districts (pages 27 to 30).

4. In all probability the Leishman-Donovan parasite is present at some period in every case, and very probably is the cause of the disease, but the proof is by no means complete.

5. The geographical distribution of Oriental Sore and of *kala azar* and therefore of the parasites found in these two diseases do not correspond, and it is probable that the parasites of these diseases, though indistinguishable in appearance, are different species of a hitherto unknown group of organisms. Probably other species will be discovered in the near future; we may conjecture that they will be found in other diseases than Oriental Sore and *kala azar*.

6. True "malarial cachexia" must still be regarded as an important disease in India. I have endeavoured to show in this paper that erroneous ideas regarding its signs and symptoms and its fatality have existed and have attempted to correct them.

7. The prevailing idea that Assam as a whole is intensely malarious is wrong: a great portion is only very slightly so, and in some parts the disease does not occur. I examined a number of tea-gardens and found only one in which the amount of malaria approached that in the tea-gardens of the Darjeeling Duars.



VI

The following are some opinions I have formed as a result of the work described in this paper and in my previous paper upon Oriental Sores—

A. This case is a disease distinct from every other. Its epidemiology has to be re-written.

B. It has no connection with malaria, not its presence and spread depend conditions different from those requisite for the presence and spread of disease. It exists in some places where malaria is not present, and is absent from some places where malaria is normally present.

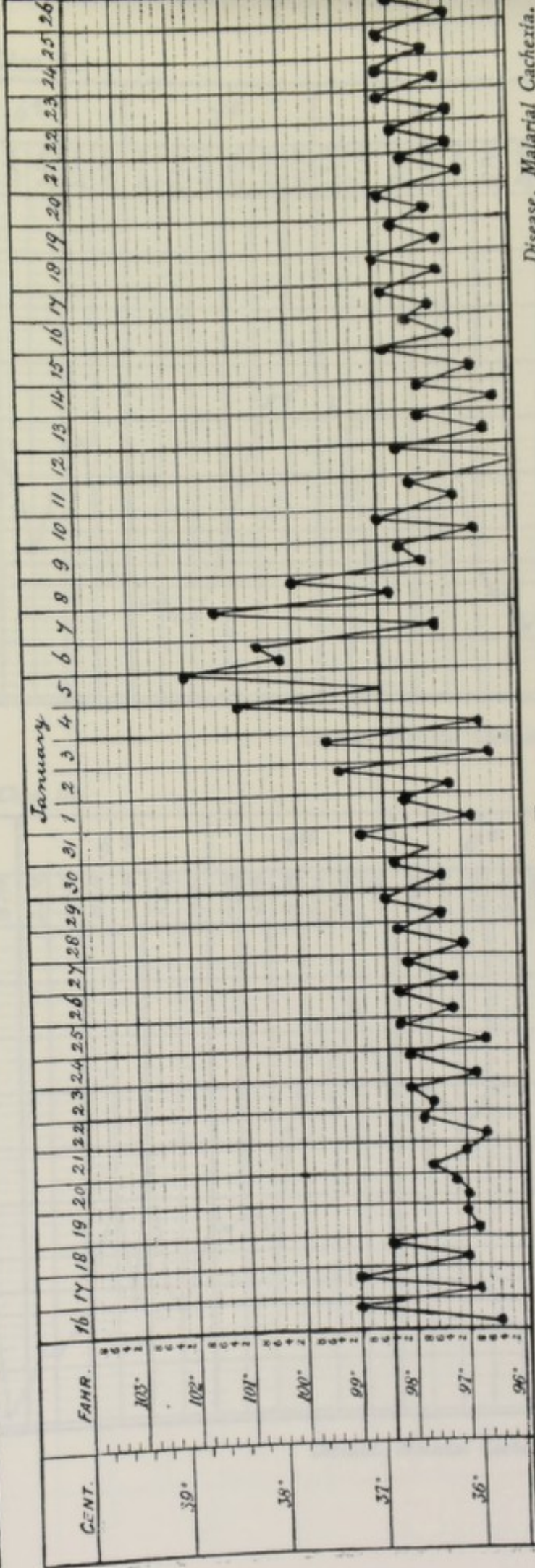
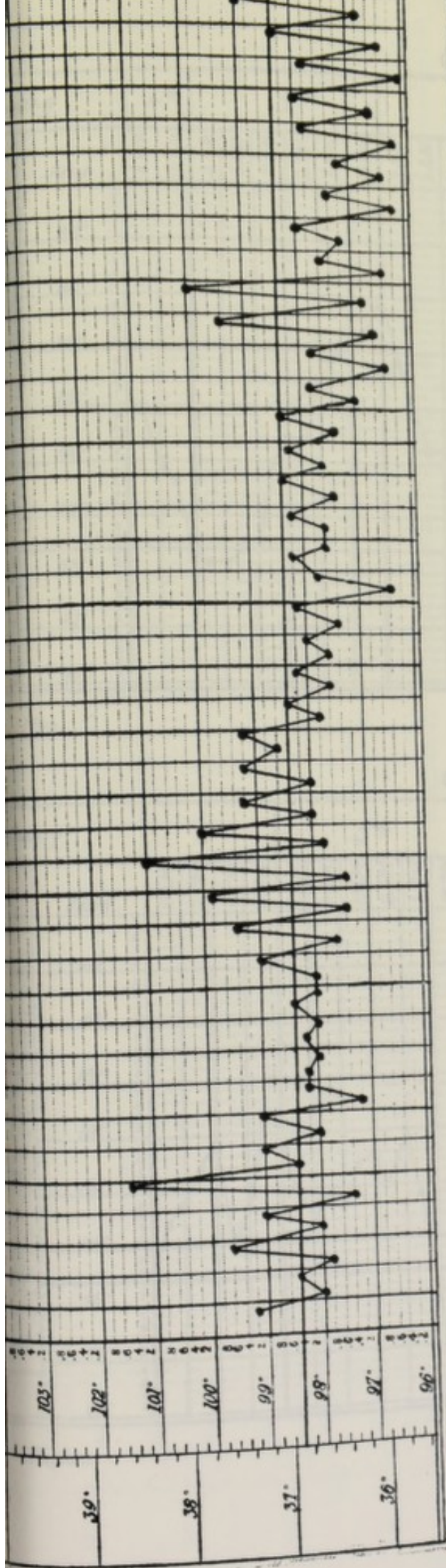
C. Its geographical distribution in India is more limited than that of the subject to countries as a result of further study, I would say at present it is confined to low-lying, malarial, water-logged districts where the temperature is high. I was unable to find a case in the Punjab. As regards Assam, it is the most prevalent at present in the Sylhet district, but it is common in Gopinoh, Kamrup, Garoah, and the other districts, and perhaps it was as that I did not visit. I believe that it does not occur in the Ganges some other districts (pages 27 to 30).

D. In all probability the Leishman-Gomman parasite is present at times in every case, and very probably is the cause of the disease, but the proof is as yet incomplete.

E. The geographical distribution of Oriental Sores and of this case and those of the parasites found in these two diseases do not correspond, and it is probable that the parasites of these diseases, though indistinguishable in structure are different species of a higher unknown group of organisms. Only other species will be discovered in the near future; we may conjecture they will be found in other diseases than Oriental Sores and this case.

F. The "malaria mephitic" must still be regarded as an important disease. I have endeavored to show in this paper that extensive areas regard- to signs and symptoms and its localities have existed and have attempted to not them.

G. The prevailing idea that Azara is a wholly unrelated mephitic is wrong; its position is only very slightly so, and in some parts the disease does not exist. I examined a number of tea-plantations and found only one in which the sort of mephitic approached that in the tea-plantations of the Teakling Forest.

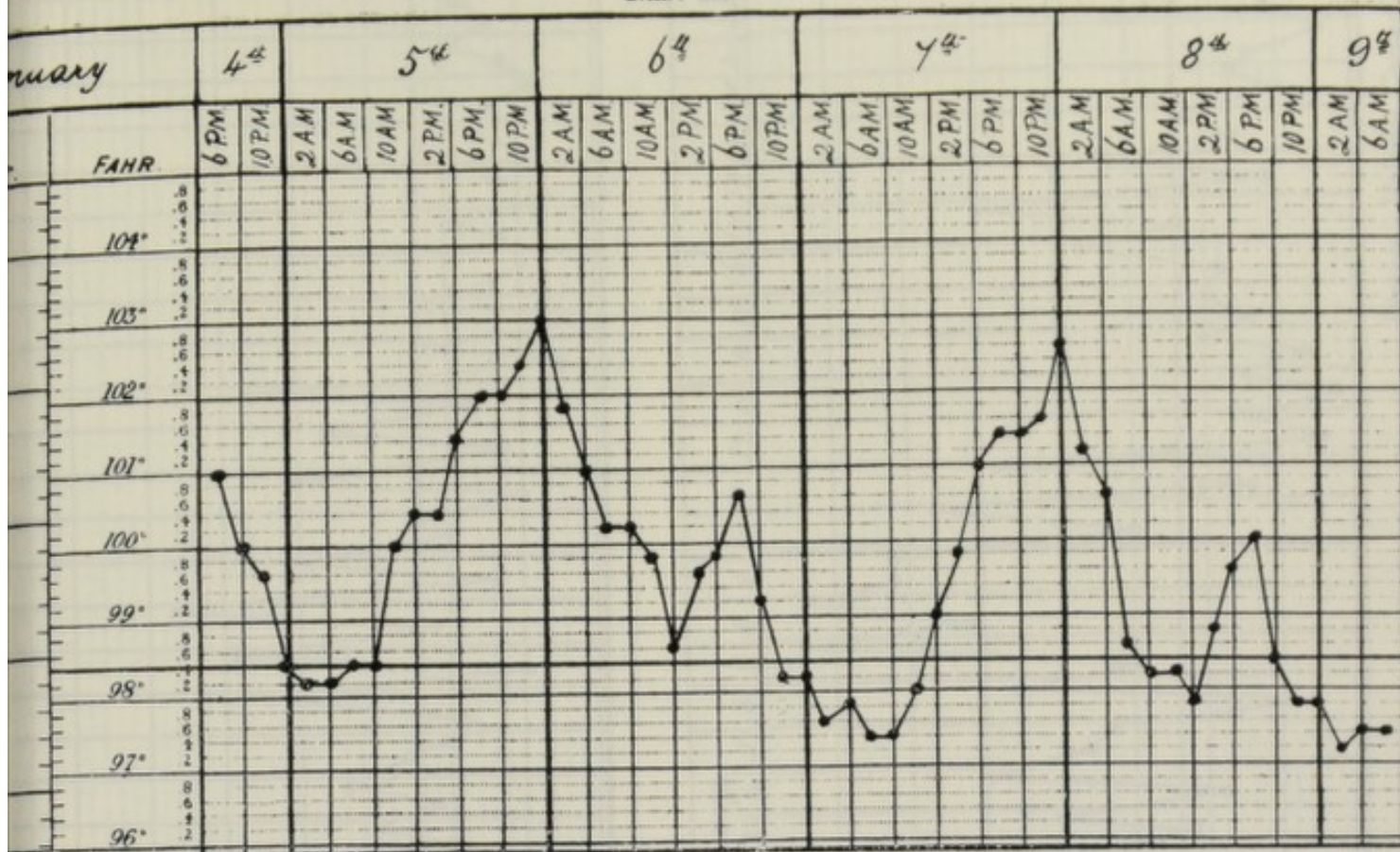


Disease, Malarial Cachexia.

Age 14 Years.

Name, Hira.

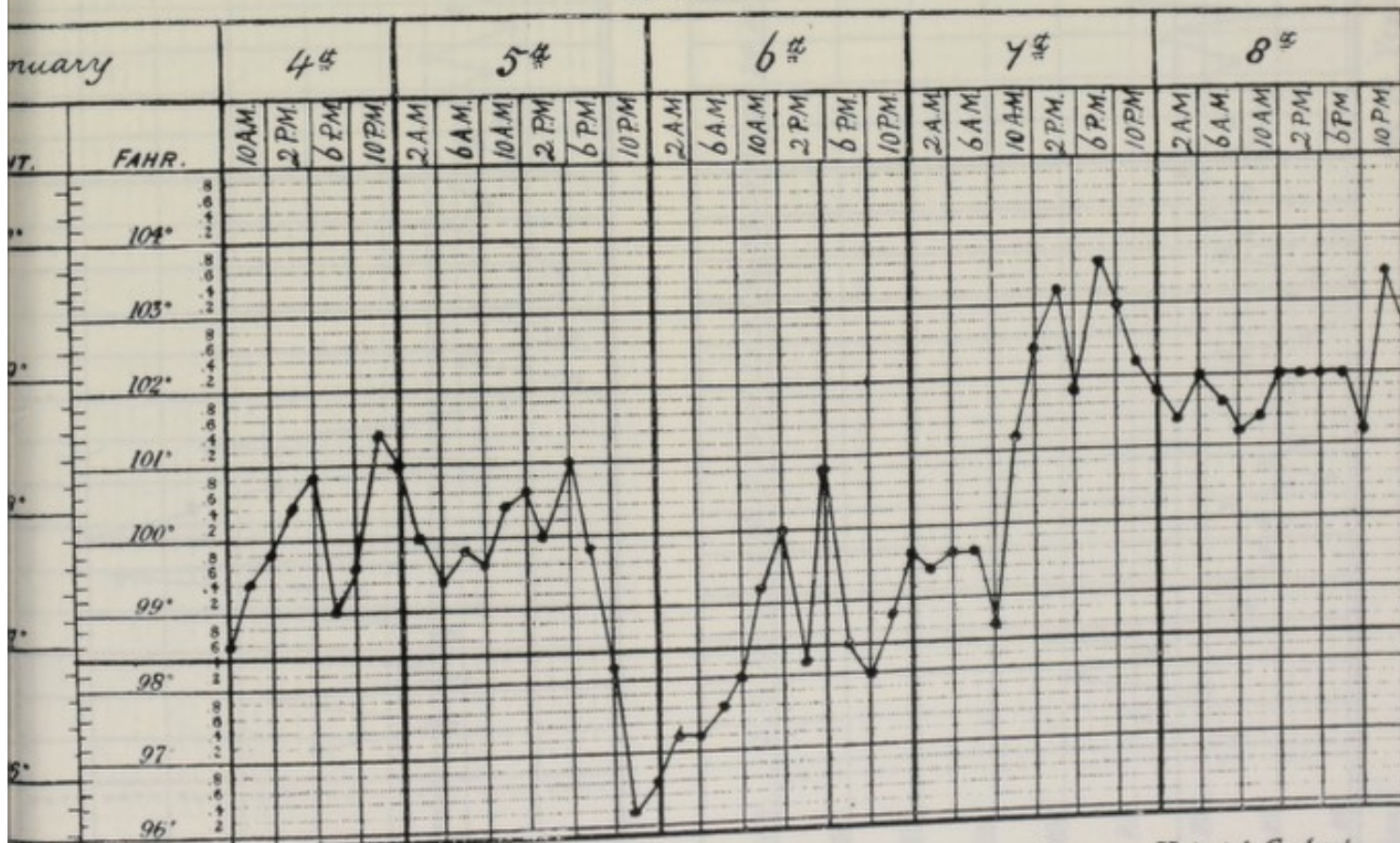
Chart II.



ne, Htra.

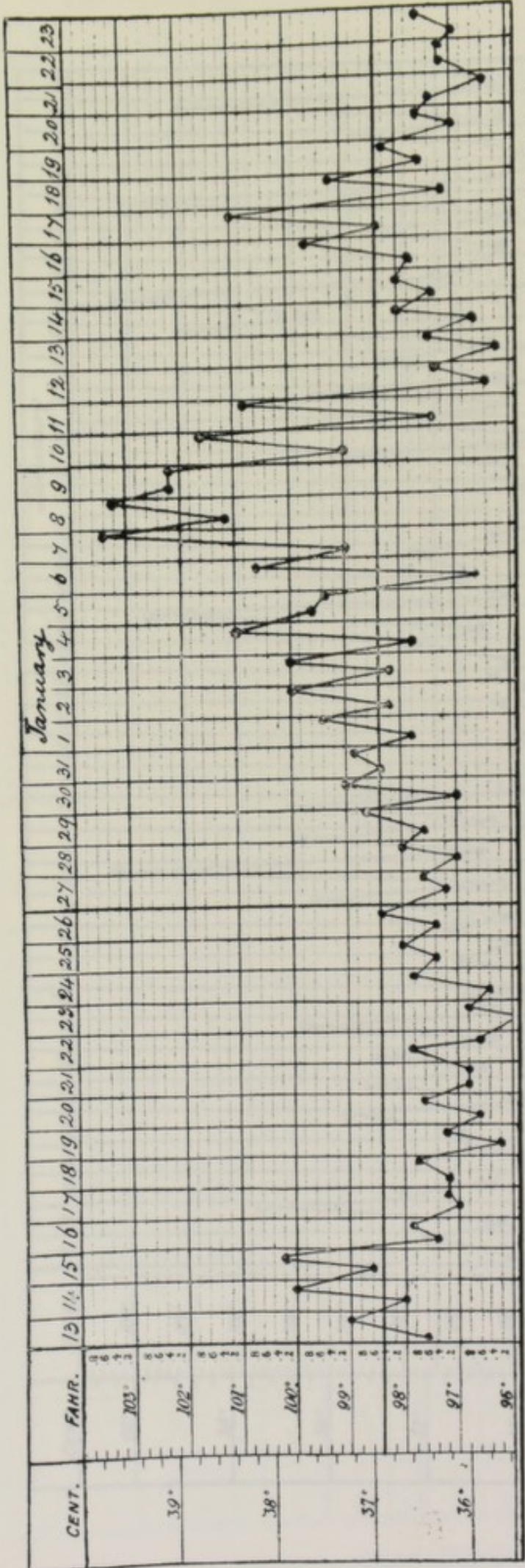
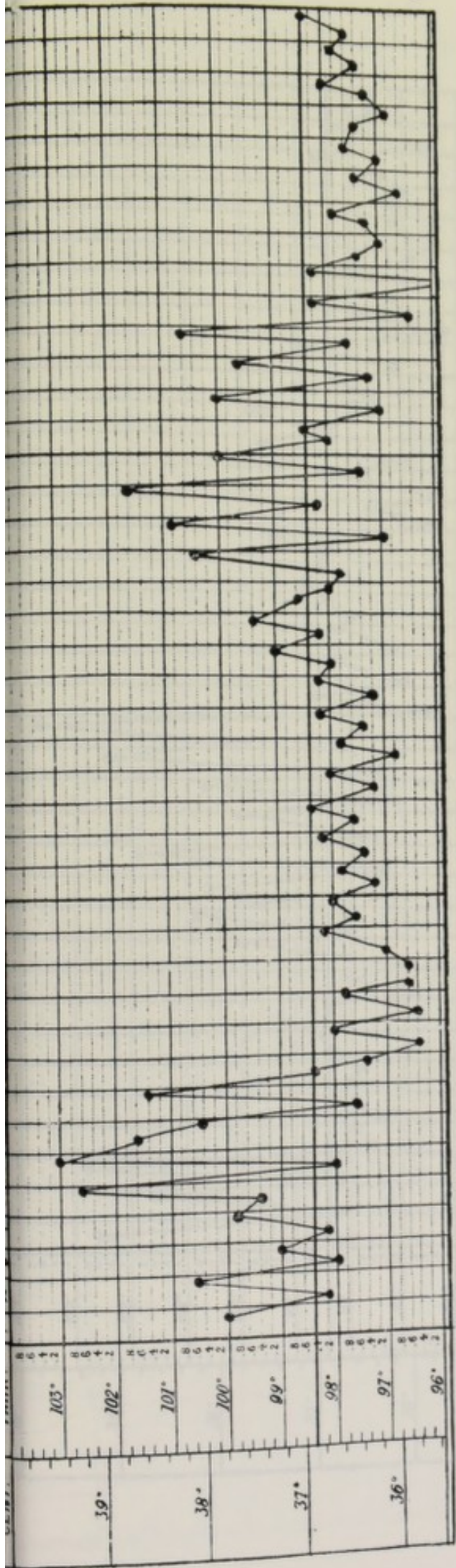
Disease, Malarial Cachexia.

Chart III.



e. Baghan.

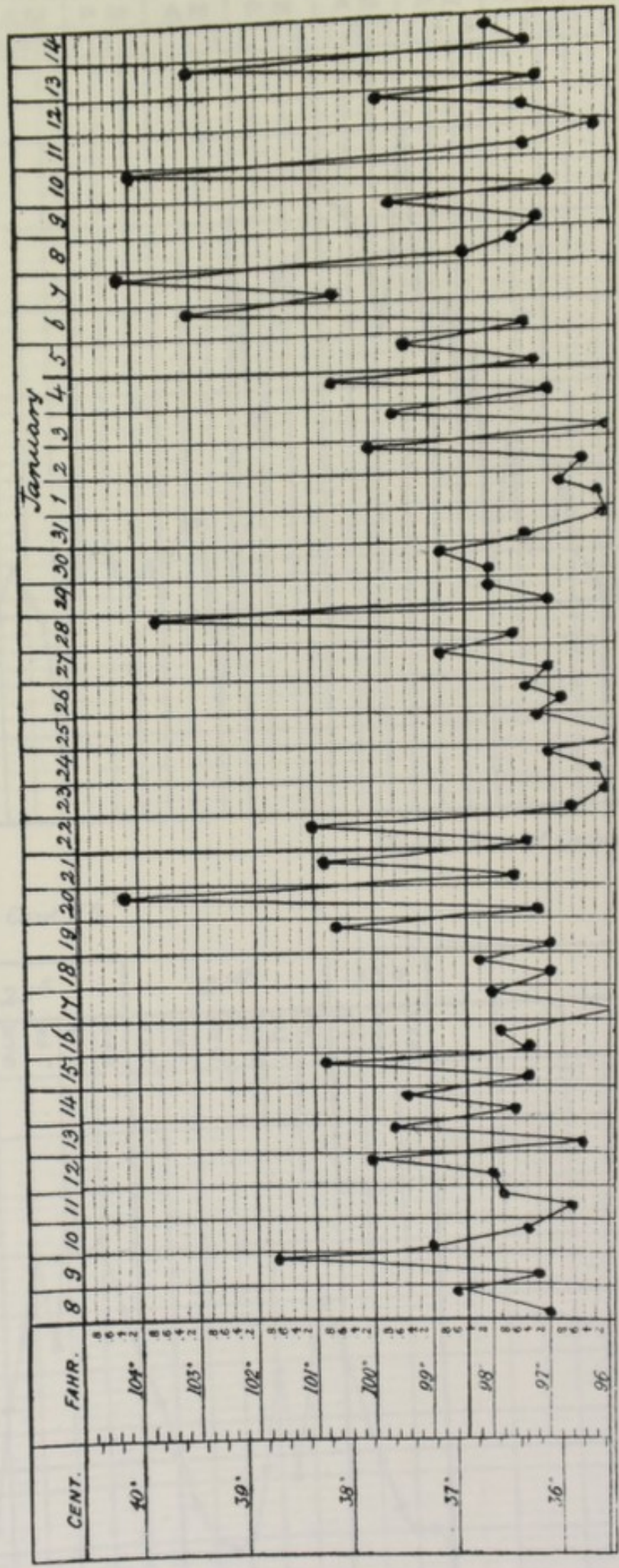
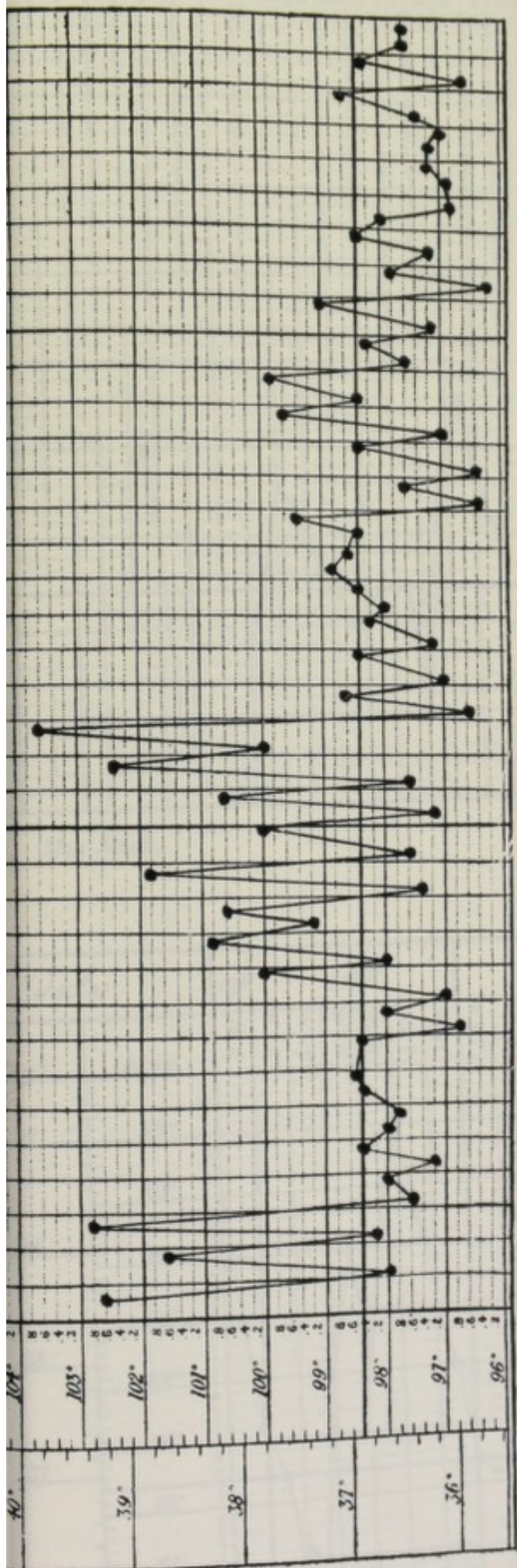
Disease, Malarial Cachexia.



Disease, Malarial Cachexia.

Age 10 Years.

Name, Baghan.

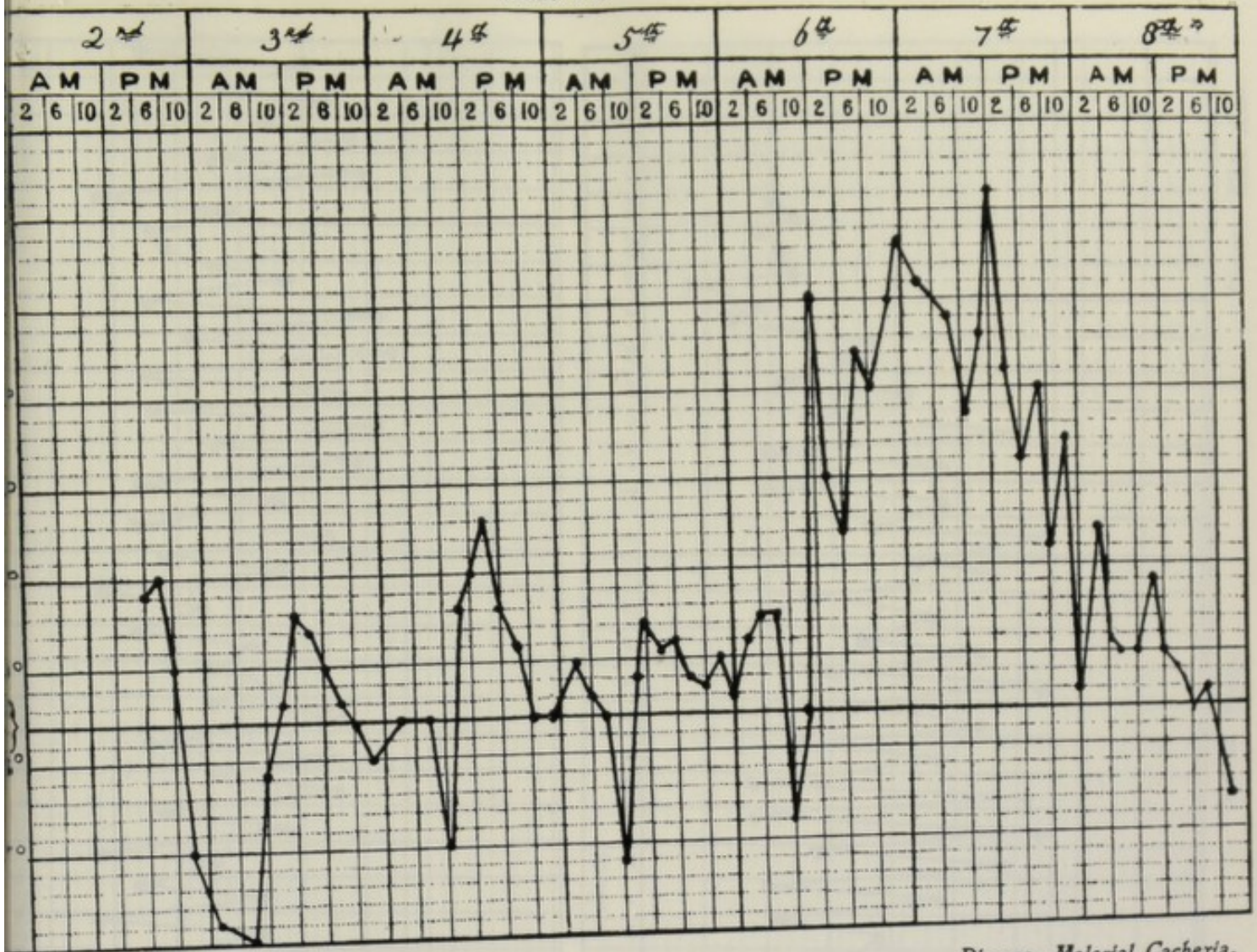


Name, Man Singh.

Age 12 Years.

Disease, Malarial Cachexia.

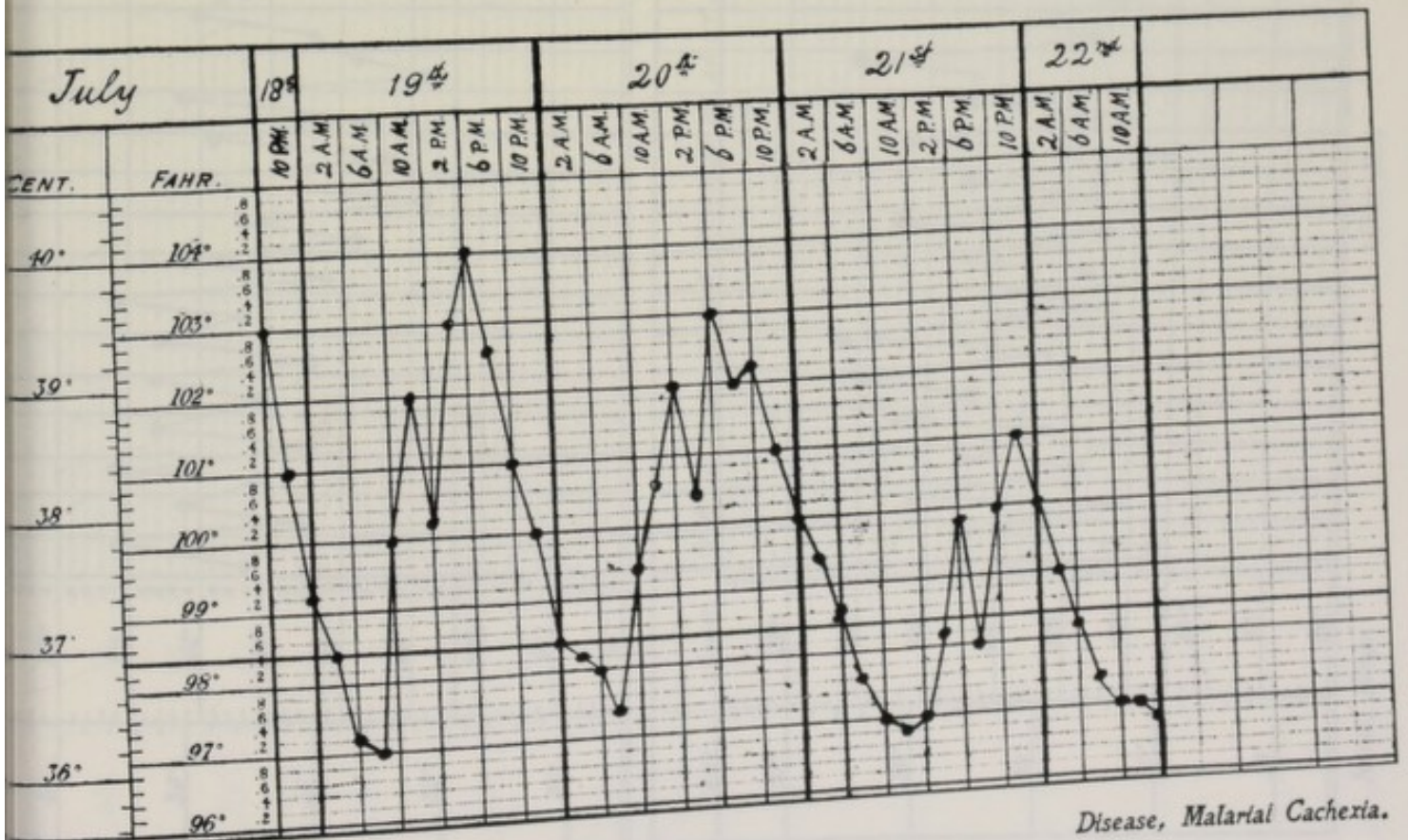
Chart VI.



Name, Man Singh.

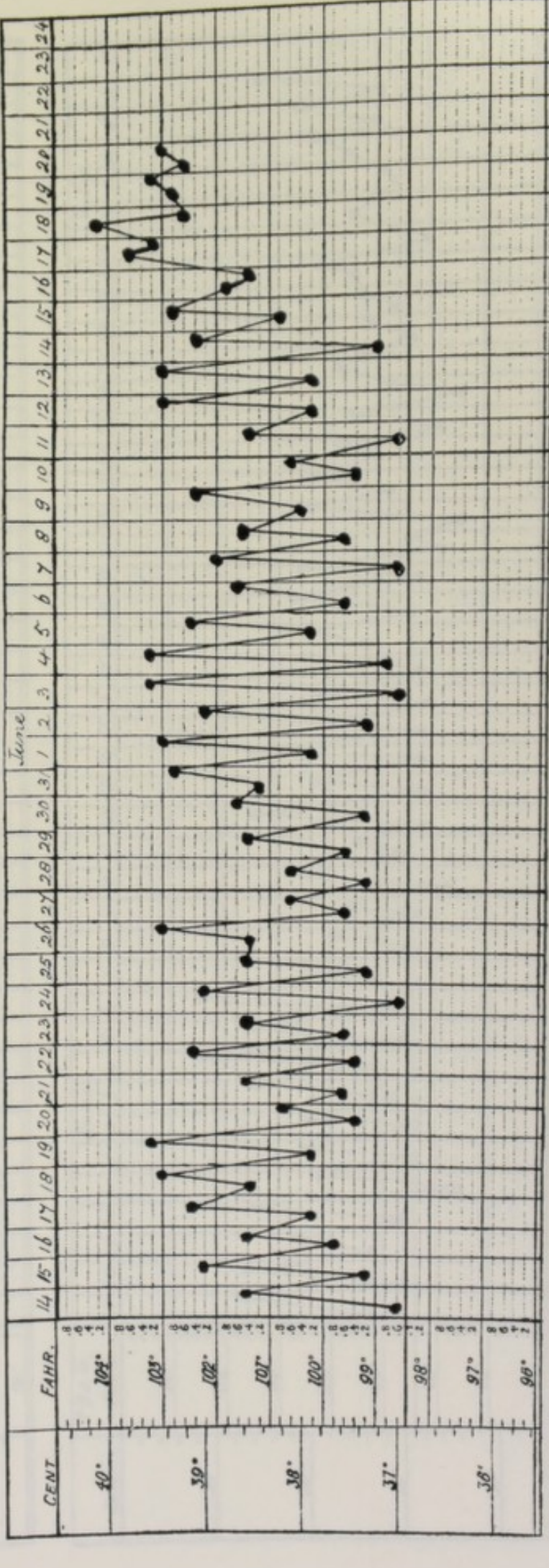
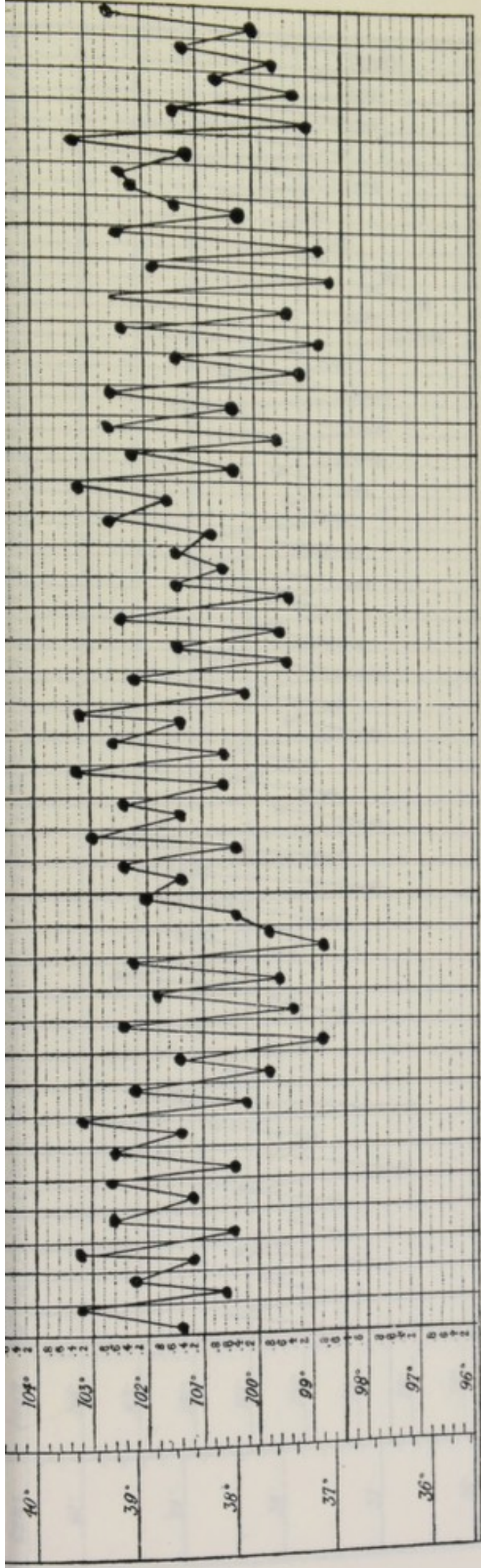
Disease, Malarial Cachexia.

Chart VII.



Name, Amir Khan.

Disease, Malarial Cachexia.

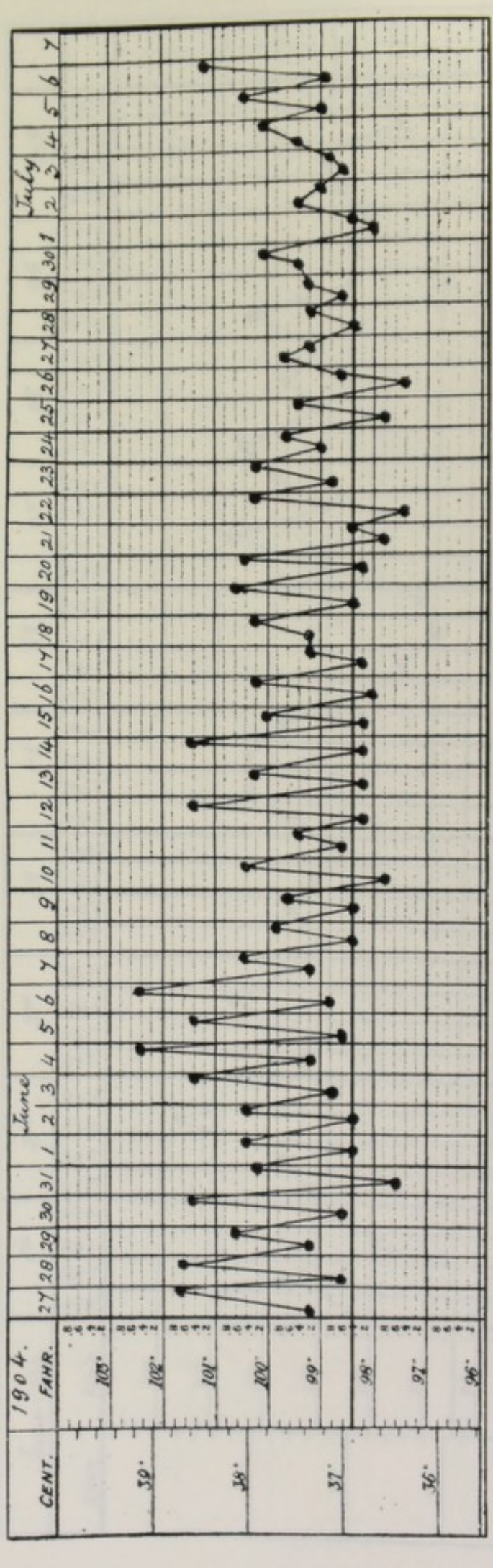
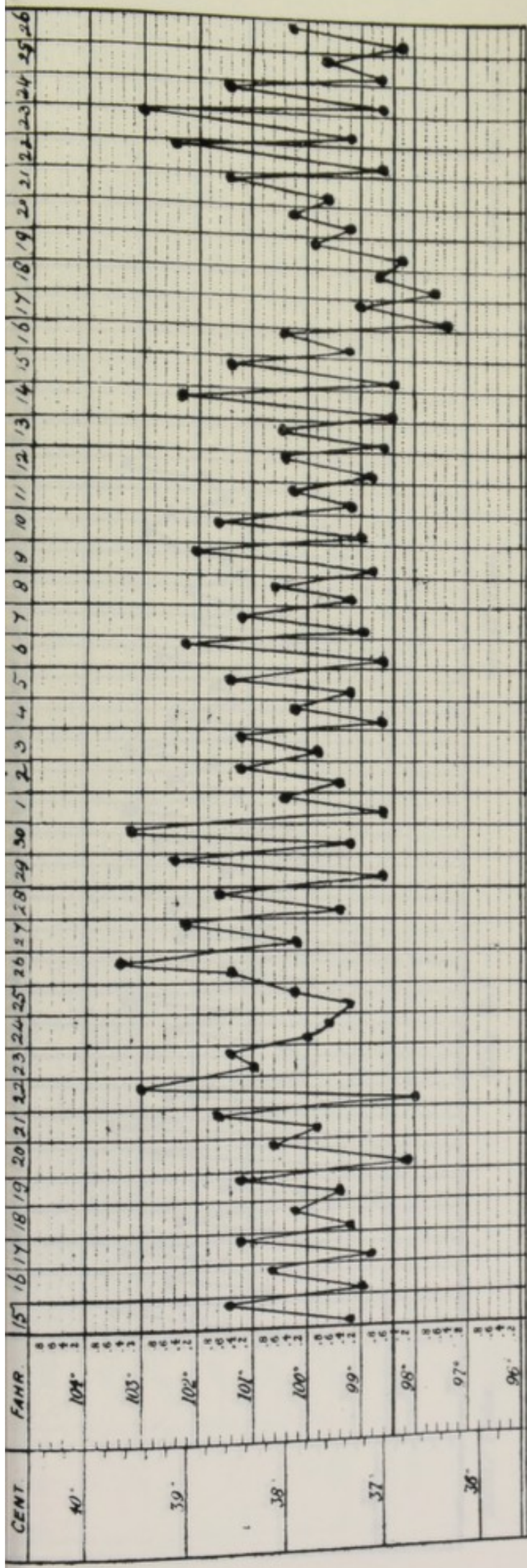


Name, Bongi.

(Case 35.)

Age 20 Years.

Disease, Kala Agar.



Name, Sindhoo. (Case 31.) Age 30 Years. Disease, Kala Asar.

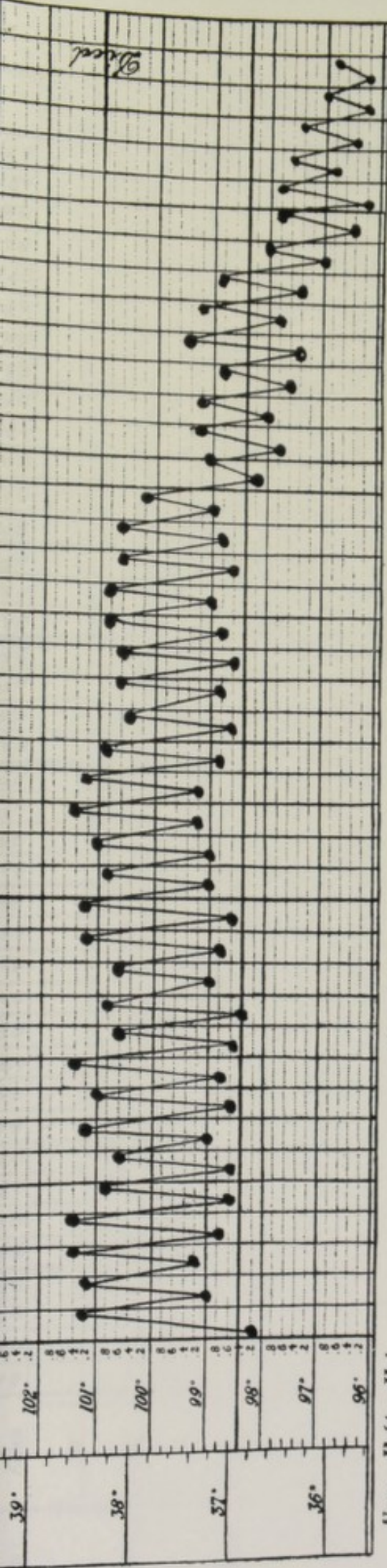
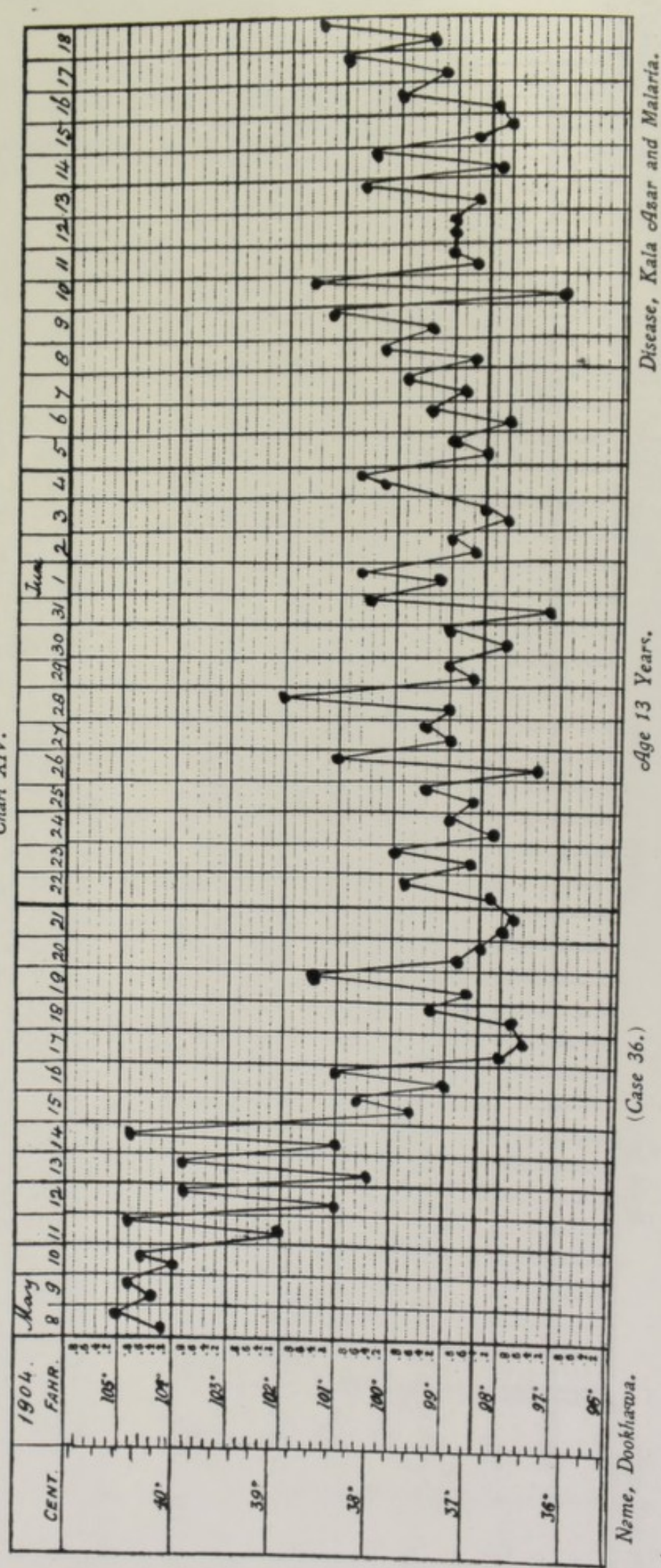
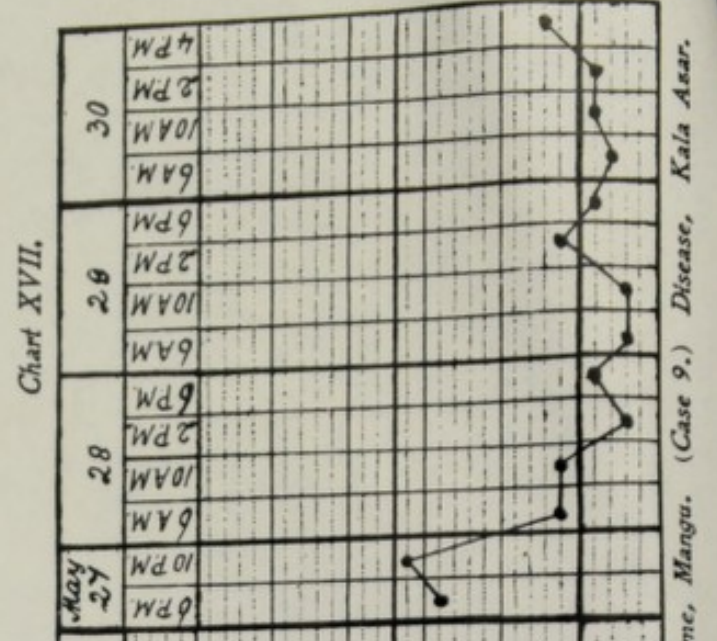
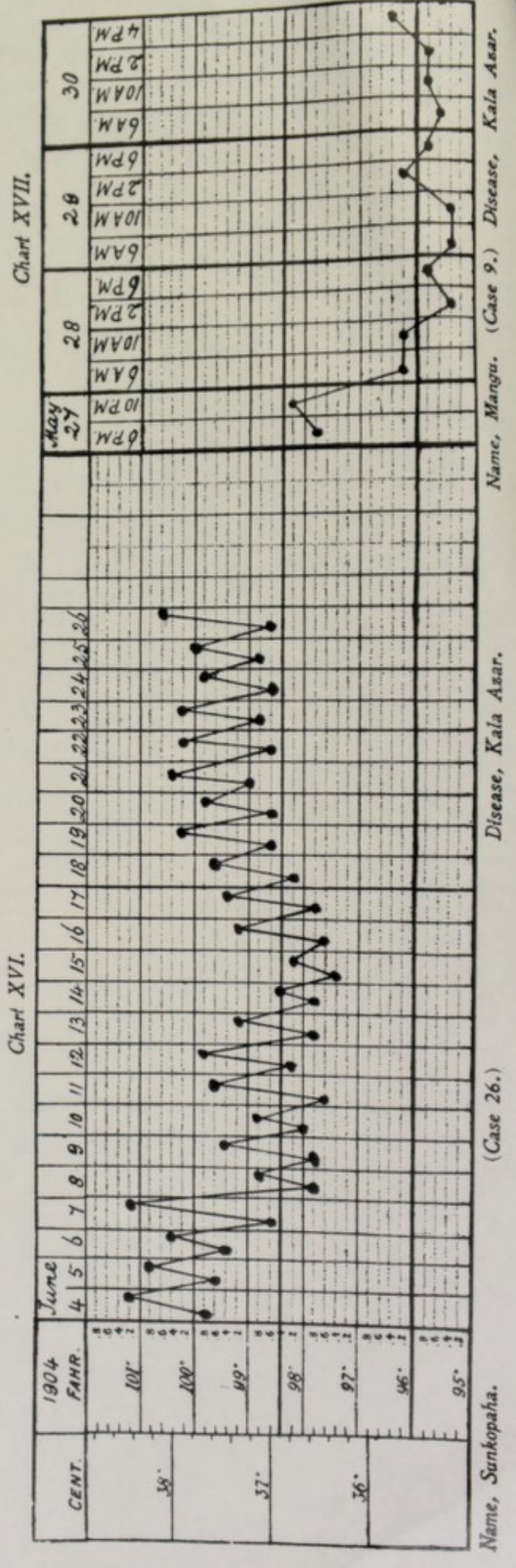
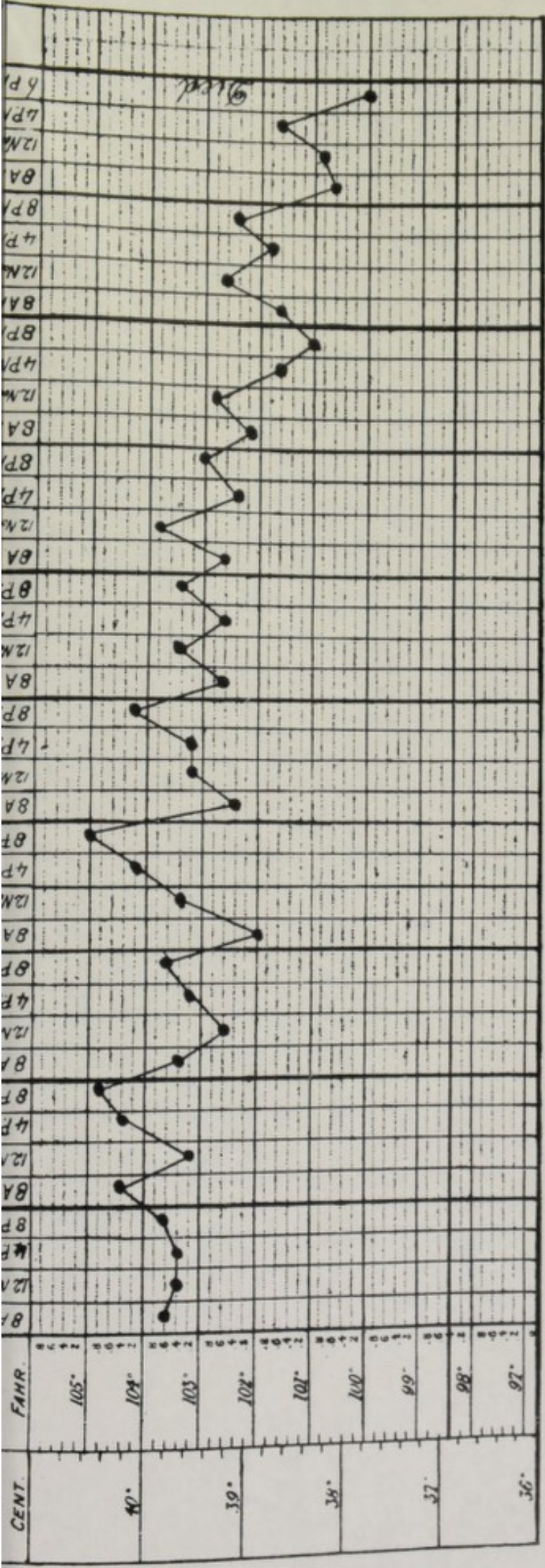
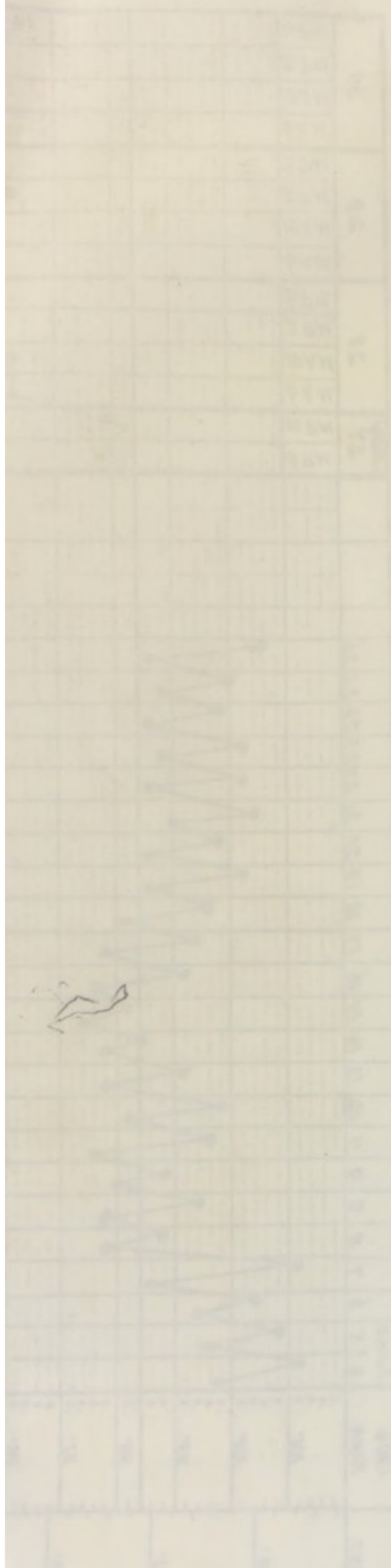


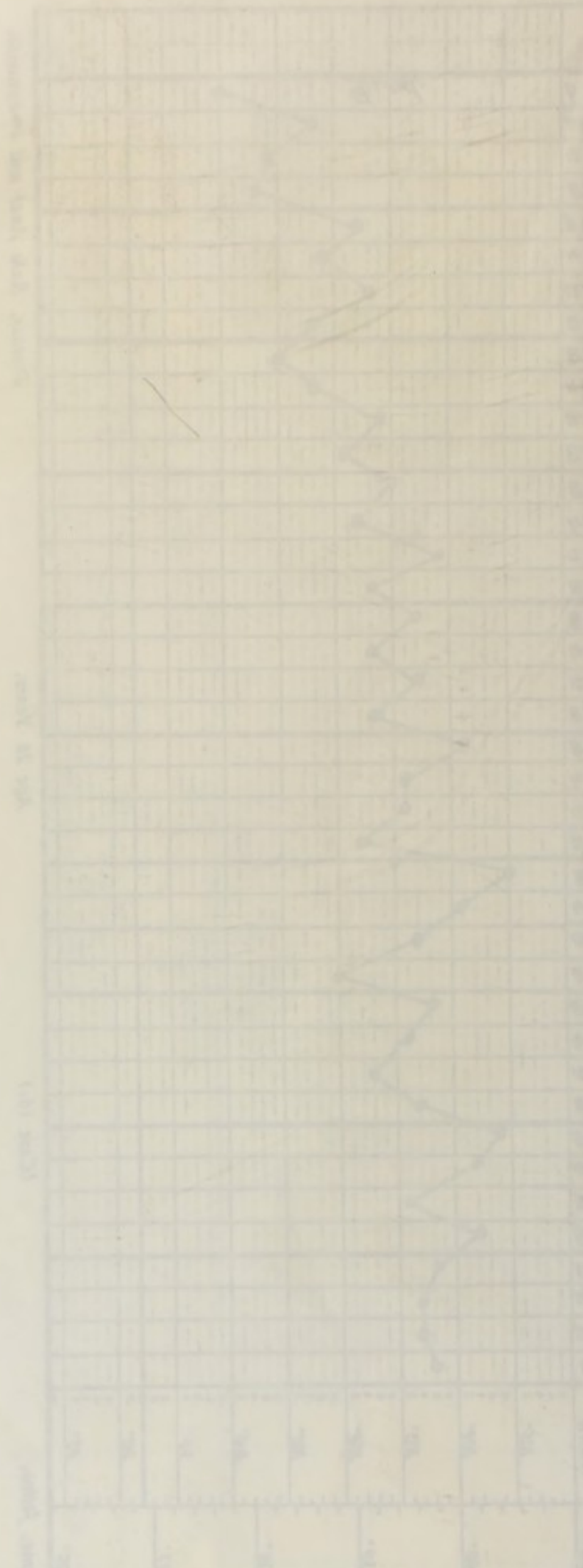
Chart XIV.







Graph 1



Graph 2