

Nov. 1915

(16 Sept.)

**THESIS**

ON

**“CERTAIN PYREXIAS OF UNCERTAIN ORIGIN”**

BY

**A. CAMPBELL MUNRO, M.B., Ch.B. (Hons.), GLASGOW,**

**INDIAN MEDICAL SERVICE.**

ProQuest Number:27626782

All rights reserved

INFORMATION TO ALL USERS

The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.



ProQuest 27626782

Published by ProQuest LLC (2019). Copyright of the Dissertation is held by the Author.

All rights reserved.

This work is protected against unauthorized copying under Title 17, United States Code  
Microform Edition © ProQuest LLC.

ProQuest LLC.  
789 East Eisenhower Parkway  
P.O. Box 1346  
Ann Arbor, MI 48106 – 1346

## PART I.

### AN EPIDEMIC OF 'CALCUTTA FEVER' IN AN INDIAN (NATIVE) REGIMENT.

THE epidemic of 'Calcutta Fever'—'Seven-Day Fever' of Rogers—which I am about to describe, is of interest in two respects. In the first place, it is the first recorded instance of the appearance of 'Seven-Day Fever,' recognised as such, in anything like epidemic form among natives of India; in the second place, owing to its departing in certain respects from the classical description of the disease by Rogers,(1) I believe that it throws new light on the inter-relationship of the Short Tropical Fevers. To this latter aspect I shall refer in Part II of my thesis.

**The subjects of the Disease.**—It is necessary first to consider some points in connection with the men among whom the epidemic occurred—the sepoys of the 27th Punjabis. In the Indian army there is not the same difficulty in getting recruits as is experienced at Home. Plenty of the best soldiering class volunteer, and we are able to insist on the recruit being of thoroughly good physique to start with, and not merely free from organic disease and physical deformity. The drill and gymnastics in the recruit's course (which lasts from six to twelve months) opportunely assists the lad's development, and, in conjunction with improved feeding, invariably results in a progressive increase in weight. The trained men are kept in good condition by regular exercise. Their pay is sufficient for them to indulge in a liberal diet. The Hindus of this class drink very little alcohol and the Mohamedans none at all. They are tolerably well housed and are not overcrowded. Medical treatment is provided conveniently for them in the regimental hospital. The majority of the men are between the ages of 18 and 28.

Moreover, all the men of any one regiment are, as nearly as possible, living under the same conditions of environment, thus making them good subjects for the investigation of an epidemic disease, since so many factors—such as age, sex, diet, physique, and climate—are practically constant.

The 27th Punjabis is a 'mixed-class' regiment, composed as follows :—

2	Companies Pathans	...	...	} Mohamedans.
2	„ Punjabi Mussulmans	...	...	
3	„ Sikhs	...	...	} Hindus.
1	Company Dogras	...	...	

These are all good fighting classes, and, in point of physique, I believe that the men compare very favourably with those of other units of the Indian army. For many years the regiment had been stationed in the Punjab, in such stations as Dera Ismail Khan and Multan, where the climate is practically that to which the men had been accustomed from childhood. There is a long 'cold-weather' followed by a 'hot-weather' of intense dry heat; the rainy season is short. In Multan, where the regiment was stationed throughout the years 1908 and 1909, there is an annual rainfall of only a few inches.

As the previous incidence of fevers in the regiment is of interest with reference to the possibility of acquired immunity, I went through the records for the last five years. In Table I,

I have shown the number of cases of "malaria" that occurred in this quinquennial period together with those for 1910 when Calcutta fever was present—

TABLE I.

	1910.	1909.	1908.	1907.	1906.	1905.
June ...	"19"	2	8	5	2	1
July ..	7	1	6	5	2	4
August ...	2	5	35	2	3	2
September ...	4	7	62	10	2	1
October ..	9	14	78	9	3	11
November ...	...	16	101	5	7	9

As I shall presently explain, there is some doubt regarding the figure "19" for June 1910.

If the exceptional year 1908 be left out of account, it is seen that the 1910 *Malaria* figures were about the average for the regiment and were not affected by its change of station. The most important point, from my point of view, is that in these five years only *eight* cases of non-malarial pyrexia of uncertain origin were reported, and that there were *no* cases of dengue.

In 1908, when the malaria figures were so high, one-half of the regiment was stationed at Dera Ismail Khan and the other half at Multan. Both wings suffered severely. The fact, that of 345 cases that occurred in the whole year only two were noted as being of doubtful nature, shows clearly that the epidemic must have been true Malaria, and not Three-Day Fever, especially as malaria is known to have been exceptionally severe all over India in 1908.

**Locality.**—The regiment came to Alipore, a suburb of Calcutta, in the end of February 1910. The climatic conditions here were strikingly different from those to which the sepoy had been accustomed up-country. In Calcutta, the rainy season lasts for several months, the surface water collecting in deep tanks or ponds which never completely dry up. The temperature does not reach extremes of heat and cold, but a damp, steamy heat prevails for the greater part of the year. The ill effect of the change of climate upon the sepoy early manifested itself by a prevalence of diseases of the respiratory system; nasal catarrh and bronchitis became very common, and there was a certain number of cases of pneumonia and pleurisy, and of general debility to which no particular cause could be ascribed. The high price of provisions, particularly of milk, in Calcutta, probably furnished a second factor in lowering the resistance of the men, as it made them disinclined to purchase a full, wholesome diet.

Alipore Cantonment has for many years had a rather dubious medical history. Most regiments have suffered severely from "malaria" during their stay there, and on one occasion it is recorded that over 200 men (25 per cent. of the strength) of a regiment were under treatment for this disease at the same time. In view of the facts (1) that the *permanent* inhabitants do not find the district unhealthy, and (2) that the administration of Quinine prophylactically did not control the disease among the imported sepoy, it seems probable that a certain number of the cases which were dubbed 'Malaria' were really 'Calcutta Fever.'

The Cantonment is situated near the Kidderpore Docks, separated from them by half a mile of native bazaars. This is a point worth noting in view of the general experience in Calcutta that epidemics of Seven-Day Fever always start amongst, and spread inland from, the shipping population.

**Calcutta Seven-Day Fever.**—This endemic fever was first identified and described by Leonard Rogers in 1905 (1a). Briefly, it is prevalent from June to September and disappears for the rest of the year. It attacks newcomers especially. Its onset is usually sudden; the disease is characterised by fever, flushing of the face, frontal headache, pains in the back and limbs, and a comparatively slow pulse. The fever is described as lasting for six or seven days, and the temperature curve is very characteristic; it rises quickly to its maximum, then slowly falls and remains at a lower level until the "terminal rise" on the 5th or 6th day. A mottled rash appears towards the end of the fever in a minority of cases. Convalescence is rapid (2b).

**Epidemiology.**—The epidemic which I am describing started at the beginning of June, reached its height in July and August, and tailed off in September. No cases appeared after the 27th of September. Table II shows the prevalence of the disease by months:—

TABLE II.

1910.	June.	July.	August.	September.
Number of cases.	8	57	39	13

I joined the regiment in the beginning of July, and saw the Charts of only one or two of the June cases. The eight cases I have quoted in Table II were entered in the hospital records as "Pyrexia of Uncertain Origin." In the same month, 19 cases were entered as "Malaria" (see Table I), but they were reported to be quite atypical. I therefore consider that my estimate of eight cases of Seven-Day Fever is below the mark.

My observations are entirely confined to the cases that occurred in July, August and September—109 in all. As I was not present at the commencement of the epidemic, I can make no remarks on the sequence or characteristics of the early cases.

In my opinion, the most important feature in this series of cases is the variety in type they presented. The chief variations had to do with the duration of the fever. In rather over half the cases (52 per cent.), the illness lasted for about a week as in typical "Seven-Day Fever" described by Rogers. In the remainder, which I call the "short type," the duration was from 24 hours to three days. A certain number of cases of this class I have not included in my series, as they were only "detained" at hospital for a day or two and no reliable records were kept. There was rarely any doubt as to the exact duration of the fever, and these short forms were not terminal cases of Seven-Day Fever which Rogers mentions in his descriptions. The sepoy always gave a definite

TABLE III.

Day of Month.	JULY.		AUGUST.		SEPTEMBER.	
	Long Type.	Short Type.	Long Type.	Short Type.	Long Type.	Short Type.
1	2	...	2	...	...	1
2	2	...	...	...	...	...
3	1	...	...	...	...	1
4	...	...	...	...	...	...
5	2	1	...	1	...	1
6	1	...	...	...	...	...
7	...	...	...	...	...	1
8	1	...	2	1	...	...
9	...	...	...	...	2	...
10	...	...	...	...	1	...
11	...	...	2	1	...	...
12	1	4	...	1	...	...
13	...	...	2	...	...	...
14	...	...	2	1	1	1
15	...	...	...	...	...	...
16	...	...	1	2	...	...
17	...	...	...	...	...	1
18	2	...	...	...	...	...
19	1	1	...	1	...	...
20	2	3	...	1	...	...
21	4	4	...	1	...	...
22	1	1	2	2	...	...
23	2	5	...	1	...	1
24	...	...	...	2	...	...
25	1	...	...	1	...	...
26	...	1	1	3	...	...
27	1	1	...	...	...	2
28	3	...	2	...	...	...
29	1	2	2	...	...	...
30	3	1	1	...	...	...
31	2	...	1	...	...	...
TOTAL	33	24	20	19	4	9

history of the disease starting suddenly at such and such a time ; he almost invariably reported sick within the first 24 hours of the attack, as he would otherwise have had to have done full duty.

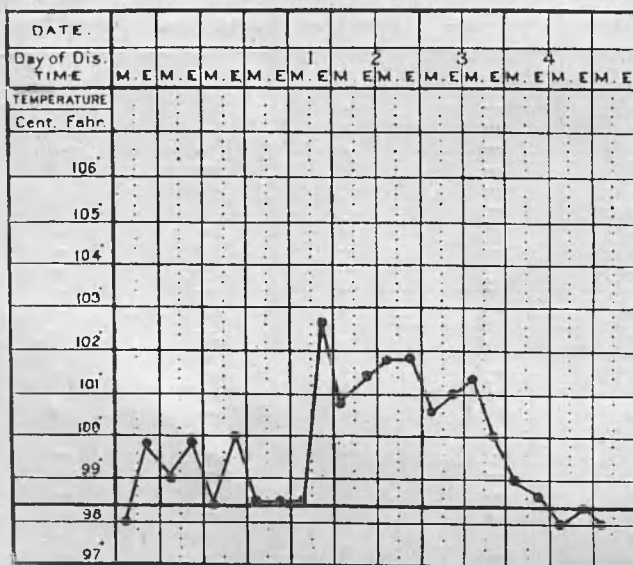
Table III shows the order in which cases occurred. In July, when the epidemic was at its height, severe, long cases predominated. In August, long and short cases occurred with equal frequency ; while in September, when the disease was disappearing, only four cases of the long form occurred (all in the first half of the month) against nine of the mild form. As I hope to show in Part II, these shorter types correspond to fevers already well known in many parts of the tropical and sub-tropical world ; their occurrence together with the Seven-Day form in this and in at least one other instance (reported by Col. Fooks, I.M.S.) (2), is strong evidence in favour of the assumption that these two short fevers are merely types of one and the same disease ; this view receives support when the facts known concerning their symptomatology, epidemiology and etiology are reviewed and compared.

### SYMPTOMATOLOGY.

*Onset.*—This was almost always sudden. The usual sequence of events was for the man to do his work all day feeling quite well ; in the evening or during the night, he began to feel cold and unwell, and a headache developed which was usually referred to the frontal or post-orbital region. As the temperature rose, the feeling of coldness passed off and the skin began to feel hot and dry ; at this period, his face, neck and the upper part of his chest were brightly flushed. The headache became more severe and pain also started in the lumbar region of the back. In this condition he presented himself at hospital at 7 o'clock next morning. In 71 per cent. of the cases there was shivering or a mild rigor at the start, but not the severe rigor of a malarial paroxysm. The rigor did not vary in intensity with the degree of fever. In six cases where the temperature rose rapidly to 103·8° or 104° there was not even a feeling of coldness.

Occasionally, there were prodromal symptoms—malaise, headache, slight fever, etc.—before the commencement of the attack. In the case of Sepoy U. (Chart 1), there was malaise and slight fever without any rigor for several days before the onset of a typical “Three-Day” attack. The man came to hospital on the 13th September feeling unwell, and was under observation up to the 17th when his temperature rose suddenly to 102·6°.

CHART 1.



*The General Appearance* of the patient during the first few days was very typical of the disease. He usually lay on one side, somewhat huddled up. His face and neck were covered with a bright red flush that showed up well even through the dark skin—the so-called “initial rash.” The face had a markedly puffy appearance, particularly under the eyes. The conjunctivæ were moist and glistening, and sometimes became considerably injected. Partly owing to the puffiness of the face, the patient’s expression was heavy and stupid. He preferred to lie perfectly still and resented being disturbed in any way. He was very irritable to noises or to a bright light. During the course of the fever, the man was

often quite prostrated and could hardly raise himself in bed.

*Temperature.*—The temperature is the most characteristic feature of the disease, and must be discussed at some length.

I. *The Long Form.* [57 Cases.] Charts 2, 3 & 4 are typical of well marked cases. Sepoy M. D. (Chart 2), was in hospital, convalescent from a mild attack of dysentery, when the fever began, so that his chart is complete from the start.

CHART 2.

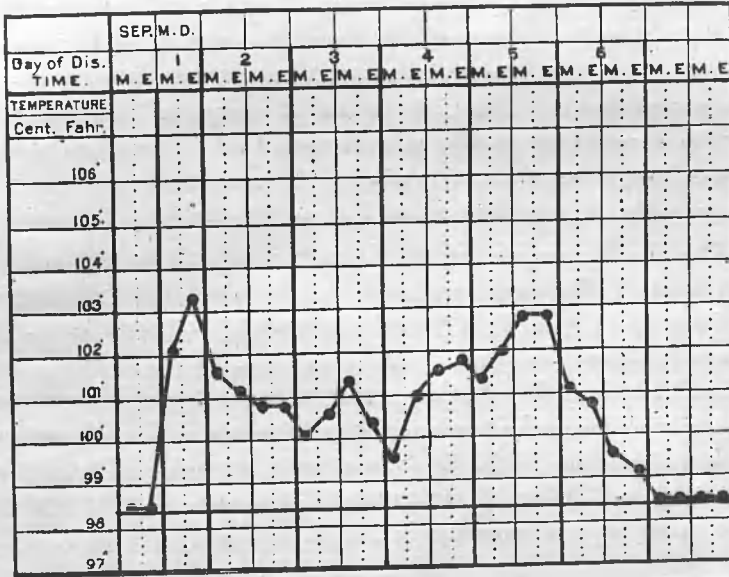


CHART 3.

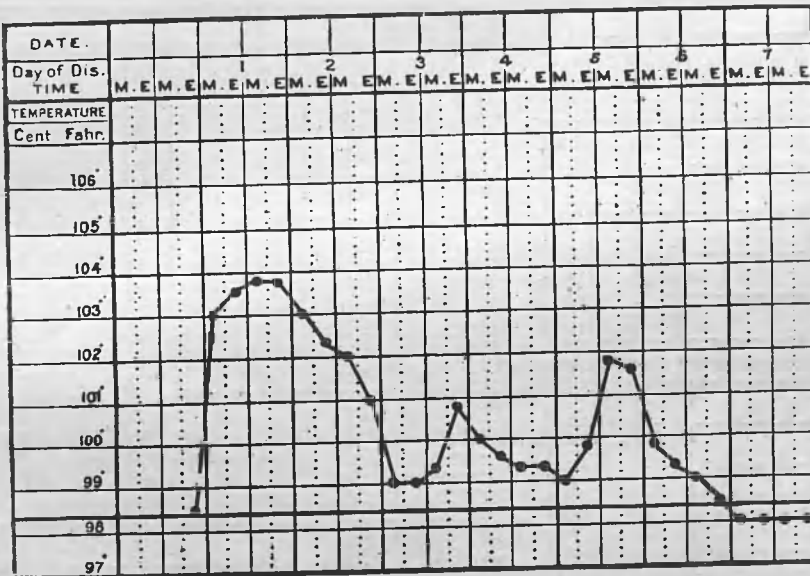
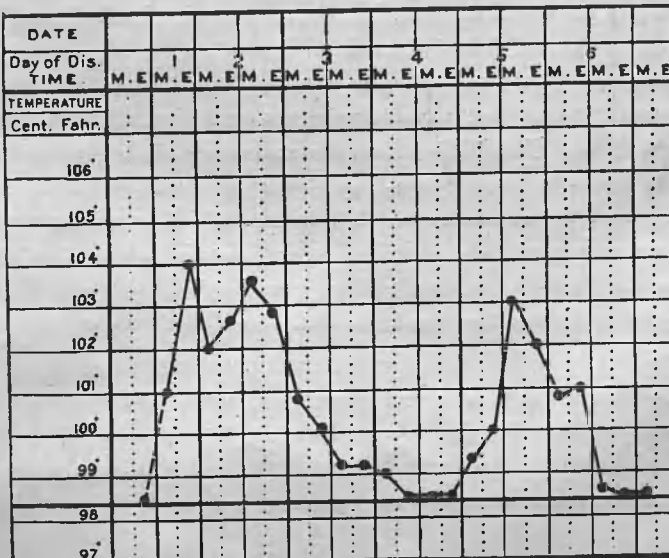


CHART 4.





In the majority of the Seven-Day cases the temperature rose early to its maximum, then fell more or less gradually and maintained a lower level till the 4th, 5th or 6th day, when it again rose, but not to the height previously reached. It then fell to normal, and convalescence was soon established. This agrees with Rogers' description of Calcutta Seven-Day Fever among Europeans, in which he distinguishes the 'initial rise,' the period of 'remission' and the 'terminal rise,' the three stages giving the temperature chart its characteristic 'saddle-back' appearance.

Among my cases the average duration of these three phases was most variable, as is seen at once when one compares the different charts that I have reproduced.

*Initial Rise.*—The rise of temperature was usually rapid, and the maximum, which averaged  $103.2^{\circ}$ , was quickly reached. In exceptional cases, the rise was slower and occupied from 24 to 36 hours, sometimes interrupted by a slight remission or even by an intermission. The temperature began to fall within a few hours of attaining its maximum, dropping from one to two degrees Fahrenheit in the first 12 hours. In a few cases, the maximum temperature was maintained for 12 or 24 hours, thus approximating to the 'continued type' to which I shall presently refer. The duration of the descent from the initial fever was most variable. Thus, in Case 5 (Chart 5) it was 12 hours, while in Case 6 (Chart 6) it was nearly 60 hours. Among my cases, the average duration of this first paroxysm was two and a half days.

CHART 5.

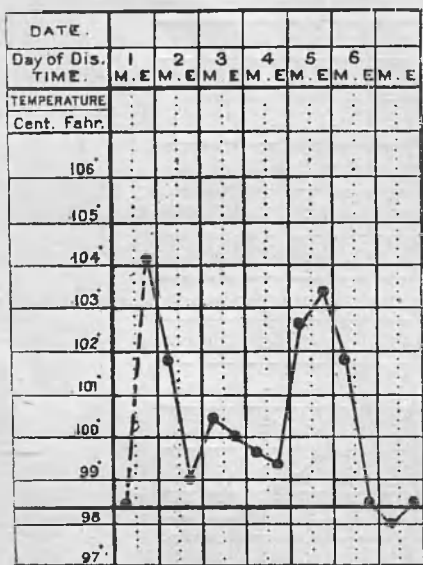
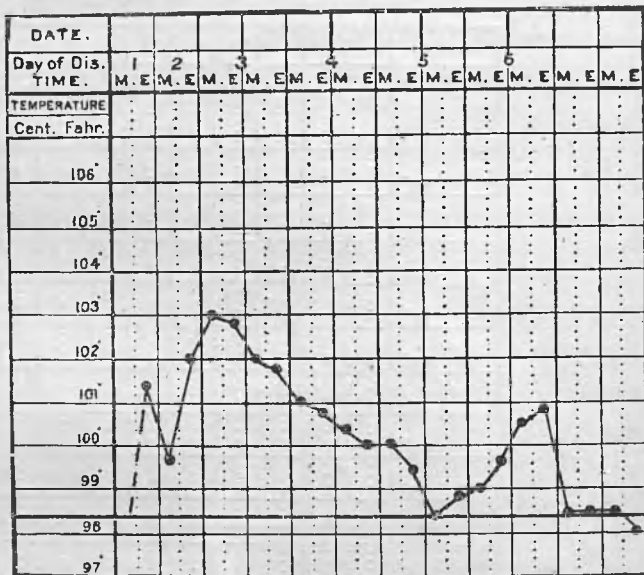


CHART 6.



*Remission.*—The period of remission extended from the completion of the descent of the initial fever to the beginning of the terminal rise; its average duration in the 52 cases in which it was well marked was 28 hours, and varied from two or three hours up to  $2\frac{1}{2}$  days. During the remission there might, of course, be a slight rise, such as is seen on Chart 2. In 23 of the 51 cases (*i.e.*, nearly 50 per cent.), the temperature touched normal during the remission, while in others it never fell below  $101^{\circ}$  F. (cf. Charts 84 & 84). This differs from the experience of Rogers, and largely discounts one of the distinctions he draws between Seven-Day Fever and Dengue, for he says—"in five-sixths of my cases, .....the temperature never fell below  $99^{\circ}$  F. during the usual remission, while in fewer still did it actually reach the normal line, a point in which this seven-day fever differs most essentially from the three-day pyrexia ending by crisis of true epidemic dengue."

Often, during the remission the headache and other pains were less severe, but they never entirely disappeared.

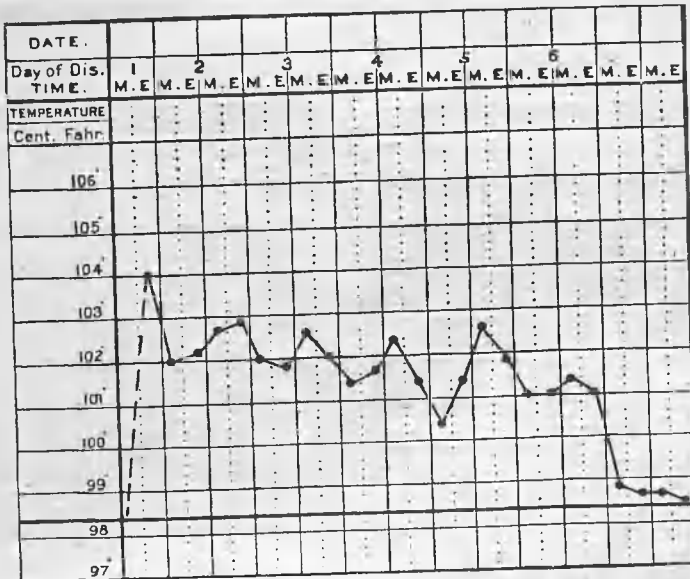
*Terminal Rise.*—This is really a second paroxysm, very similar to the first but usually less severe; in only five of my cases did the temperature at this period equal or exceed that of the initial fever. The height of the rise varied from  $1.5^{\circ}$  to  $3.5^{\circ}$  F. above the level of the previous remission. In one or two cases where the temperature had sunk to normal during the remission,



the recurring fever was very evanescent. It is possible that in a few such cases the secondary fever has been missed and the chart been included under heading II. The terminal rise was absent in only five of my Seven-Day cases.

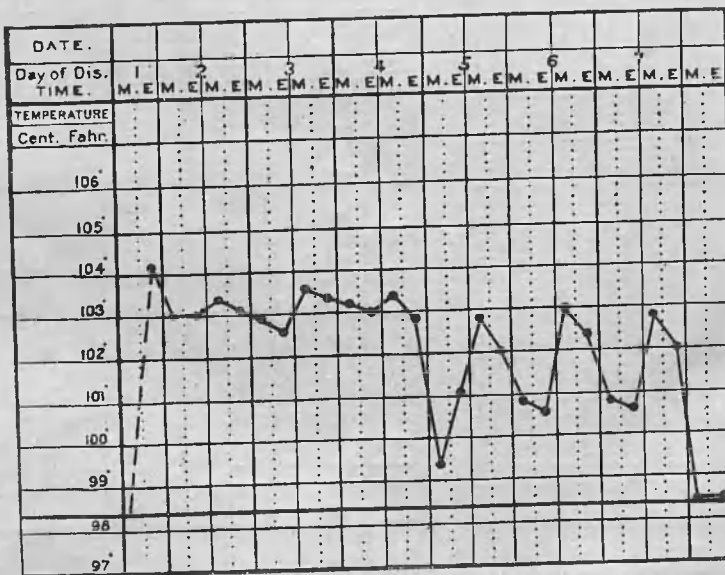
The five cases, to which I have just referred, belong to the "continued typhoid-like group" of Rogers. They differ from the majority of cases merely in that there is no definite remission and subsequent rise of temperature. Their clinical picture is identical with that of the common remittent type. Chart 7 is taken from one of these cases. I have reproduced also the chart (Chart 8) of another of these five cases, as it was exceptional. Clinically the case was typical

CHART 7.



of Seven-Day fever, but the chart showed three remissions on the 5th, 6th and 7th days of the fever. No reason for the remissions could be found, and no sweatings or rigors occurred with them. No quinine was administered, and the temperature fell abruptly seven days from the start.

CHART 8.



II. *The Short Form.* [52 Cases.]—In the majority of these cases, the fever lasted for a little over two days. As might be expected, the temperature was not so high as in the longer forms; the average maximum was  $102.4^{\circ}$  compared with  $103.2^{\circ}$  among the Seven-Day cases.

A sharp rise to the maximum and a slow fall was the usual course ; Charts 9 & 10 show typical cases. Variations were got, such as a remission during the rise or a slight exacerbation during the fall ; the latter phenomenon was the commoner and is illustrated in Chart 11. The temperature was nearly always taken and recorded for several days after the termination of the fever in order that no slight terminal rise about the 6th or 7th day might be missed.

A minority of these cases lasted only 18 or 24 hours, as is seen in the case of Charts 12 & 13.

I may say that in both these cases the blood was examined for malaria parasites with a negative result ; in both, quinine was altogether withheld, and no periodic fever occurred. The patients both had the characteristic frontal headache and muscular pain in the lumbar region of the back. In these very short cases, all the symptoms were comparatively mild.

CHART 9.

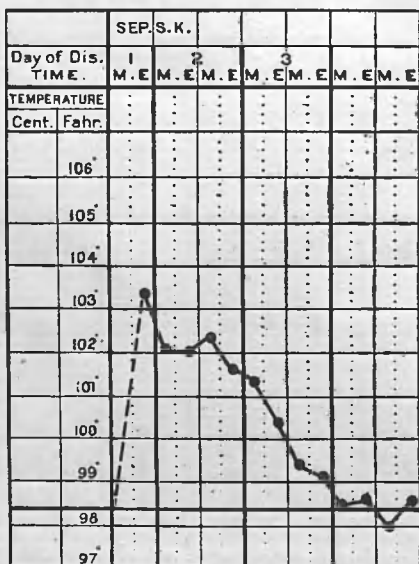


CHART 10.

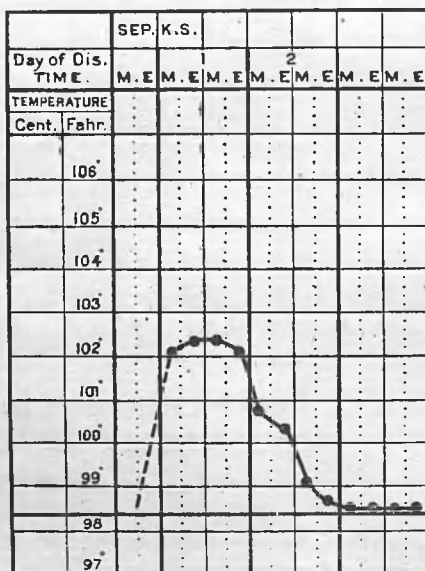


CHART 11.

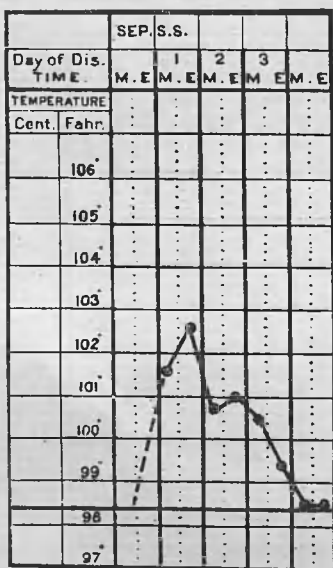


CHART 12.

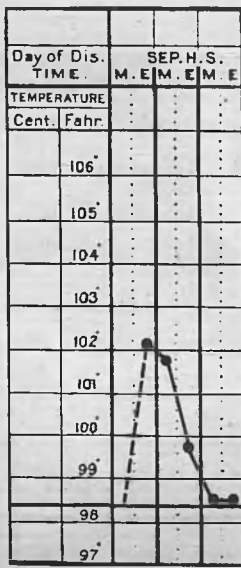
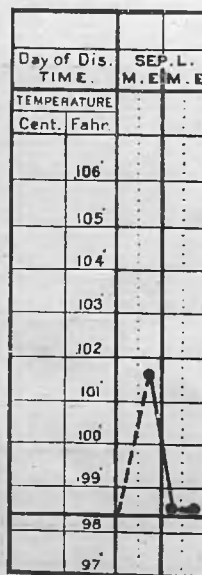


CHART 13.



*Headache.*—This was practically constant and was usually very severe. It persisted to the end of the fever, but, as stated above, in the cases that showed a marked remission of temperature, the headache was less severe during this period. Its location was almost always frontal or post-orbital. In some cases, pressure applied over the supra-orbital notch and also over the temporal



Individual cases showed remarkable disparity between the pulse and temperature tracings. Thus, in the primary fever, pulse-rates of 96 and 100 accompanied a temperature of 103·8. In the terminal rise, a pulse-rate of 80 accompanied a temperature of 103·6. In many cases, the pulse-rate remained below 60 for two or three days after the temperature reached normal, and was sometimes as low as 48. Among single paroxysm cases, the same phenomenon was noted. In a three-day case, the pulse was found to number only 70 when the temperature was 102·8. In a one-day case, a pulse-rate of 78 was noted with a temperature of 103·4!

*Blood Changes.*—I had very scanty opportunities of carrying out blood examinations on my cases, and Capt. W. Bennett, R.A.M.C., did these for me. Before the nature of the epidemic became evident, the malaria parasite was searched for in almost all the cases; blood films from between 30 and 40 cases were examined with negative results. Thereafter it was found to be quite easy to diagnose the cases from their general appearance even on the first day of the fever. Capt. Bennett found that the leucocytes were invariably diminished while there was a relative increase of the hyaline leucocytes. In three cases where I did a leucocyte count during the first few days of the fever, the results were 4300, 5200 and 6000 respectively. I attach little importance to figures taken from so few cases, but, as far as they go, they agree with those given in other descriptions of the disease. Pigmented leucocytes were not found in the films.

There was no marked anæmia following the fever, except where some complication, such as a long bout of bronchitis, supervened.

*Digestive Tract.*—The tongue was usually flabby and broad and rapidly became coated with a white fur; the edges and tip were left clean and they remained red and raw-looking throughout. Often the fur darkened towards the end of the fever, and the tongue cleared shortly after convalescence was established. The degree of furring varied, and some tongues showed none but were bright red in colour. In a few cases, where other gastro-intestinal symptoms were lacking, the tongue presented a normal appearance throughout the illness.

Anorexia was invariably present. The sense of taste was more or less lost. Nausea and vomiting were noted as occurring in nine cases, and were confined to the first few hours of the attack. Thirst was not a marked feature. In 50% of my cases, the bowels were constipated; two cases had diarrhœa, and the rest were normal. This is quite different from Rogers' cases, among whom 25% had diarrhœa and 25% were constipated.

The liver was never found to be enlarged; two patients had slightly enlarged spleens, but their medical history sheets showed that they had both suffered from malaria within recent years, and the enlargement was taken to be of old standing.

*Respiratory System.*—Catarrhal inflammation of the respiratory tract was not a feature of the outbreak. There were only three cases of sorethroat and one of nasal catarrh in all my series. In the former, there was general congestion of the pharynx and soft palate with slight enlargement of the tonsils; in one of these three cases, the submaxillary lymphatic glands were enlarged and tender.

Bronchitis occurred in 17 cases, usually appearing on the first or second day of the fever and lasting on for some days after the temperature fell to normal. Since they came to Calcutta, our men had been very subject to attacks of bronchitis, and I regarded it in these 17 cases as a complication favoured by their temporarily lowered resistance, rather than as a symptom of the disease.

There were no cases of epistaxis either early or late.

*Nervous System.*—The headache has already been described. The more severe cases suffered from insomnia, and lay groaning all through the night during the height of the fever. No case of delirium was noted, even with temperatures of 104°. The patients were dull and stuporose during the attack and their facial expression bespoke complete lassitude of mind. There was sometimes great tenderness along the lines of the nerves in the limbs, as well as over the superficial branches of the 5th cranial nerve.

*Rashes.*—The early flushing of the skin of the upper part of the body constitutes the "Primary Rash" and was always seen. It was brightest during the first 48 hours, but was sometimes visible for four or five days altogether in the long form of the disease.

A secondary rash is mentioned by Rogers as occurring towards the end of the fever in 7% of his cases. I searched diligently for this terminal rash, but found it in only one of my 57 long cases. This is not to be wondered at, since many of the fainter secondary rashes that one sees among European patients in Calcutta would be quite invisible on the dark skin of the Asiatic.

In my single case, the rash developed about the sixth day and finally disappeared about three or four days after the fever had subsided. It was very distinct, mottled, and similar to the rash of measles; it was most marked on the chest, over the flanks of the abdomen and on the upper arms.

The skin was hot and dry during the fever, but sweatings occurred at the time of defervescence.

Convalescence was rapid and uninterrupted in most cases. The patient began to take his food well as soon as the fever left him, and, though he was rather weak for a day or two he was generally able to return to work within four or five days. In some cases, an attack of bronchitis prolonged the convalescence. Often a slight headache or aching pains in the body persisted for a day or two but there were no other sequelæ. The mortality was nil.

**Recurrences.**—No instance of definite recurrence during the epidemic was noted. One case I strongly suspect to have been a recurrence. The man had been admitted to hospital in June, a few weeks before I took over medical charge of the regiment. He was diagnosed as "Pyrexia of Uncertain Origin" and a note was kept of his having suffered from epistaxis during the fever; he remained in hospital for eight or nine days, but his temperature chart could not be found. On the 14th September he was readmitted with a typical attack of seven-day fever.

**Treatment** was on general lines. A purge was usually administered when the patient was admitted. Quinine was abandoned as useless and as merely aggravating the headache. Phenacetin had little or no effect on the severe headache. Counter-irritants were used for the pains and a simple diaphoretic mixture was given two or three times a day. For food, milk and broth were given as they were wanted; in the main, the patient's desire 'to be left alone' was found to be the best indication as regards treatment.

**Incidence.**—The average strength of the regiment in Alipore from 1st July to 30th September 1910 was 630. The number of cases during that period was 109, giving an incidence of 173 per mille. The large case-rate shows that the native of India who has not become immune through residence in an endemic area is just as susceptible to the disease as is the Europeans. For example, Rogers(1a) found that in two years 200 cases of the disease were treated in the Calcutta European Hospital, which, of course, draws from a population of very many times that represented by my one regiment. Yet I had 57 cases of the typical "Seven-Day Fever" in less than one complete fever season; I leave the shorter forms out of account, as these milder cases would be unlikely to seek admission to a general hospital, and as apparently none of them were entered under this heading in the Presidency Hospital returns.

This point is even better brought out by comparing the number of admissions for Calcutta Fever in the three regiments that formed the Calcutta garrison during the summer of 1910.

All three regiments had arrived in Calcutta in the preceding cold weather, and therefore went through their first "fever season" in the district together. The 27th Punjabis (Indian) and the 2nd Battalion Rifle Brigade (British) had come from Multan and Shahjahanpur respectively; in neither of these places is Seven-Day Fever known to occur. The 88th Carnatic Infantry (Indian) came from Madras, which is near the men's homes, and where the malady is endemic. The corresponding figures for the period 1st July to 30th September, 1910, are shown in Table IV.

TABLE IV.

Regiment.	Approximate Strength.	Number of cases of Calcutta Fever.	Rate per 1,000 of strength.
27th Punjabis ... ..	630	109	173
Rifle Brigade ... ..	800	79	99
88th C. I. ... ..	460	10	22





(a) *Contagion*.—This term must be held to comprise all infection that arises from close proximity to an infected person, his bedding, or his clothing. It includes infection conveyed to the skin or mucous surfaces by the secretions of the diseased, such as occurs in Diphtheria, Small-pox and Phthisis, as well as that which results from the bites of vermin that live about the person of the patient, like the flea in Plague and the bed-bug in Kala-Azar.

In epidemics of such diseases, there is a spread of the malady *by contact*; there is some history of the person attacked having been in close contact with an earlier victim, to whom several cases occurring in the same household or barrack-room can be traced. I found no sign of such a spread among our men. Each of the eight companies of the regiment was housed in three or four barrack-rooms, with from 20 to 25 men in each. Table VII shows the order in which the cases occurred in July.

TABLE VII.  
*Occurrence of Cases in July, 1910.*

Company.	DATE OF MONTH.																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
A	..	1	..	..	..	..	..	..	..	..	..	2	..	..	..	..	1	..	..	1	..	..	..	..	..	..	1	..	1	..	..
B	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	1	..	..	..	1	..	..	..	1	..	..
C	..	1	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	..	..	1	2	..	..	..	..	1	1	..	..	
D	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1	..	..	..	..	..	..	..	1	..
E	..	..	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..	1	..	..	..	..	..	..	1	..	..
F	..	..	1	..	..	1	..	..	..	..	..	1	..	..	..	..	..	..	..	2	..	3	..	1	..	..	..	..	..	..	1
G	..	..	..	..	1	..	..	..	..	..	1	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	1	..	..	..
H	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1	3	..	..	..	..	..	..	1	1	..	2	1

It will be seen that there were sometimes spaces of 7, 9 or 14 days between the occurrence of two cases in the same company. Anything like the continuous spread of the disease in a single barrack-room was unknown. Further, there was no case of the disease among over 40 persons who were at one time or another employed in hospital nursing the patients.

(b) *Ingestion with Food or Drink*.—If transmission occurred by the medium of food or drink, it must have been by some article common to all the classes of men of the regiment, since all classes suffered equally (*vide* Table V). These articles are rice, milk and water. The water is got from the Calcutta filtered supply. The two former were bought by the men from several shops in the regimental bazaar, and milk was also bought from shops in the town bazaar. The men formed little messes of six or eight who cooked their food in common and ate it together, and I found no instance of several men of one mess developing the disease at about the same time.

The strongest objection to this theory of transmission is the fact that Calcutta Fever is prevalent for only a few months in the year, and dies out altogether in the cold season—a phenomenon which is altogether unexplained by the food theory.

(c) *Transmission by Biting Flies*.—On the whole, this appeared to me to be the most probable mode of spread. My reasons for thinking so are as follows :—

- (1) The epidemic was limited to those months when biting insects were most prevalent.
- (2) The irregular way in which the cases occurred during the three months (Table III) was compatible with the irregular flight and biting of infected insects.
- (3) Throughout the months of July to September, the men complained very much of the biting of mosquitoes at night.

(4) There were no cases of Calcutta Fever among the officers, though they lived within 200 yards of the men's barracks. The officers lived in raised bungalows and slept under electric fans and were on this account not much bitten by mosquitoes.

I collected specimens of the various blood-sucking Diptera in the Cantonment, and had them classified through the kindness of the Imperial Entomologist, at the Agricultural Research Institute, Pusa. The commonest species of mosquito, found in the barrack-rooms was *Stegomyia scutellaris*, a vicious day-biter which has a wide distribution in India. Also very common were *Culex fatigans* and *Culex gelidus*; *Culex microannulatus* was less common. *C. concolor* and some species of Crane-flies and Midges were found, chiefly out of doors in grass, etc.

Four species of the genus *Phlebotomus* (Sandflies) are described as inhabiting Bengal.(4) I specially searched the Cantonment for both their adult forms and their breeding places, but without success. Major Williams, R.A.M.C., who had experienced these pests in Malta where they have been proved to transmit disease, was also on the look-out for them in the British Troops' lines in Calcutta but he informed me that he found none.

From the numbers in which they were present, *S. scutellaris*, *C. fatigans* and *C. gelidus* seem to be the most probable carriers of infection. It is worthy of note that one of them, *Culex fatigans*, has been proved to be capable of transmitting Dengue Fever.(5 & 6)

I was unable this year, owing to military work, to carry out experiments in blood injection and in transmission by mosquitoes. The arrangements necessary were complicated, involving a supply of susceptible subjects in a non-endemic locality.

**Incubation Period.**—None of my cases threw any light on this point. I hoped to obtain definite data when 250 men arrived in Alipore from furlough in the middle of October, but unfortunately—from this point of view—the fever had entirely died out by that time.

**Diagnosis from Malaria.**—This was quite easily made. The temperature chart was quite distinct except in a few of the very short cases. Here, the fact that the course of the fever was the same whether Quinine was administered or not, the failure to find parasites in the blood films that were taken, and the absence of enlarged spleens or persisting anæmia, were sufficient to eliminate malaria.

**Special conclusions regarding this fever drawn from a survey of my cases:—**

(1) That natives of India, when they enter an endemic area for the first time, prove as susceptible to this disease as do Europeans.

This has not, I believe, been previously demonstrated.

(2) That the disease has sometimes one, and sometimes two, paroxysms, the second coming 5 or 6 days after the first.

The deciding factor as to whether a second paroxysm occurs may be either greater virulence of the causative agent or greater susceptibility on the part of the subject, or both.

(3) A regular series of cases can be shown beginning with single paroxysm cases of one day, two days, and three days; then single paroxysm cases followed by apyrexia for 2 or 3 days with a small rise of temperature on the sixth or seventh day; next, cases in which the severity of the second paroxysm increases and gradually encroaches on the period of apyrexia, until one gets those cases where the temperature does not touch normal between the two paroxysms; thereafter come cases where the remission becomes less and less till the severe 'Continued Type' is reached, where there is no remission at all. Such a series is constituted by my Charts 13, 12, 10, 11, 20, 4, 6, 3 and 7.

(4) That the most constant and typical symptoms of this disease—apart from the temperature chart—are the frontal and post-orbital headache, the suffused and often reddened eyes, the primary flushing of the skin, the severe pain in the lumbar region of the back, the pains about the rest of the body, and the comparatively slow pulse.



**Calcutta Fever among British Troops.**—Through the kindness of Major Williams, R.A.M.C., I was able to examine the hospital records of the Rifle Brigade for 1910 and to compare the fever cases of this British regiment with those of my own. Ninety cases of 'Pyrexia of Uncertain Origin' were admitted during the summer :—

TABLE VIII.

Month ... ..	May.	June.	July.	August.	September.
Number of cases — ...	2	10	27	35	16

During this time only 8 cases of Malaria occurred. The epidemic of Calcutta Fever reached its height a few weeks later than in my regiment. The disease spread in the same irregular way, cases occurring on the same day in barrack-rooms far removed from each other. The epidemic ceased in the middle of September, only 3 cases occurring after the 15th of that month. I found clear records and the charts of 55 cases; of these, 40 were of the long, "seven-day" form, and the remaining 15 were short 2—3-day cases. Almost all the longer cases showed a remission and a terminal rise, but in only a few did the temperatures fall to normal during the remission; in this they resemble the cases among European civilians on which Rogers based his description of the disease. The usual clinical features were noted—frontal headache, pains in the back and limbs, pain on moving the eyes, bright flushing of the skin, and a comparatively low pulse-rate, but I found no note of any secondary rashes.

The proportion of short cases was really greater than would appear from the "admission" figures, since these milder cases were first treated for a day or two at the Garrison Dispensary near the barracks, and only persistent or serious cases were sent on to hospital. I found notes of many such short cases having been treated throughout at the Garrison Dispensary, but did not include them among my figures as the records were so brief.

**Colonel Fooks' Cases.**—I have referred to the epidemic of mixed three-day and seven-day fever among the 15th Lancers at Sialkot (Punjab) which was described by Lt.-Col. Fooks, I.M.S.(2) As his is—so far as I can find—the only other description of a nearly equal admixture of these two types, I must refer briefly to it.

In that case also, it was an Indian regiment that was attacked; there were 140 cases—65 of the Short form and 75 of the Long. The disease "spread uniformly through the regiment," and the epidemic was marked off into three periods, as follows :—

1. The first 10 days when only three-day fever occurred.
2. Three weeks of very severe seven-day cases.
3. The last 2 weeks when there was a mixture of three-day and mild seven-day cases.

The symptoms were an erythematous rash of the face and neck, frontal headache, severe pains in the lumbar region, pain behind the eyes, central furring of the tongue, injection of the conjunctivæ, and a comparatively slow pulse that sometimes fell below 50 after the crisis. The peculiar thing about the three-day cases was that they showed a slight rise (to about 100° F.) on the seventh day, after having been normal for three or four days.

The severe seven-day cases had high temperature, and the general symptoms were marked; there was a slight remission of the fever after the first two or three days, followed by a rise just before the crisis on the seventh day.

In the mild seven-day cases, the remission of temperature was much more marked.

I have reproduced charts of these three forms from Col. Fooks' paper, and below them have placed charts from my own series to show the similarity between them (charts 15 to 20). It will be seen that the other symptoms in the 15th Lancers' cases were just those described by me in mine. In fact, except for a few minor points, Col. Fooks' and my cases appear to be identical.

Col. Fooks believed that the disease was being spread by sandflies. He and other medical men who witnessed the epidemic had not the slightest doubt that they were dealing with Dengue, of which disease one at least of them had had a very large experience.

## PART II.

### CERTAIN PYREXIAS OF UNCERTAIN ORIGIN.

**Introductory.**—In the introduction to his earliest communication on *Phlebotomus Fever*,(7) Doerr made the tentative suggestion that many of the tropical and subtropical Fevers of a certain type, hitherto regarded as distinct entities, were really a single disease, and he pointed out that many of the outstanding features were common to the group. Having dropped the hint, Doerr did not recur to the subject, and it was lost sight of in the interest that was aroused by his work on the etiology of the newly-isolated disease.

In India, also, two writers have of recent years drawn attention to the similarity that exists between certain Indian Fevers and Dengue. In 1906, Capt. J. W. D. Megaw, I.M.S., published a paper entitled “Is Calcutta Seven-Day Fever a Form of Dengue?”(8) in which he drew attention to the many points of resemblance between the two diseases, but admitted that the case for the affirmative answer to his query was not yet proved. According to Rogers, “the idea does not seem to have struck any of the many medical officers of the European Hospital, Calcutta, who have treated numerous cases for many years past.”(1)(b)

In 1908, Capt. R. McCarrison, I.M.S., drew a comparison between Three-Day Fever of Chitral (originally described by him) and Dengue Fever.(9) He considered that, although they resembled each other in very many points, yet his “failure to find in Chitral Fever either a rash or a terminal fever renders it impossible to class the two conditions as identical,” and ends by saying that in his opinion the question, “Is Chitral Fever Dengue?” remains unanswered. The following year, there appeared a second contribution from Capt. Megaw, comparing in detail Three-Day Fever, Seven-Day Fever and Dengue Fever.(23)

My own cases furnish such unexpected testimony to the correctness of Capt. Megaw’s views that I think, I am justified in re-opening the subject. Moreover, during the past two years, new facts have come to light regarding these fevers, through the work of Doerr and his colleagues in Southern Austria and of Birt in Malta and Crete. A fever of the same type has also been described in Egypt by several observers including T. S. Wakeling.(10)

The following are the Dengue-like fevers with which I intend to deal.

1. *Dengue*.—(a) Classical Dengue (as described by Manton(11) and by Scheube.)(12)  
(b) Dengue in Brisbane, Australia (Robertson Committee’s Report.)(13)  
(c) Dengue in the Philippines (Ashburn and Craig.)(6)  
(d) The Indian Epidemic of Dengue of 1872 (Rogers.) (1)(b)
2. *Seven-Day Fever* (Simple Continued Fever) of Calcutta and other Indian Ports. (Rogers.)(1)(b)
3. *Three-Day Fever* of Chitral and Upper India (McCarrison (9 and 14), Wimberly (15) Wall(19) and Fooks.) (2)
4. *Phlebotomus Fever* of the Mediterranean coasts, viz. :—
  - (a) South Austria. Doerr.(16)
  - (b) Malta and Crete. Birt.(17) Gerrard.(18)
  - (c) Egypt. Wakeling.(10)

I think it is certain that fevers of this class exist in many other warm countries and are given local names. Thus, Birt says that Phlebotomus Fever occurs also in Cyprus, Gibraltar, and Straits Settlements. (17b) I have not been able to find any detailed description of the diseases of the Burmese and Chinese coasts or of the Pacific islands, where one would probably find a record of short endemic fevers. Doerr(6) states that the fever in Italy that goes by such names as 'Summer Fever' and 'Climatic Fever' is identical with the form he describes in Herzegovina.

### 1. Dengue in different epidemics.

In reading the different accounts of Dengue, one is struck by the variability of type that this disease presents. This is well brought out in Scheube's description. He quotes de Brun's Classification of Dengue as consisting of no less than five different forms according to the presence or prominence of one or other class of symptoms. The Committee of the Queensland Branch of the British Medical Association, in their report on the two great epidemics in Brisbane, draw attention to this variability of Dengue and state that the proportion of severe cases and the relative frequency of many of the symptoms and complications are not always the same. Ashburn and Craig emphasise this point still more strongly—"there is no one symptom that can be said to be pathognomonic, or even constant, if we except fever.....This doubtless accounts for the different descriptions of the disease that have been written. We agree with Guiteras and Cartaya that many cases cannot be properly diagnosed except in the presence of an epidemic."

While this variability is noticeable in different cases of a single epidemic, one observes it to a still greater degree in the difference between the general type of cases of one epidemic and that of another, especially if they occur in different quarters of the globe. ~~So~~ instances of epidemics that differed widely in their clinical type, one may cite the great Indian epidemic of 1871—3 (Rogers), the Brisbane epidemic of 1905, and the Fort William McKinlay (Philippines) epidemic of 1906.

*Onset.*—This is invariably described as being sudden in the majority of cases, but, in all three of the above-mentioned epidemics, cases were noted where premonitory malaise, pain or slight fever existed for a day or two before the actual onset. The proportion of cases exhibiting a slight rigor at the start is variable; in most descriptions it is put at a high figure but, in connection with the Fort McKinlay epidemic, 'chilliness' is stated to be 'at times, but not usually, complained of.' Pain in the loins, headache, and fever are spoken of as the earliest symptoms. Manson and the Brisbane Committee mention occasional cases of dramatically sudden onset; Ashburn and Craig state that such cases are exceptional in their experience.

*General Appearance.*—The descriptions by all observers of the patient's appearance early in the disease are practically identical. Ashburn and Craig say "The face is usually deeply flushed and the eyes injected and watery at the onset of the disease. This appearance we have found ..... an almost pathognomonic sign." Manson similarly describes a deep suffusion of the face, which is very often bloated and swollen, with conjunctivæ injected. The early rash is described by all as being merely an erythematous flushing which is most marked on the face.

*Temperature.*—As this is a crucial point in my comparative study of this class of Fevers, I must here deal separately with several accounts of Dengue (1b and 21)

The observers of the *Indian Epidemics* of 1824 and 1872 state that the temperature rose quickly to its maximum and fell quickly, the whole occupying from one to three days. The temperature thereafter remained normal, but in exceptional cases there was a rise to 100° between the 4th and 6th days. Chart 21 is a copy of one of Edmonstone Charles'(21) illustrations of this rarer form, reproduced from Rogers' text-book. It will be seen to correspond closely with the temperature type I have shown in Charts 17 and 20 (Part I), taken from my own and Col. Fooks' series.

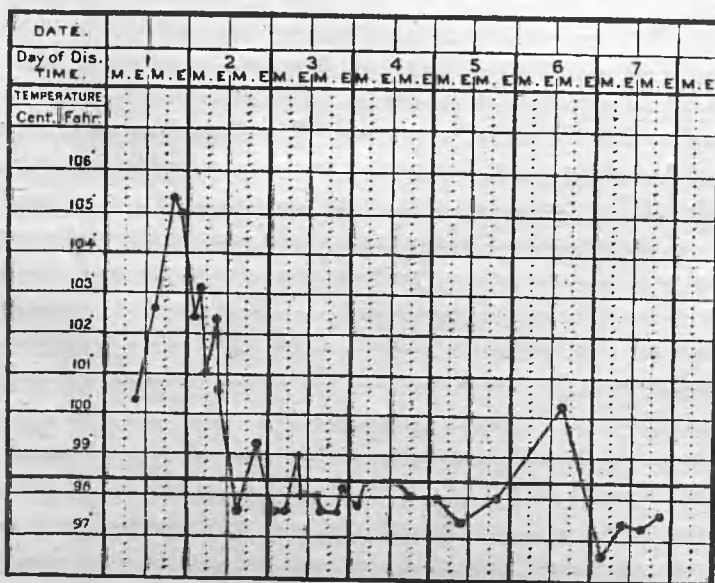
*Scheube* states that the temperature reaches its maximum (102°—104°) in a few hours, and is usually remittent; later, from the 3rd to the 5th day, a very varied rash appears, "sometimes



accompanied by a renewed rise of temperature, usually lasting only a few hours." This description would exactly apply to Charts 17, 20 and 21.

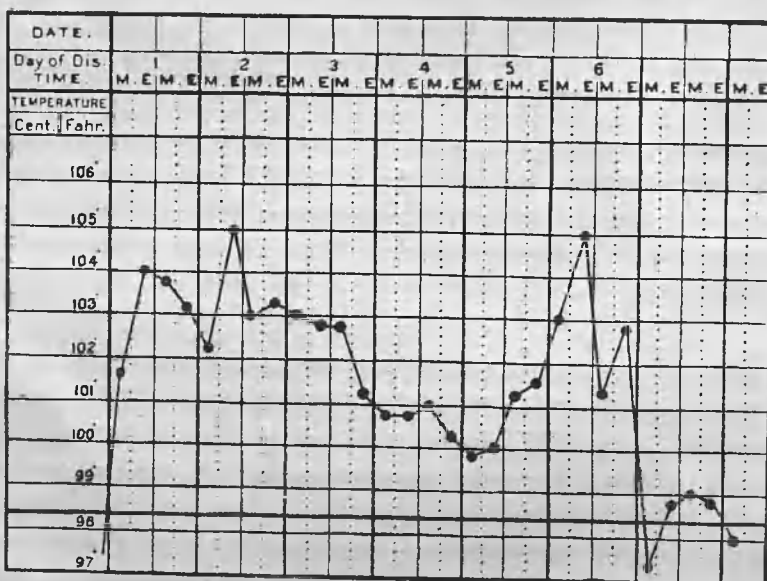
Manson says that fever rises in a few hours to 103°, occasionally to 105° or 106°. It begins to decline after the first day and falls to normal in from one to three or four days. A normal temperature is maintained up to the terminal fever which appears on the fourth, fifth, sixth or even the seventh day. The secondary fever does not always occur, is usually slight and of short duration, but in some cases is more severe.

CHART 21.



The temperature curve that was most typical of the Fort McKinlay Epidemic is practically identical with that of Seven-Day Fever. [See Chart 22 and compare with my Charts 2, 3, 4, 5 and 6.] Ashburn and Craig say that the temperature reached its maximum (usually about 103.5°) in the first 24 hours, and soon thereafter began to drop; in some cases, the fall in temperature

CHART 22.



[This chart was characterised by Ashburn and Craig as being 'an ideal Dengue curve.']

did not start for a few days. The falling temperature might reach normal or might stop as high as 102° during the remission; generally it did not fall to normal. About the fifth day, it again rose to almost as high a point as its early maximum.

The description of the temperature curve in the great *Brisbane* epidemic (in which over 90,000 persons are reckoned to have been attacked) tallies with that in the Philippines. Usually, the temperature rose to 102°, and fell on the third or fourth day, *sometimes* to normal. After a few hours, the temperature again rose for one or two days, and reached its greatest altitude in this secondary paroxysm. In this last respect, it differs from the rule in any other account I have read.

*Headache* is always spoken of as a practically constant symptom. It is severe, and its location is commonly frontal or post-orbital.

*Pains*.—The lumbar region of the back is always mentioned as the most common site of pain. The occurrence of pains in other parts of the body is more variable. Scheube states that there are sometimes pains in the bones. The Brisbane Committee and also Ashburn and Craig say that severe breakbone pains are only occasionally met with. Scheube and Manson describe joint pains, but the former quotes de Brun's assertion that the pain is always really muscular and not in the joints themselves, tallying with my observation (p. 89). With this view the Brisbane clinicians are in agreement.

Most descriptions (including Manson's) of the Indian epidemics state that some one or more pains persisted for days or weeks after the attack in a large proportion of cases. Scheube says that the joint pains may persist. Ashburn and Craig, on the other hand, say that this never occurred among their cases, while the Brisbane Report contains no mention of such after-pains. In brief, then, the pains of Dengue are extremely variable both in their intensity and in their location.

*Pulse*.—Manson says the pulse-rate is 120 or more at first; Scheube says it averages 100—120, but is often only 80—100. In Brisbane, it was noticed that the pulse was, as a rule, slow considering the height of the temperature, and often a pulse-rate of 75—80 accompanied a temperature of 102 or 103. Ashburn and Craig state as their opinion that the pulse-rate follows the temperature fairly well, but the tendency to slowness is manifested by a *relatively small rise in pulse-rate*.

*Gastro-intestinal Symptoms*.—The tongue is usually described as furred, with red edges and tip. Anorexia is present; occasionally there is vomiting which is usually confined to the early stages of the illness. Constipation is commonly present.

*Nervous System*.—Insomnia is common, delirium rare. Convulsions may occur in young children. The headache and pains have been mentioned already.

Nasal catarrh, tonsillitis and respiratory symptoms are not features of Dengue Fever.

*Blood Changes*.—No parasite has been demonstrated in the blood.

There is no anæmia. A marked leucopenia is present; the decrease is among the polymorphs, and there is a great relative leucocytosis of the small lymphocytes. These changes occur very early in the disease.

*Hæmorrhages*.—Epistaxis sometimes occurs according to Manson at the time of the defervescence from the first fever paroxysm. Hæmorrhages from other parts are very rare.

*Secondary Rash*.—Manson and Scheube put this as being usually present. In Brisbane it was absent in at least half of the cases, but it was often found difficult to decide whether slight appearances constituted a rash or not. Ashburn and Craig are convinced that the rash varies greatly both in the frequency of its appearance and in its characters; it is often very faint, but they believe they saw it in 75 per cent. of their cases. It is generally described as consisting of reddish-brown rubeoloid spots, often rather itchy; it appears at about the time of the terminal rise and affects most often the trunk, wrists, forearms and thighs. In Europeans, there is often a bright pink discoloration of the palms and soles.

Relapses and second attacks within a few months sometimes occur, but as a rule, susceptibility to the disease is exhausted by one attack in one epidemic (Manson). Mortality is practically nil.

*Epidemiology*.—A fairly high temperature is necessary for Dengue to spread. Therefore, except in the tropics, it flourishes only in the summer months, whether they be wet or dry. It is a coast disease, and hangs about seaports and the deltas of rivers, but may spread far inland (Manson). It is noted for its very rapid spread, sometimes laying low 75 per cent. of a population

within a few weeks. That this is not an invariable characteristic is proved by the Fort McKinlay Epidemic among the U. S. soldiery. This epidemic lasted for over three months and only 29 per cent. of the garrison were attacked. Some persons have been proved to be naturally insusceptible (Ashburn and Craig).

*Etiology.*—Ashburn and Craig's work proves that the disease-causing organism is ultramicroscopic and that it can be conveyed from person to person by the mosquito *Culex fatigans*; they experimented with no other insects. They likewise showed that the disease cannot be transmitted by mere contagion in the absence of mosquitoes.

The *Incubation Period* is put down at from one to four days. In Ashburn and Craig's experimental cases, it varied from  $2\frac{1}{2}$  to 7 days; in Graham's (23) just under five days.

From a survey of the more recent epidemics of Dengue, therefore, it appears that the old text-book description of the disease requires to be considerably modified. Many of the clinical features that formerly figured as constant in Dengue—such as the very sudden onset, the joint and bone symptoms, the after-pains and the fever limited to three days—are found to be really most variable in their occurrence.

## 2. Dengue and Seven-Day Fever.

By comparing the above description of Dengue with Seven-Day Fever as outlined in the earlier portion of this thesis, it is seen that these two diseases correspond very closely with each other. The mode of onset, the puffy appearance of the face, the injected, suffused eyes, the general condition and appearance of the patient, the characters of the first and second rashes, the temperature curve, the bradycardia, the severe pain in the small of the back, the less constant pains in the limbs, the frontal and orbital headaches, the gastric symptoms, the character of the tongue, the duration of the illness, the leucopenia, the probable incubation period, the seasonal incidence—all are identical in the two diseases. I have brought forward certain considerations pointing towards *culicid* intermediary in the case of Seven-Day Fever, and the probability—so far as it goes—constitutes yet another point of resemblance between this disease and Dengue.

I think I have established my contention that Seven-Day Fever comes well within the variations of Dengue, and that there are greater differences between the various forms of undoubted Dengue that appear in different epidemics than there are between Seven-Day Fever and 'Typical Dengue.' Seven-Day Fever of Calcutta appears to be merely an endemic, sporadic form of Dengue Fever. To summarise effectively the arguments that have been raised against this view, I furnish the table of "Differences between Dengue and Seven-Day Fever" given in his admirable text-book, 'Fevers in the Tropics,' by Leonard Rogers who strongly advocates the distinct nature of Seven-Day Fever.

TABLE IX.

	Dengue.	Seven-Day Fever.
1 Prevalence ...	At long intervals in epidemic form attacking a large proportion of residents.	Annually in sporadic form.
2 Distribution ...	Specially attacks coast towns but spreads far inland.	Only known near the coast so far.
3 Race incidence ...	Europeans and natives equally attacked ...	Very common in Europeans, comparatively rare in natives.
4 Seasonal incidence ...	Mostly in hot months, but may prevail in cold season (1872).	Prevails in hot and rainy seasons only
5 Relapses ...	Very common in same year as first attack	Rare, and not in same year as first attack.
6 Pains ...	Very severe and breakbone in character ...	Moderately severe, as in influenza, and not of breakbone character.
7 Joint symptoms ...	Very common and characteristic ...	Absent, or only present as slight pain.
8 Convalescence ...	Very tedious, lasting one to three months, with persistent joint-pains.	Rapid. No after joint-pains.
9 Fever ...	Lasts two or three days, falling to normal with crisis. Occasional very short secondary rise, markedly remittent.	Five to eight or more days with typical saddle-back remission to 100° to 99° F. only. Otherwise continued in type.
10 Pulse ...	Rapid	Slow, especially in terminal rise.

1. The variations of Dengue in this respect are wide. In the Philippine epidemic, the spread was slow, and a comparatively small percentage of the population was attacked. Obviously, the disease must persist somewhere endemically between the pan-epidemics—in the West Indies for instance. It is also said to be endemic in certain parts of Egypt and Syria. (9)

2. For Dengue to spread far inland is the exception, not the rule (Manson, Scheube). Similarly, 'Seven-Day Fever' occurs inland in the Punjab (Rogers, p. 317); it also occurred among the troops in Lucknow in 1909, and was recognised as Seven-Day Fever by medical men who were conversant with this disease in Calcutta. [Paper read by Lieut. Morison, I.M.S., to the Lucknow Medical Society on 200 cases of Seven-Day Fever, unpublished.]

3. My cases show that natives who have not before been exposed to the disease are just as susceptible to it as are Europeans in a like condition.

4. All descriptions of Dengue state that epidemics are immediately arrested by cold; this has now been explained by the work of Graham and of Ashburn and Craig on transmission by mosquitoes. The instance quoted by Rogers of the disease persisting through one cold weather during the Indian epidemic of 1871—73 is, therefore, altogether exceptional, and mosquitoes must have somehow managed that year to survive throughout the Calcutta cold weather, which is never very rigorous.

5. This supposed feature of Dengue is not evident in all epidemics. In the Philippines, as a result of their observations, Ashburn and Craig came to the conclusion that reports of such relapses were very dubious.

6. The facts I have quoted regarding the Brisbane and Fort McKinlay Epidemics of Dengue removes this distinction.

7. From the observations of de Brun and of the Robertson Committee, it appears that inflammation and pains actually in the joints are rare in Dengue. The Committee says of these particular pains "They are certainly not in the joints, and are not at all aggravated by movement and could not be confused with the pains of acute rheumatism." The pains, in fact, are not to be distinguished from the severe limb pains of Seven-Day Fever.

8. The reports of the Robertson Committee and of Ashburn and Craig state that in young healthy adults, convalescence from an attack of Dengue was rapid and uninterrupted.

9. The usual type of Dengue in the Brisbane and in the Fort McKinlay Epidemics showed a temperature chart identical with that described by Rogers in Seven-Day Fever (compare Chart 22 with Charts 2 to 6).

10. "As a rule the pulse is slow in comparison with what would be expected from the rise in temperature"—report of the Robertson Committee on the Brisbane Epidemic of 90,000 cases.

### **3. Phlebotomus Fever of the Mediterranean coast, and its relation to Seven-Day Dengue Fever.**

This fever has been described in Herzegovina, Dalmatia and Italy by Doerr and his colleagues; in Malta and Crete, by Lt.-Col. Birt, R.A.M.C.; and in Egypt, by T. S. Wakeling and others.

The descriptions show that the disease in Austria is of a severer type than in Malta and Crete, and it appears that, in Austria at least, the type varies in different epidemics. (16c)

The disease occurs only in the summer months, and new arrivals in the district are chiefly attacked. It does not spread far inland or usually reach an elevation of over 2,000 feet. All these points are equally characteristic of Dengue.

Doerr and Birt showed independently that the disease is due to an ultramicroscopic agent that can pass through certain Pasteur-Chamberland filters and not through others, and that it is conveyed from person to person by insect agency. So far, their results agree with those of Ashburn and Craig in regard to Dengue. But they further prove that the ordinary insect host in the Mediterranean form is a Sand-fly—*Phlebotomus papatasi*.

*Incubation Period.*—Doerr puts the incubation period at 5—7 days. In Birt's experimental cases, it varied from 3 days 16 hours to 7 days. Wakeling, in Cairo, says "about 4 days."

*Symptoms.*—All the accounts of the onset of the fever and of the general appearance of the patient would equally apply to Seven-Day Fever as I have seen it, or to Dengue as described by Ashburn and Craig. In Malta, the characteristic congestion of the conjunctivæ gave the name of 'Pink-Eye' to the disease. Frontal or orbital headache, pains in the eyes and in the back, and a flush over the upper part of the body are noted as early symptoms. Epistaxis occurred in a few of Birt's cases, but was fairly common in the Dalmatian epidemics.

Bradycardia was a well-marked feature of the Mediterranean cases. "At a temperature of 104° or less, the average pulse-rate was 92."—[DOERR].

A leucopenia, chiefly affecting the polymorphs, was noted.

Disturbances of the digestive system are a marked feature. A furred tongue with a red tip is described as characteristic.

There is pain and stiffness in the muscles of the back and in the calves of the legs. Among Doerr's cases, every grade of severity was noted, from fulminating cases showing hyperpyrexia, delirium, very severe pains and slow convalescence, down to those with but very slight symptoms. He recognised two classes clinically:—(1) the nervous class, where such symptoms as headache, pain, delirium and insomnia predominated, and (2) the gastro-intestinal where a thickly furred tongue, pronounced anorexia, nausea, vomiting and constipation were most evident.

Birt mentions many of the trivial points that one has noted in Seven-Day Fever—the flushed, puffy, dissipated appearance of the face, the aversion of the patient to turning his eyes, and the occasional tenderness along the course of nerves.

A large number of the Austrian cases had a slow convalescence. Doerr describes the bradycardia as often persisting for a week.

*Temperature.*—The chief point of difference between this Mediterranean type and that seen in Calcutta lies in the large preponderance of 'single paroxysm' cases in the former.

(1) *The Austrian Cases.*—The following is a quotation from the monograph written by Doerr, Franz Craig and Taussig "Relapses may occur apart from fresh infection; they usually occur shortly after the previous access of fever, the interval sometimes being as short as 18—24 hours." If such cases had preponderated, would not the disease have been named 'Seven-Day,' instead of 'Three-Day,' Fever? These relapses certainly seem to agree very closely with the second paroxysms of Dengue and of Seven-Day Fever.

(2) *The Malta and Crete Cases.*—The duration of the fever in these places was more variable than on the Northern shore of the Mediterranean. Although it is named "Three-Day Fever," in 1909 the cases varied in duration from one to ten days, and 27 per cent. of them (69 cases) lasted for over four days (Birt). Clear evidence of the occurrence of the typical Seven-Day form is afforded by a paper by Lt.-Col. Gerrard, R.A.M.C., (19) containing notes on the charts and records of a single hospital in Malta. Among the cases for the five years 1904-1908, he found 42 "which showed the 'saddle-back' type of temperature chart described by Rogers in his Calcutta cases." He further expresses his belief that the number would have been greater, but for the fact that cases which appeared likely to be at all severe were sent to other hospitals for treatment." Colonel Birt does not give any individual charts of his longer forms, and in composite charts such as he gives, non-coincident summits of several terminal rises would tend to be obliterated; in spite of this tendency, a small rise of about 1° is shown in his composite chart.

I have not referred much to Phlebotomus Fever in Egypt, as I have not, while writing, been able to refer to the more detailed descriptions of this disease in that country. I may point out, however, on the authority of Professor Sandwith that Seven-Day Fever occurs in Egypt (Rogers, p. 301).

This fever of the Mediterranean littoral agrees in the course of its temperature with the type of Dengue of the Indian 1872 epidemic, there being a terminal rise in only a small proportion of the cases. But in no place where Phlebotomus Fever has been described is there lacking an admixture of double paroxysm cases, closely agreeing with those of Calcutta Fever.

#### 4. Three-Day Fever of Northern India.

This fever appears to be widespread and common in Upper India. Its occurrence has been noted by McCarrison (14) in Chitral, James (22) in Lahore and by Rogers (16) in parts of the

Punjab and United Provinces. Lately it has been described by Wimberley in Nowshera, and it appears to be common during the hot weather all over the Peshawar Valley. The various accounts of the disease exactly tally, and the different writers seem to have no doubt that they are dealing with the same disease throughout this tract of country. McCarrison's two papers give the fullest account of the disease and it is from them in particular that I quote.

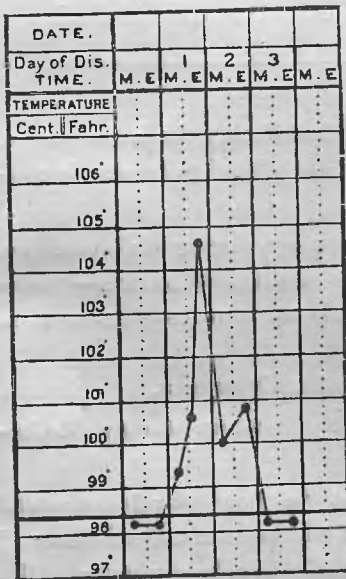
The disease in Chitral occurs every summer among the Chitrali children and among newcomers to the country. It has attacked our troops annually since our occupation of the country. It always disappears on the arrival of the cold weather. It spreads rapidly in a susceptible population. McCarrison establishes the facts (1) that this disease is not directly contagious, (2) that Madrassis and Punjabis are much less susceptible than Europeans and Goorkhas (probably due to acquired immunity on the part of the former), and (3) that the incubation period is about five or six days, never longer.

McCarrison found that there was a leucopenia during an attack, only evident after the temperature has begun to drop; this corresponds with the observations above quoted of Birt and Doerr in the Mediterranean. His blood inoculation experiments he regarded as inconclusive since the men he used as his subjects were later found to be practically immune to the disease.

Second and even third attacks in one epidemic sometimes occurred among the susceptible Goorkhas. McCarrison suspected sandflies of being the transmitters of the disease; and, though transmission by this means has not been proved to occur, it is generally assumed to do so, and this disease seems to be generally known as "Sandfly Fever" both in Chitral and in the Peshawar Valley (15) & (19). In regard to variability of the disease type, he brings out the following points:—

- (1) The cases in 1903 were on the whole of a more severe type than in 1904.
- (2) A more severe type was got in Chitral than in Drosh close by.
- (3) Quotation from a report of the disease in 1898 shows that the symptoms that year were chiefly of the abdominal type—thirst, burning in the epigastrium, abdominal pain and irregularity of the bowels; while in the 1904 epidemic, cough and bronchitis were frequent accompaniments.

CHART 23.

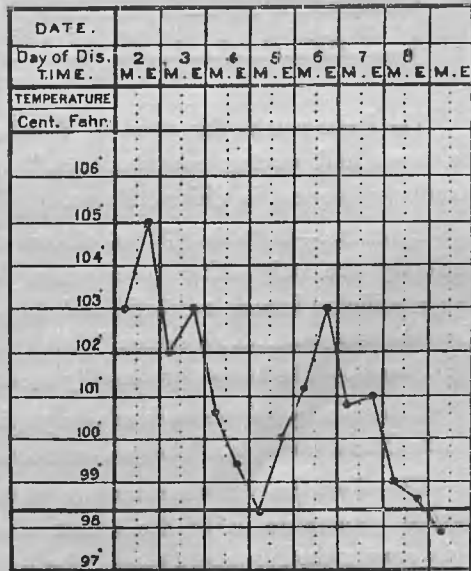


*Symptomatology.*  
—Fever (Chart 23.)

The temperature rose rapidly to a maximum which was usually a little below 104°. The decline took place during the second and third days. Often a slight rise interrupts the descent. There was no return of fever after it once reached normal, in the large majority of the Chitral cases.

Thus, out of 78 of McCarrison's cases

CHART 24.



where temperatures were taken for several days after defervescence, only nine show any return or persistence of fever after the third day. In several of these, there was severe bronchitis to which the exceptional type of temperature might be attributed. One case (Chart 24) which was noted as a 'relapse,' shows all the characteristics of a Seven-Day Fever or Dengue Chart. Quite recently Wall (19) has published observations on 427 cases of Chitral fever that occurred



in the summer of 1910. Among them he notes seven cases where a relapse or second paroxysm occurred on the sixth or seventh day ; he says that this is probably an underestimation, as many men had returned to duty before the " relapse " was due. Chart 26 is from one of his cases.

In the epidemic in Nowshera, which was described by Lieutenant-Colonel Wimberley, a terminal accession of fever was quite common. Chart 25 from his cases is typical of all these ' seventh-day relapse ' cases, which have thus been noted in Chitral and Nowshera (Frontier), Sialkot (Punjab) and Alipore (Bengal). In all these places, they have occurred in epidemics of diseases which had all their clinical features in common, except that the ratio of single to double paroxysm cases varied in the different epidemics. The other features of this disease are described by McCarrison, Wall and Wimberley in practically the same terms as are those of " Dengue " by Ashburn and Craig and those of " Phlebotomus Fever " by Doerr and Birt, and their recital would savour of the repetition of a thrice-told tale. I shall merely touch on one or two of the less constant symptoms of this polymorphic disease.

CHART 25.

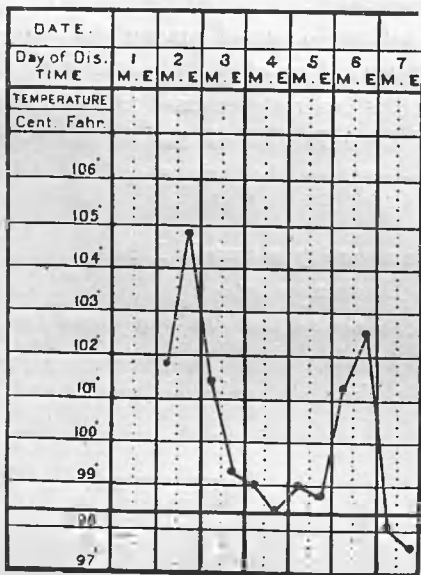
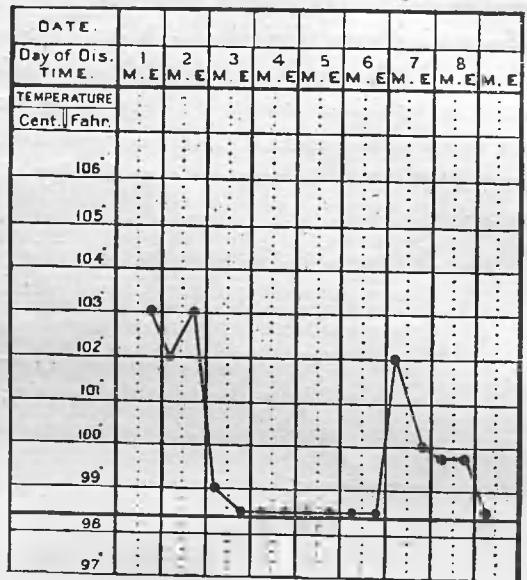


CHART 26.



The Pulse-rate as described by Wimberley is " markedly diminished during the latter part of the fever and during convalescence," and McCarrison says that a diminished pulse-rate is comparatively frequent in Chitral Fever.

*Epistaxis.*—Both the Chitral officers mention that epistaxis is common during defervescence. Curiously the only other place where this symptom is described as common is Austria—" beim Pappataciefieber kommt es häufig zu heftigem Nasenbluten,.....die nie vor dem Ende des zweiten Krankheitstages.....einsetzen." (16b.)

*Bowels.*—The bowels are usually constipated but diarrhoea is occasionally present.

*Ocular symptoms* such as pharyngitis and bronchitis were fairly common among McCarrison's Chitral cases, but Wall makes no mention of them in 1910.

*The Duration of Convalescence* varied. McCarrison says that " a slow convalescence and marked prostration after the attack is one of the most characteristic features of Chitral Fever ;" while among the Nowshera cases " the bulk of the sufferers expressed themselves as quite well a couple of days after their temperature fell."

Chitral Fever, then, agrees in all respects with Phlebotomus Fever as it occurs round the Mediterranean coast. In neither case has the germ been discovered, but I venture to say that the assumption that they are the same disease is as firmly based as is the analogous supposition that measles and whooping cough in India are identical with the diseases that go by these names in Europe.

On the other hand, I have pointed out the close connection that exists between these short fevers and the longer Dengue—Seven-Day Fever forms.

In every part of the world where the short forms have predominated, the longer 'two paroxysm' case has been described as co-existing in the same epidemics. Wherever the Seven-Day type has appeared in epidemic form, short Two or Three-Day cases have not been wanting.

I have tabulated (Table X) for the purpose of comparison the features of all these fevers as described by the various writers to whom I have already referred. In it, I have, as far as possible, used the exact words of these writers. Once again I draw attention to the extreme variability of the 'type' disease—Dengue Fever—and ask whether all these fevers do not come easily within the range of that already proved variability. The points that create apparent difficulty in adopting this view are three in number :—

1. The lightning spread of 'typical dengue.'
2. The severe breakbone pains of that disease.
3. The secondary fever and rash of dengue.

To summarise the solutions of these difficulties :—

1. The rate of spread of an infectious disease depends on several factors relating both to the strength of virus and to the resistance of the individuals among whom it appears. In the Philippine epidemic of true Dengue, only 29 per cent. of the American soldiery were attacked. On the other hand, of 568 Gurkhas stationed in Drosh in 1910, 80 per cent. were struck down by Chitral Fever.

2. The degree of severity of pain and the exact location to which the patient refers it are very unsound bases of distinction between two diseases.

In the Brisbane Epidemic of 75,000 cases, severe breakbone pains were observed "only in comparatively few cases." From the descriptions of persons who have suffered from 'Calcutta Fever' and from written accounts of Three-Day Fever in different parts of the world, I formed the opinion that the pains in these conditions are by no means to be despised.

3. Both rash and secondary fever are inconstant. For instance, the latter was rare in the Indian 1872 epidemic. In those epidemics where no secondary fever occurs in the majority of cases—as in Upper India and round the Mediterranean—it is not surprising that the accompanying rash does not appear.

In conclusion, I submit that where there is so much that is identical and so little or nothing that is dissimilar, it is irrational to continue to give separate place-names to these varieties of Dengue Fever, and that unless and until more than one causal organism are isolated these fevers should all be included under the one name.

**Analogies between Dengue and other Diseases.**—The short fever with which I have dealt in this Thesis presents analogies with two other diseases—Influenza and Yellow Fever.

In the variability of the form and of the severity that it may assume, in its occasional pandemic spread, and in the body pains, it resembles INFLUENZA. But Dengue is purely a warm weather illness, and it cannot spread at great altitudes; implication of the respiratory system, and, indeed, all catarrhal symptoms, are rare; the mortality from Dengue is *nil*, and there are no serious sequelæ. There could seldom be any difficulty in distinguishing the two conditions.

The analogy with YELLOW FEVER is much more marked. There seems, indeed, to be a close connection between these two fevers. The etiology of each has been traced to an ultramicroscopic organism which is transmitted by one or more species of biting flies. Each is especially a sea-coast disease, endemic in certain parts of the world whence it occasionally spreads in great epidemics to other countries. Both vary so greatly in their symptoms that they have been sub-divided into many types according to the predominance of one group of symptoms. An isolated, mild case of Yellow Fever could not be differentiated from one of Dengue. As in the latter disease, so in Yellow Fever (16 and 12) there is an abrupt rise of temperature

accompanied by supra-orbital headache, pains in the limbs and back, flushed face and injected conjunctivæ. This goes on for two or three days, after which the temperature drops and the pains become less severe. In a mild case, the temperature falls to normal and convalescence ensues ; such cases, according to Rogers, often form over 60 per cent. of all cases in an epidemic. One such case taken by itself could not be distinguished clinically from the short form of Dengue. In the severe cases of Yellow Fever—analogue with the Seven-Day form of Dengue—, the temperature rises again after the remission and all the other symptoms reappear. The pulse is from now onwards slow in comparison with the temperature. Jaundice, vomiting, diarrhœa and hæmorrhages make their appearance. As Doerr and Russ(16*b*) point out, these symptoms never appear during that period of an attack of Yellow Fever when the causal germ is circulating in the blood ; in like manner, in Phlebotomus Fever, diarrhœa and epistaxis never set in before the third day when, as these observers have demonstrated, the blood has become a virulent. In Yellow Fever, death may supervene or else, after three or four days of this stage, the temperature may fall and recovery occur.

Altogether, there is a remarkable correspondence between these two diseases, which, when their etiology is more completely worked out, will in all probability be found to result from some close relationship between their causal organisms.

---

	Dengue Fever (Manson and Scheube).	Dengue Fever (Brisbane Committee and Rogers).	Dengue Fever (Ashburn & Craig).	Seven-Day Fever (Rogers, Megaw, etc.).	Mixed 7-day and 3-day Fever epidemic (Self).	Three-Day Fever of Chitral and Upper India (McCarrison, Wall, Wimberley and Fooks.)	Mediterranean Three-Day Fever in Malta and Crete. (Birt).	Mediterranean Three-Day Fever in South Austria. (Doerr).
1. Etiology	Nothing known. M.	.....	Ultramicroscopic organism that can be transmitted by culex fatigans.	Unknown	Culex or Stogomyia mosquitos suspected	Sand-flies suspected as carriers	An ultramicroscopic virus, transmitted by Phleb. papatasi	An invisible virus conveyed by Phleb. papatasi.
2. Epidemiology	"Sudden rise." "Extends with great rapidity." M.	"Suggests some peculiarity in the method of propagation differing from that of the well-known diseases, influenza, scarlet fever, etc. Spread particularly to contiguous houses." B. C.	Did not spread by contagion	Sporadic. Starts among shipping population each year. Chiefly affects newcomers. R.	Slow, regular spread	Extends rapidly and is generally prevalent in an affected community. M.	Spreads among the troops annually. The number of cases in different corps differs very much.	Prevalent annually among the garrisons in Herzegovine.
3. Percentage of Population attacked.	"Affects a large proportion of the inhabitants." In one case seen personally "quite 75%" M.	75% in Brisbane	29%	No figures	17%	From 5% in Punjab Mohds. to 80% in Gurkhas. W.	Apparently about 25% (?)	
4. Racial Incidence	No distinction drawn	"Attacked all races and showed no preference for Europeans." R.	Only U. S. soldiery dealt with	Much rarer among natives than among Europeans. R. [But see my remark on this, p. ]	All four classes of natives about equally affected	Gurkhas and Europeans most susceptible. W. M.	British troops dealt with	Only Austrian troops dealt with.
5. Seasonal Prevalence	High temperature demanded. Rainy or dry no consequence. M.	Summer months. B. C. Hot weather months but persisted in Calcutta through cold weather, 1871. R.	July to November	Hot weather and rains	June-September	Summer months	Summer months	Summer months.
6. Distribution	Coastal towns chiefly. S. "Elevated places enjoy a relative immunity." M.	Brisbane city and suburbs. B. C. (See report). Started Calcutta (seaport) and spread all over India. R.	Fort McKinlay is on low-lying, badly-drained land.	Calcutta. Low-lying ground in delta of Ganges	Alipore Cantonment	Does not exist in altitudes above 7,000 feet. M.	Islands of Malta and Crete	Herzegovine and Dalmatian coast. Does not occur in garrisons above 1,500 feet.
7. Susceptibility	.....	Universal, but medical men much exposed to infection appeared immune. B. C.	Some persons were proved experimentally to be absolutely immune to Dengue.	Especially affects newcomers	All were newcomers	One attack gives immunity in 80% of cases (among Gurkhas). M.	Newcomers most susceptible	Chiefly among men in their first year of residence in the district.
8. Age Incidence	.....	All ages. Vigorous adults have severest attacks. B. C.	.....	.....	Especially younger men	Younger men much more susceptible. M.	.....	.....
9. Relapses	"Second and even third attacks during the same epidemic have been recorded. As a rule, however, susceptibility to the disease is exhausted by one attack." M.	"Have occurred." B. C.	The correctness of reports of cases in which attacks have occurred about a month apart, we very much doubt.	Does not relapse in same year. R.	One or two doubtful cases	13% had a second attack in epidemic. W.	Second attacks have occurred in 6%	Relapses may occur apart from fresh infection.
10. Mortality	"Almost nil." M.	"1% but usually on account of pre-existing diseases. B. C.	We have seen no deaths	Nil	Nil	Nil. M.	Nil.	Prognosis is always favorable.
11. Total Duration	"Averages 6-7 days." S. 4-7 days. M.	5 complete days. B. C. 2-3 days. Exceptionally a secondary rise to 100° F. on 4th-6th day. R.	6 days	6-7 days. R.	Long Form—average 5½ days Short Form—average just over 2 days.	3-8 days. Wim. 7 days. F. 3 days. M.	1-8 days	3 days as a rule.
12. Incubation Period	1-3 days. M. & S.	3-6 days. May be 24 hours. B. C.	Averages 3 days 14 hours	.....	.....	Between a few hours and 5 days. M.	Average of 4 experimental cases, 4 days, 20 hours	5-7 days.
SYMPTOMS.								
13. Variability	"There is considerable variety in the symptoms of this disease in different places and in different epidemics." M.	Many rare symptoms and complications, but most cases were of one general type. B. C.	There is no one symptom that can be said to be pathognomonic, or even constant, if we except fever.	There may be considerable variations from the characteristic saddle-back temperature curve. R.	Considerable variation in degree of severity	"Great variability in the severity of the symptoms."	.....	The intensity of the disease varies greatly.
1st PAROXYSM.								
14. Onset	Almost always sudden, usually at night or early morning. S.	Usually sudden. Occasionally slight premonitory symptoms for one or two days before. B. C.	Usually rather sudden, but many cases have a gradual onset.	Almost always sudden. R.	Almost always sudden. Occasionally, malaise, etc., for a day or two before.	Usually sudden. M.	Usually sudden, but sometimes a few days' malaise	Sudden.
15. Rigor	"Sometimes a feeling of chilliness or even a smart rigor." M.	"Shivering is common during initial rise." B. C. "Chills, scarcely amounting to rigors." R.	Chilliness at times, but not usually	In 60% of cases, chilliness or rigor. R.	In 71%	May be a slight rigor or shivering. M. Not in the majority of cases. W.	Chilliness and slight rigors may be observed	Usually begins with a rigor.
16. General Condition	Profound prostration. M.	Prostration. B. C.	.....	Dull and listless expression. R.	Prostrated. Irritable	In some cases, extreme nervous prostration. W.	.....	Extreme prostration in some cases.
17. Temperature	To maximum in a few hours—102° to 104°. Usually remittent. S. Fever declines somewhat after the first day. In vast majority of cases ends by crisis about the end of the second day. M.	Rise to 102-103°, rarely over 104°. Falls on 3rd day, sometimes to normal. B. C. Descends by crisis to normal on 2nd or 3rd day. R.	Rises within 24 hours to maximum about 103°. Then begins to fall, may reach normal or 100°, 101° or 102° only.	Rapidly to maximum. Falls for a day or two, exceptionally to normal.	Rapid rise to 101° to 104°, maximum not long maintained. Duration of descent varies. Average duration 2½ days.	Within 24 hours, the temperature reaches its height, as a rule just below 104°. Then declines though the 2nd and 3rd days to normal. Sometimes a secondary rise takes place on 2nd day. M.	Rises to 103° in 24 hours. Then falls rapidly or gradually. Average duration 3 days 18 hours.	Rises very quickly; in a few hours it reaches 102-104°. Lasts 2-3 days.
18. Pulse	Averages 100-120, but often only 80-100. S.	"Not as a rule accelerated in proportion to the temperature." B. C. "Very rapid." R.	In general, the pulse follows the temperature fairly well, although the tendency to slowness is most apt to be manifested by a relatively small rise in pulse rates.	Rarely over 100	Usually slow, markedly so in some cases	Usually rapid but in some cases as low as 80-90 with a temperature of 103° or 104°. W. and M. Markedly reduced towards end of fever. F. and Wim.	Slow 70 to 80	Bradycardia, first noticed on the 2nd day and may remain for a week.
19. Headache	Severe. Usually frontal, especially supraorbital and in the eye socket. S.	Usually severe. Most commonly frontal or post-orbital.	In nearly every case. Frontal most frequent; post-orbital second.	Very constant. "Almost invariably frontal and frequently affecting the back of the eyes."	Constant. Frontal or post-orbital	Frontal and in the eyeballs. M.	Severe, chiefly frontal or behind the eyes	Occurs.
20. Loins Pain	"The muscular pains have their seat in the loins in particular." S.	"Severe pains in the loins." R. "Present in most adult cases." B. C.	Almost as frequent as headache.	Very constant	Practically constant and severe	Pain was specially referred to the lumbar region. W.	Rarely wanting	Severe pain in the lumbar region.
21. Other Muscular Pains	"Severe pains in limbs." M.	In many cases in limbs, especially calves. B. C.	Trunk and limbs. Varying severity. Fleshy calf is often very painful.	Almost as frequently as in back	Thigh muscles, and muscles generally	Often the muscles of the legs. W.	Pain in calves of legs rarely wanting	In the shoulder-blades and muscles of the calves.
22. Pains in Eyeballs	Occasionally pains in muscles of eyeballs. S.	Pain on moving eyes in some cases	Movement of the eyeballs is often a cause of pain.	Pains in the back of the eyes	Movements painful, sometimes tender to pressure	In muscles of eyeballs. W.	Eyeballs are sensitive to movements and gentle pressure. Joints are not swollen; pain is sometimes referred to the knees.	Pain in the eyeballs.
23. Joint Symptoms	"Some limb or joint is racked with peculiar, stiff, rheumatic-like pains." M.	Pain in joints well marked. R. The pains "are certainly not in the joints." B. C.	Joint pains frequent especially in knees.	Pains in joints in 7% of the cases	Muscles, tendons, etc., round a joint were sometimes painful and tender.	Aggravated by movement of eyes. M.	.....	.....
24. Breakbone Pains	Sometimes sharp pains in bones. S.	"The most characteristic symptom." R. "Have been observed but only in comparatively few cases." B. C.	Seldom	"In only one case (out of 200) were the bones specially mentioned as being involved."	Did not occur	.....	Not mentioned.	.....
25. Conjunctiva	Eyes much injected. M.	Suffusion is common at outset	Eyes injected and watery	Palpebral conjunctiva vivid red	Shuffed and congested	Conjunctiva injected and suffused	Eyes are bloodshot	Conjunctiva injected.
26. Face	Bloated and swollen. M.	.....	.....	Flushed	Puffy, particularly under the eyes	"Puffiness of the features." W.	Somewhat tumid. Features puffy.	.....
27. Rash	A vaso-motor reddening of the skin, most pronounced on face. S.	Flushing of face, sometimes spreading into the neck. B. C.	Skin much injected, especially head and neck	"The face is flushed"	Bright red flush over face and neck	Face flushed at start	Face deeply flushed	There are rapid changes in the colour of the skin.
Digestive System.								
28. Tongue	"Thickly coated in the middle and red at the tip and edges." S.	Often densely furred ..... may be clean and moist. B. C.	Heavy central fur, with red tip and edges	"Marked furring of the dorsum with red, raw edges."	Furred except at edges and tip	Furred except at the tip and edges. M.	Coated with a thin white fur, except at the tip and edges	Furred. A characteristic sign is a triangle of normal colour at the tip.
29. Appetite	Bad. S. M.	Complete anorexia. B. C.	Impaired or absent	.....	Lost	Anorexia is a prominent symptom. M.	Loss of appetite is constant.	.....
30. Taste	.....	.....	.....	.....	More or less lost	.....	Impaired.	.....
31. Nausea and Vomiting	At the start, in some epidemics. M.	Often, at all periods of attack. B. C.	In a few cases, always at onset	Both present in one-fourth of cases	At the start, in 9 cases	Vomiting in 8% of cases. M.	Nausea is frequent Vomiting in 2% of cases.	Vomiting occurs once only.
32. Constipation	.....	Constipation the rule! B. C.	Slight constipation as a rule	In 25%	In 50% of cases	Constipation is the rule. M.	Constipation is commonly observed	Usually starts with constipation.
33. Diarrhoea	.....	A few suffer from Diarrhoea. B. C.	In a few cases, at onset	In 25% but seldom severe	In only 2 cases	Occasional. M.	In 2%	Diarrhoea sometimes during defervescence.
34. Liver	.....	Not enlarged. B. C.	.....	.....	Never enlarged	No enlargement. M.	.....	.....
Nervous System.								
35. Insomnia	Sleep disturbed. S.	Common	Frequent	Only 6% had slightly enlarged livers. Probably not due to the disease.	Common	Occurs	.....	Even delirium may occur.
36. Delirium	.....	Not very often. B. C.	In three cases	Sleep troubled as a rule. M.	Never observed	Nervous symptoms are slight. M.	Occasionally noted	None found.
Blood Changes.								
37. Parasites	.....	.....	None demonstrable	An organism, apparently related to the coli group, was isolated by Rogers in six cases. Its relation, if any, to the causation of the disease is unknown.	None found	No organism met with. M.	None found	Serum did not agglutinate. B. typhosus, B. Paratyphosus A and B, or B, Gaertner.
38. Leucopenia	.....	.....	Marked. Average 3,800. Great relative increase of small lymphocytes.	Marked. Leucocytes number 2,000 to 4,000.	Present. Diminution of polymorphs	Total number of leucocytes diminishes. Usually an increase in mononuclear elements. M.	There is a moderate degree of leucopenia, some counts under 2,500.	Characteristic. Average 3,700.
39. Hemorrhages	Epistaxis may accompany defervescence. M	Epistaxis sometimes. Hemoptysis and hama-temesis rarely. B. C.	None observed.	.....	None observed	Epistaxis in 30% of cases. M.	Epistaxis seldom. Occasionally blood in faeces	Epistaxis common. Occasionally blood in stools.
40. Spleen	.....	Not enlarged. B. C.	.....	Was rarely enlarged	Enlarged in two of the cases, probably due to antecedent malaria.	Not enlarged	Not enlarged	Generally unchanged.
Respiratory system.								
41. Coryza. Pharyngitis	Often throat and mouth mucous membrane congested, perhaps with small erosions. M.	Absent. Sometimes moderate congestion of throat. B. C.	Not present	Conspicuously absent	Rare	Pharyngeal catarrh in 67% of cases. M. Catarrhal respiratory symptoms were rarely present. W.	No coryza. Sore throat rare	Often slight catarrh of nose and throat.
42. Bronchitis	Sometimes. S.	Conspicuously absent. Sometimes in those predisposed to bronchitis. B. C.	.....	Slight bronchitis in 4%	Occurred as a complication in 17 cases	In 17% of cases, usually as a complication. M.	None	None.
REMISSION.								
44. Duration	1-3 days. M.	A few hours. B. C. 2-3 days. R.	About 3 days	2-3 days. Sometimes absent	Averaged 1½ days	About 2 days in Wimberley's charts. 3-4 days. F.	.....	.....
45. Temperature	Normal	Normal R. Sometimes to normal. B. C.	Any point between normal and 102°.	Exceptionally normal	From normal to 101° F.	Sometimes normal; in other cases, only slight remission. F. Not to normal; descending gradually. Wim.	.....	.....
46. Other symptoms	Disappear except occasional twinge and giddiness	.....	Appetite returns	.....	Moderated somewhat	Diminished. F. Occurred "in many cases." Wim. "There is no return of fever." M.	A recrudescence of the fever on the fourth or fifth day has once or twice been charted.	Relapses may occur shortly after the previous access of fever, sometimes at so short an interval as 18-24 hours.
2ND PAROXYSM.								
47. Temperature	Slight fever, rarely rising to 103°, lasting a few hours	Reaches greatest maximum and lasts one or two days. B. C. Epileptical rise to 100° F. R.	Falls by crisis on 6th day	5th or 6th day. Marked rise and fall on 6th and 7th day.	From a few hours to 2 days. 1° to 3°	Constant. F. In 46% slight fever to 100° F. In others, high rise. 6th or 7th day. F. 6th or 7th day. Wim.	.....	.....
48. Rash	Rubeoloid, evanescent or may last 2-3 days. M. Very varied. Sometimes missing. S.	Minute red spots. 4th or 5th day. 50% of cases. Often evanescent. B. C. Papular. 5th or 6th day. Usually occurs. Often short duration. R.	"We think we have seen the rash in 75% of our cases." Sometimes very faint and ephemeral. Resembles that of measles but varies.	In 7%. Usually mottled	In one case	Never. M. In 8% of cases, a marked maculo-papular rash appearing about the time of the terminal rise. Wim.	.....	.....
49. Pulse	.....	May be more accelerated. B. C.	.....	Commonly about 80 or 90 only. After the fall, it may be 60 or less.	Slow	Markedly diminished. F. Wim.	.....	.....
50. Other symptoms	Pains return, sometimes more severe than at first	Marked aggravation of the pains. B. C.	.....	.....	Headache and pains persist	Increased headache. F.	.....	.....
51. Convalescence	Slow. Pains sometimes persist. S.	"General prostration often rather severe after an attack." B. C. "Often very slow." R.	In all our cases convalescence has been prompt.	Very rapid	Almost always rapid	Slow, and marked prostration after the attack. M. Rapid. Wim.	.....	Protracted convalescence.
52. Sequela	With most, "peculiar pains" persist for days or weeks. M.	Symptoms persist two or three days or perhaps longer after defervescence. B. C. After joint-pains may persist for long after convalescence.	Nil	Nil	Nil	"Few sequela were noticed." Wim.	No after-effects.	.....

## REFERENCES.

- (1) (a) Rogers, Leonard. "A Peculiar Influenza-like Fever prevalent in Calcutta." *Indian Medical Gazette* 1905, page 407.  
 (b) Rogers, Leonard. Text-book, "Fevers in the Tropics," second edition (1910).
- (2) "Report on an Epidemic of Dengue, consisting of both a Three-Day and a Seven-Day Fever type among the 15th Lancers at Sialkot, 1907." Lt.-Col. H. Fooks. *Indian Medical Gazette*, February 1908.
- (3) (1) (b) above, page 317.
- (4) "Indian Insect Life," by Maxwell-Lefroy, Imperial Entomologist to the Government of India.
- (5) Graham, Harris. *Journal of Tropical Medicine* (1903), Vol. VI, page 209.
- (6) P. M. Ashburn and C. F. Craig. "Experimental Investigations regarding the Etiology of Dengue Fever, with a general consideration of the Disease." *Philippine Journal of Science*, May 1907.
- (7) Doerr, R. "Ueber ~~in febrile~~ <sup>in febrile</sup> invisibles Virus," Ber. Klin. Woch., 12th Oct. 1908.
- (8) Megaw, J. W. D., Capt., I.M.S. "Is Calcutta Seven-Day Fever, a form of Dengue?" *Indian Medical Gazette*, November 1906.
- (9) McCarrison, R., Capt., I.M.S. "A Critical Analysis of the Etiology and Symptomatology of the Three-Day Fever of Chitral; and an Analogy between this condition and Dengue Fever."
- (10) Wakelling, T. S., Cairo. "On Fever caused by the Bite of the Sandfly (*Phlebotomus pappatasii*)" *B. M. J.*, 15th October 1910.
- (11) Manson, Sir P. V., Text-book, "Tropical Diseases," fourth edition, 1907, page 252.
- (12) Scheube, B., Text-book, "The Diseases of Warm Countries," page 38.
- (13) "Report on the Dengue Epidemic in Brisbane in 1905." *The Journal of Tropical Medicine*, 15th December 1905.
- (14) McCarrison, B., Capt., I.M.S. "The Three-Days' Fever of Chitral, a Contribution to the Study of the Unclassed Fevers of India." *Indian Medical Gazette*, January 1906.
- (15) Wimberley, C. N., Lt.-Col., I.M.S. "Dengue or Phlebotomus Fever." *Indian Medical Gazette*, August 1910.
- (16) (a) See (7) above.  
 (b) Doerr, R.; and Russ, V. K., "Weitere Untersuchungen über das Pappatacifeber." *Archiv. Schiffs-und Tropen-Hygiene*, XIII, page 693, 1909.  
 (c) Doerr, Franz and Taussig. "Das Pappataci Fieber," Vienna, 1909. Summarised in *Bulletin de l'Institut Pasteur*, Vol. VII, page 186.
- (17) (a) Birt, C., Lt.-Col., R.A.M.C. "Phlebotomus Fever in Malta and Crete." *Journal of the R. A. M. Corps*, February and March 1910.  
 (b) Birt, C., Lt.-Col., R.A.M.C. "Phlebotomus or Sandfly Fever." *B. M. J.*, September 24, 1910, page 875.
- (18) Gerrard, J. J., Lt.-Col., R.A.M.C. "Further Notes on Fevers in Malta." *Journal of the R. A. M. Corps*, October 1909.
- (19) Wall, F., Major, I.M.S. "Sandfly Fever in Chitral." *Indian Medical Gazette*, February 1911.
- (20) Summarised in "Fevers in the Tropics." (Rogers), page 242.
- (21) Charles Edmonstone. "Clinical Lecture on Dengue." *Indian Medical Gazette*, 1872, page 25.
- (22) James, S. P. A. Report on the Anti-malarial Operations at Mian Mir (1901-2). Reports of the Malaria Commission of the Royal Society.
- (23) Megaw, J. W. D., Capt., I.M.S. "Are 'Seven-Day Fever' and 'Three-Day Fever' forms of Dengue." *Indian Medical Gazette*, January 1909.
-

CALCUTTA :

PRINTED BY THACKER, SPINK AND CO.