

Original Articles.

A TYPHUS-LIKE FEVER IN INDIA,
POSSIBLY TRANSMITTED BY TICKS.By J. W. D. MEGAW, B.A., M.B.,
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INTRODUCTORY REMARKS.

IN a note in the *Indian Medical Gazette* of January, 1917 on "A Case of Fever resembling Brill's Disease," I referred to an unpublished report by Lt.-Col. (then Major) McKechnie, I.M.S., on what he believed to be typhus fever in Bhim Tal and Sat Tal. These places are small hill stations at a height of about 4,500 feet near Naini Tal in the Kumaon Division.

McKechnie's report contained a record of the observations made by him from July till October, 1913, during which time he was on special duty to investigate the fevers prevailing in Bhim Tal and Sat Tal.

My reference to the report was brief as I hoped that Lt.-Col. McKechnie would adopt my suggestion that he should publish an account of his very important work on these fevers.

About two years ago Lt.-Col. McKechnie proposed to write a paper on the subject, and asked me if I would add a note giving my own observations and opinions on the fever in question. To this proposal I readily assented, but as I have not heard further from him on the subject and as he is on long leave in England, it seems likely that he has not been able to carry out his intention.

The subject appears to me to be of considerable importance, and as Lt.-Col. Harvey and other experts with whom I have discussed the fever strongly supported my view that the essential facts ought to be published, I am taking the liberty of making a brief review of Lt.-Col. McKechnie's report, and of adding to this a statement of my own views on the fever.

It is quite impossible to do full justice to the report in a short note like this, and I still hope that Lt.-Col. McKechnie may be forced in self-defence to record his own observations in greater detail.

The importance of McKechnie's report is that it contains the only record known to me of a number of cases of what I think to be a previously unrecognized disease in India. For though I entirely agree with McKechnie that his cases were clinically undistinguishable from typhus, a disease which has been observed by a number of medical men in India, I think there is reason to believe that these cases should be classed with the Rocky Mountain spotted fever, a disease which differs very widely from typhus in its epidemiology though its symptoms very closely resemble those of typhus.

PART I.

REVIEW OF MAJOR MCKECHNIE'S REPORT ON
TYPHUS IN BHIM TAL AND SAT TAL.

Except when specially indicated, this part of the paper consists entirely of a brief statement of McKechnie's observations and conclusions, to a large extent in his own words.

The only previous systematic enquiry into the fevers prevalent in Bhim Tal and Sat Tal was made by Capt. Howlett, R.A.M.C., who was appointed in November, 1912, to enquire into the alleged prevalence of typhoid and paratyphoid fevers in European residents of these places.

Capt. Howlett failed to find any evidence of the existence of human carriers of these diseases among the indigenous native population, but little importance was attached to this negative result owing to the floating nature of the population and to the inherent difficulties attending on such an investigation.

McKechnie's special attention was directed to finding evidence of "enterica," and relapsing fever; the former being the accepted diagnosis of the cases previously seen, and the latter having been found to occur in Bhim Tal by Major Graham, I.M.S.

On his arrival, McKechnie at once found evidence that a small epidemic of relapsing fever had recently occurred among the Indian inhabitants of a row of huts in Bhim Tal. The nature of the disease had been placed beyond doubt by the finding of spirochaetes in three cases by Major Graham. Six persons out of a total population of 41 died, presumably of this disease, between the middle of May and the middle of June, 1913.

The infection appears to have been introduced by an old woman who came from Haldwani, a small town at the foot of the hills.

This outbreak appears to have been sharply limited, as no further evidence of the existence of relapsing fever could be found, though 130 blood films were carefully searched between the months of July and November.

McKechnie started his enquiry with the preconceived idea that the fevers of the place were enterica, this idea being the one universally prevalent up till that time.

Only once does the suggestion of typhus appear to have been made; this was by Mr. Hardy, I.M.D., in the case of a European lady of Sat Tal; but Major McKechnie scouted the idea on the ground that typhus is a disease of city slums, filth, overcrowding and bad ventilation and not at all the kind of disease that one would expect to find in a lady living in a cottage in the Sat Tal jungle, and Mr. Hardy at once recanted and took refuge in the diagnosis of paratyphoid A.

McKechnie's soliloquy on this incident is worth quoting in full: "Thus does authority browbeat us all, and obsessed as we are by *obiter dicta* and dogmas, which, though no doubt applicable to the circumstances under which they arose, are not necessarily of universal application, the tender shoot of truth attempting to rear its

head is blighted by the cold wind of tradition." At first it seemed that definite evidence was forthcoming that the disease was typhoid; this was due to a mistaken history of a Widal in one case and to a mistaken reading of the Widal report in another case, but when these misunderstandings were cleared up, it turned out that, out of 16 cases in which a Widal was done 10 or more days after the onset, only 4 gave a partial reaction in low dilutions, the rest being completely negative, "so that the considerable probability is that the majority of the 16 cases of continued fever were not enterica, though it is a reasonable probability that some of them were."

In 9 cases samples of from 2 to 5 c.c. of blood were cultured on fresh bile flasks supplied partly by Major Grattan, R.A.M.C., and partly by the Central Research Institute at Kasauli. These cultures were examined for the most part by Major Grattan, but in some cases also at the Research Institute at Kasauli.

In every case the cultures remained sterile, though from flasks belonging to the same batch cultures of paratyphoid A were obtained from the blood of patients belonging to another place.

It is obviously exceedingly improbable that any considerable proportion of the above cases should have been enterica.

Apart from the cases actually examined by Major McKechnie, the case sheets of all the enterica cases from Bhim Tal and Sat Tal which had been treated in the Ramsay Hospital in recent years were examined. There were 16 such cases from 1905 till 1912, all of them occurring between the months of May and October (the "season" at these hill stations is from April till October). Of these only three were prolonged beyond 18 days, and in two of the three there was a positive Widal reaction, while the third was clinically typical of typhoid. In the other 14 cases there was no record of the Widal reaction having been done. There were thus three cases in which the diagnosis of typhoid fever was highly probable; in the remaining cases there was no satisfactory evidence as to the nature of the disease.

Of 26 cases of fever in Bhim Tal and Sat Tal which could be studied the average duration of the fever was 12.6 days, a period which, while not exclusive of mild typhoid, is emphatically not exclusive of typhus.

Taking the evidence of the Widal reaction and the blood cultures, McKechnie concludes that the chances are very strongly against the majority of the cases having been enterica.

He discusses the possibility of malaria, cerebro-spinal meningitis, dengue, sand-fly fever, seven days' fever and other fevers, but finds that all of these can definitely be excluded so that "there were left only typhus fever, Brill's disease and the spotted fever of the Rocky Mountains among the continued epidemic fevers which did not yield blood cultures."

The following significant passage occurs:—

"As I have no acquaintance with the latter I

cannot eliminate it, and for all I know "Jhar" (the local name of the disease) and the Rocky Mountain fever may be the same, but it is necessary to state that there is some doubt as to the Rocky Mountain fever itself being an entity separate from the other two so that it can be left out of account for the purpose of this diagnosis. Thus, if "Jhar" is not in the main enterica, we are forced to the conclusion that it is in the main typhus or Brill's disease or some hitherto unclassified fever."

Reference is made to the difficulty of diagnosis between typhoid and typhus fever especially when the latter is not suspected. An account is also given of Brill's disease, Mexican typhus and Nicolle's experiments on the transmission of typhus from monkey to monkey by body lice.

The Sat Tal cases.

In the next part of the report some facts are stated in connection with 15 cases of fever which occurred at Sat Tal, but for various reasons no detailed examination of the cases occurring among Indians could be made.

Eight of the patients were Europeans and the charts of three of these are given (Charts I, II, and III); these are much more suggestive of typhus than of enteric.

The distribution of the disease in Sat Tal is remarkable. "There are only eight cottages, in every one of which one or more cases occurred in the two years 1912-1913."

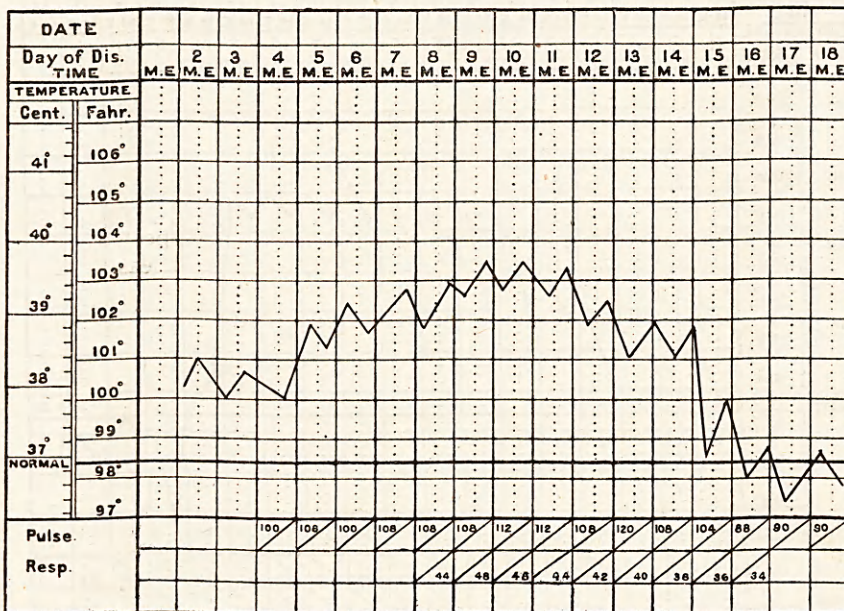
Evidence of typhoid carriers being present in Sat Tal was sought in a large number of servants and persons connected with the milk supply, but all gave negative Widal reactions even in low dilutions.

The Bhim Tal cases.

There were 21 cases in Bhim Tal, but only four Europeans had an illness which was clearly of the typhus type. One case, which was that of Col. McKechnie's daughter, aged 7½, is described in detail in the report. The temperature curve showed a rapid rise, a duration of 13 days with rapid lysis (see Chart IV). There was congestion of the face and eyes, photophobia, an extensive macular rash appearing on the 5th day and conspicuous on the 7th day; this consisted of numerous rose red spots and flat red blotches all over the body, except on the lower part of the front of the chest and the abdomen. The characteristic odour of typhus was present; there was bronchial congestion and rapid breathing. Blood cultures on the 5th day and Widal's on the 11th and 19th days were negative to the typhoid group. There was no obvious leucocytosis. The case which converted Col. McKechnie to the diagnosis of typhus was that of an Indian girl aged 13 called Ganguli, the last of the Bhim Tal series. Up till the occurrence of this case the outbreak had been regarded as one of the typhoid group in spite of the negative blood cultures, negative Widal's and the clinical features which were more in favour of typhus

CHART I.

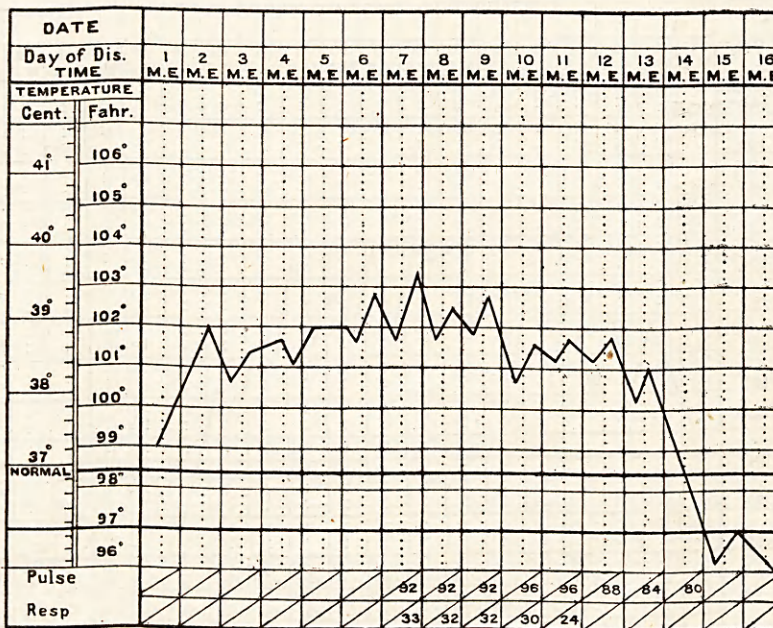
Sat Tal. Mrs. G. 18-8-13.



Notes.—Widal on 5th day. Negative to Typhosus.
 Widal on 31st day. Incomplete to Typhosus. 1 in 10. Negative in higher dilutions.
 Negative to Paratyphoid A and B.
 There were considerable congestion of the lungs, photophobia, and shrunken expression.

CHART II.

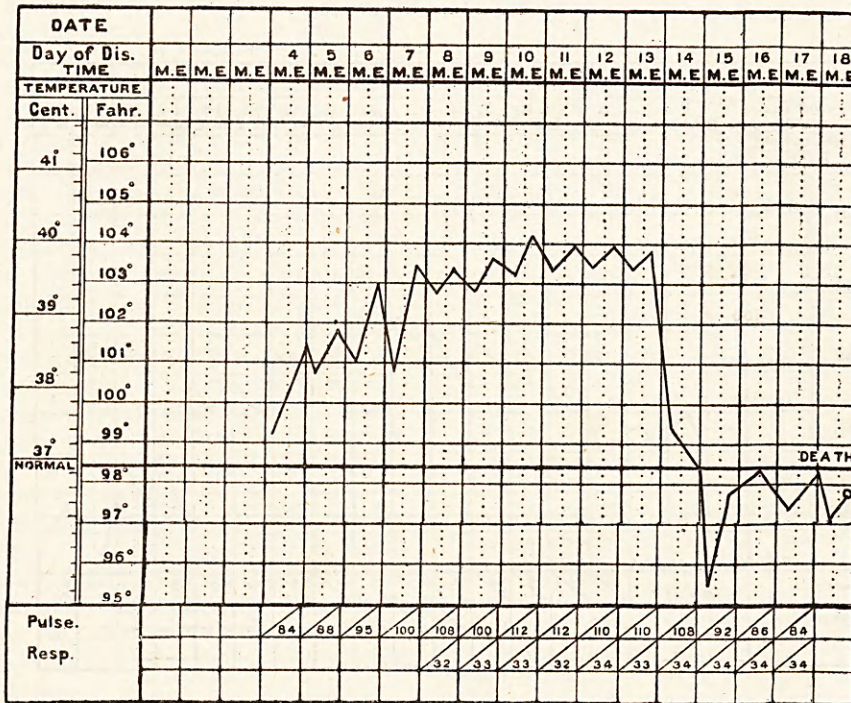
Sat Tal. Mr. N., aged 60. 7-9-13



Notes.—Blood Culture on 3rd day. Negative.
 Faint subcuticular mottling on 3rd day, photophobia. Flushed face, deafness. Shrunken expression. Rapid recovery.

CHART III.

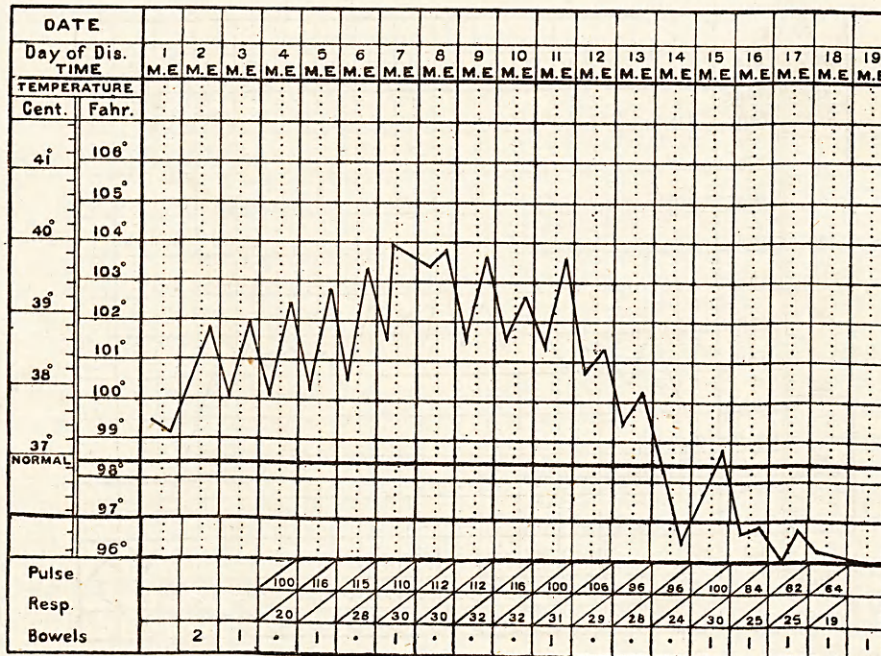
Sat Tal. Miss M. 21-8-13. A Fatal Case.



Blood Culture 4th day—Negative—No Widals. No Autopsy. A middle aged lady. Strong and active. Abundant spots on 5th day, becoming subcuticular. Great toxæmia from 6th day. Nearly died at crisis and never recovered consciousness.

CHART IV.

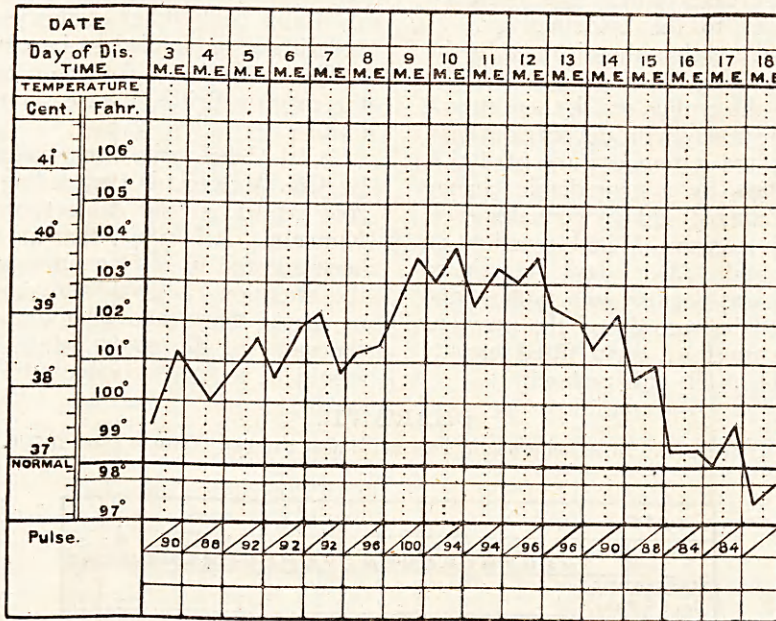
Bhim Tal. Barbara McK., aged 7½. 1-9-18.



Blood cultures on 5th day, negative. Widals on 11th and 19th days. Negative to Typhoid and Para. A and Para. B. No marked leucocytosis. Sudden recovery. See text for details of this case.

CHART V.

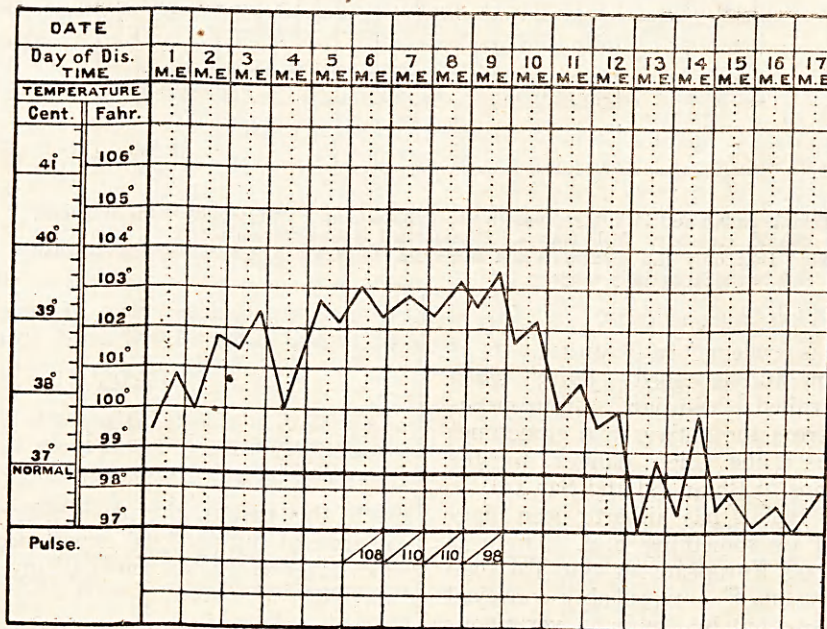
Bhim Tal. Mrs. M., aged 55: 31-7-13.



Widals on 17th and 38th days, both negative. Rapid recovery. Macular rash on chest, back and abdomen, not disappearing on pressure, when seen first by Lt.-Col. McKechnie on 10th day. Face swollen.

CHART VI.

Bhim Tal. Indian Cook: 16-8-13.



Blood Culture 4th day, Negative. Widals on 10th and 25th days. Negative to Typhoid and Paratyphoids. Rapid recovery. Except for a few rose spots no rash could be detected on the dark skin. Bronchial congestion. Condition good throughout.

than of typhoid. "After seeing her (Ganguli), I simply had to revise my notion and then I found that the only thing against my thinking of typhus for other cases which had occurred was my obsession as to the epidemiology. If some of the cases were typhus then it must be the *obsession* that was wrong."

In Ganguli's case the typhus smell, the extreme prostration on the 13th day with unconsciousness, distended abdomen and a temperature of 103.8, followed in two days by a remarkable change for the better and almost sudden convalescence, and the completely negative Widal reaction on the 13th, 17th and 23rd days convinced McKechnie that he was dealing with typhus, and then a reference to the records of the previous cases showed that most of them fitted exactly with typhus and not at all with typhoid.

reasoning; it requires the further support of the experimental method.

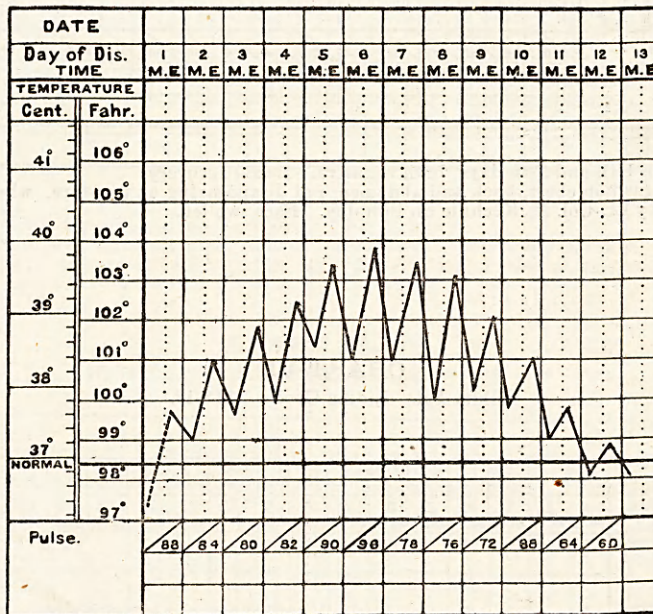
"The far-reaching importance of the subject *per se* and in relation to the still obscure fevers of India and other countries, demands that experiment be applied to its elucidation.

The methods of Anderson and Goldberger in the case of Brill's disease should be followed at first."

It has been quite impossible to do justice to Lt.-Col. McKechnie's exceedingly interesting and able report on the subject of typhus fever in Kumaun. It is a pity that his work should have been allowed to remain unrecognized, except for the attention called to it by myself. A number of maps, charts and photographs greatly add to the value of the report which if suitably edited, would be a very valuable addition to the litera-

CHART VII.

My own case. Infection probably contracted near Sat Tal. Date of onset 21-7-16.



Widals on 9th and 11th days, negative to Typhoid and Paratyphoids in all dilutions.
 Rapid recovery. Mild course. Pronounced typhus-like rash.
 Note that only the maximum and minimum temperature of each day are recorded, hence the large daily range.

McKechnie's Conclusions.

Typhus fever is endemic in Kumaun. It is usually subvirulent and is called "Jhar;" when virulent it is called "Sunjar." Europeans contract typhus from the natives and sometimes die of it. Typhus is the chief danger to the health of Europeans in Bhim Tal and Sat Tal.

In this locality typhus has hitherto been diagnosed as typhoid or something else. There is more typhus among Europeans at Sat Tal than at Bhim Tal. Typhus is not probably conveyed by dipterous insects, but by human verminous ectoparasities (fleas or lice or bugs are suggested).

The conclusion that "Jhar" is typhus is based on exclusion, clinical observation and inductive

ture of the typhus group of fevers. Six charts of typical cases are extracted from the report.

PART II.

PERSONAL EXPERIENCE AND VIEWS ON THE TYPHUS-LIKE FEVER (? TICK TYPHUS) OF KUMAON AND OTHER PARTS OF INDIA.

In this part of the paper will be given a brief résumé of my personal experience of the typhus-like fever and a statement of my views as to its nature.

My Own Attack.

My attention was directed to this fever by an attack from which I suffered in July 1916 (see Chart VII).

It is not necessary to go into details of my personal observations as they can be found in a note written by me in the *Indian Medical Gazette* of January, 1917.

Only a brief recapitulation will be given in which one or two fresh points will be introduced.

The salient points connected with the attack were:—Between the 29th June and the 2nd July, 1916, I travelled by motor from Almora to Lucknow halting at Bhowali from the morning of June 30th till the morning of July 1st. I was accompanied by my wife, who occupied the same room at the bungalow and so was living under the same conditions as myself. We spent several hours of the afternoon of June 30th picnicking in the forest between Bhowali and Sat Tal, and while there, we were about a mile and a half from Sat Tal and about two miles from Bhim Tal. Next morning, July 1st, I found a tick firmly fastened on my neck, but as the idea of any disease being conveyed by the tick in India did not occur to me, no trouble was taken to preserve or identify the tick, which was probably *Rhipicephalus sanguineus* or *Hyalomma ægypticum*. My wife was not bitten by a tick, and, so far as we know, the only other animals that attacked us on our trip were sandflies, by which we were bitten at Mujhkhal, on the night of the 29th June. We travelled quite alone throughout the journey and we came very little in contact with the people of the places through which we passed. On July 21st, I was attacked by fever, which showed a step-like rise and looked like typhoid fever until the 5th day when a diffuse macular erythematous rash was observed all over the body, including the palms and the soles; on the hands the rash appeared early.

The rash became brownish red and petechial within two days and faded with the fall of the temperature which occurred by lysis ending on the 12th day, but a brown staining was visible at the sites of the spots for about 5 weeks after the fall of the temperature.

The spots were about 3 to 7 millimeters in diameter, and their number may be estimated from the fact that over the front of the right thigh 21 definite spots were counted. Except for malaise, supraorbital headache, weakness and pain in the back, there were no special symptoms. At the height of the fever there was a slight degree of lethargy. The pulse was relatively slow, being over 90 on only one occasion, though the temperature varied between 101° F. and 103° F. for 3 days at the height of the fever. Convalescence was rapid; I was able to get up on the 13th day, and on the 14th I left Lucknow for a few days' rest in the hills and returned to duty 9 days after the temperature became normal.

The Widal reaction to typhoid and the paratyphoids was completely negative on the 9th and 11th days.

On the 11th day, the leucocytes were reported as 15,400 per c. mm. the differential count showing nothing special. No malarial parasites

were found and no quinine nor other special drug was taken. Owing to my being the victim, it was not possible for me to make a complete investigation of the case, but throughout the attack I was able to take an active interest in the course of the fever. At first it was naturally supposed that the fever belonged to the typhoid group, but when the spots appeared, the resemblance to the Rocky Mountain fever suggested itself to me and then the possible significance of the tick bite near Sat Tal naturally occurred to me. The next steps were to read as much as was available of the literature of the similar fevers and to get Major McKechnie's report on the fevers of Bhim Tal and Sat Tal. The fact that McKechnie had investigated the fevers of these places was known to me, but I had not seen his unpublished report nor did I know the conclusions that had been arrived at by him. On reading the literature, it was evident to me that my attack showed a close clinical resemblance to McKechnie's cases (regarded by him as typhus) to typhus, to Brill's disease, to the spotted fever of the Rocky Mountains, to McNaught's cases in South Africa and to the "macular fever" of Tunisia. All these diseases show a close resemblance to each other clinically, indeed the more one reads the literature the more difficult it becomes to find any reliable points on which to base a differential diagnosis between them.

The importance of McKechnie's work was at once evident to me, and though only a brief reference was made to it, the hope was expressed that he would publish his report which gave the first clear account of the fever as it occurred in India. My conclusions were the same as those reached by McKechnie in so far as the placing of the fever in the typhus group was concerned, but I differed from him with regard to the important question of the probable epidemiology of the disease.

Discussion of my attack of fever.

My own case did not at first sight fit in completely with the typhus group; the gradual onset, the absence of nervous symptoms and the fall by lysis did not correspond to the existing text-book descriptions of typhus; also the persistence of the brown staining after the fading of the rash was not described in the books. My previous experience of the misleading nature of text-book accounts prevented me from falling into the error of regarding these as safe guides. Text-books often lay special stress on one type of a particular disease and do not take into account the great variations that occur.

It is interesting to note that recent descriptions of typhus (*e.g.*, Shattuck) show that the fever often begins gradually, often falls by lysis, and in the milder cases nervous symptoms are often slight or absent.

The staining that persists long after the rash has faded is also referred to by some recent writers.

The one remaining difficulty in accepting my view as to the nature of the attack of fever from which I suffered is the long incubation period as compared with that of typhus and Rocky Mountain fever, the maximum for typhus being 15 days and that for Rocky Mountain fever being 12 days (Wolbach). It is not easy to assess the importance to be attached to the statements of the incubation periods of diseases like typhus, and great doubt is thrown on the reliability of these by the experiments of Nicolle, who found that the incubation period of experimental typhus in guinea-pigs is from 5 to 21 days and in monkeys from 5 to 24 days.

In the case of my own attack, in spite of the unusually long incubation period, the balance of evidence appears to me to be very strongly in favour of the infection having been contracted in the neighbourhood of Sat Tal where the fever was common. The other alternative is that I contracted the disease in Lucknow, where no other cases of such a fever have ever been observed.

My attack resembled in every detail the milder forms of the fever described by McKechnie, note for example the correspondence of the temperature curve with that shown in Chart IV, the similarity of the eruption and the sudden recovery. I may mention that within two days of the fall of the temperature I walked three miles without fatigue. The chart of my case shows a greater daily range of temperature than is usual, but this is largely accounted for by the fact that the temperature was taken very frequently and only the extreme upper and lower limits for each day are shown on the chart. It is likely that a much greater daily variation of temperature occurs in typhus fever than is shown by charts in which the temperature is recorded at two fixed hours each day.

The most important of the suggestions made by me in connection with the fever were:

(1) The disease probably belongs to that form of typhus-like fever in which is included the spotted fever of the Rocky Mountains.

(2) The disease is probably conveyed by a tick or by some biting insect from man to man or from another animal to man.

I must at once point out that I was probably wrong in suggesting that Brill's disease was the same as this fever. The mistake was due chiefly to my not having access to a satisfactory account of Brill's disease, which is of course now regarded as a mild form of louse-borne typhus occurring chiefly in New York. It has no epidemiological relationship whatever with the Rocky Mountain fever which is tick-borne and occurs among isolated country dwellers.

The general argument is not affected by this mistake which affects Brill's disease and not the fever of Kumaon. My views as to the epidemiology of the Kumaon fever and as to its probable relationship to the tick-fever of the Rocky Mountains have been strengthened rather than

weakened by further experience and study of the evidence.

It now appears to me to be unlikely that the disease is conveyed from man to man, the alternative suggestion that it is conveyed from an animal to man being much more probable if the tick proves to be the carrier.

In this connection, however, the account of *Ornithodoros savignyi* by Patton and Cragg must be borne in mind; they say that "this tick is common in some of the third class waiting sheds on the South Indian Railway. In South India it is said to cause a particular kind of fever, but there is no reliable information on this point."

Evidence of the existence of the disease elsewhere in India.

As a result of the publication of my note, the following further cases were reported to me:—

(1) Three cases by Lt.-Col. Chapman, I.M.S., Civil Surgeon of Nagpur, two of which occurred in persons living in plague huts.

(2) A case reported by Col. Hardy, R.A.M.C., of a European soldier at the Station Hospital, Cawnpore, on the 3rd November, 1912.

This was undoubtedly a case of the same kind and was regarded by him as being of the same type as Brill's disease and McNaught's disease of South Africa. Unfortunately, no record of the man's previous movements could be obtained, he might have come from Bhim Tal for all that was known, and on the other hand his disease may conceivably have been louse typhus.

(3) A case seen subsequently by Lt.-Col. Sprawson, C.I.E., I.M.S., in consultation with Major Brodribb, I.M.S., at Bangalore. Col. Sprawson had seen me towards the end of my illness and he was at once struck by the resemblance between the Bangalore case and mine.

In this case there was a history of a recent bite by a tick which might have come from a dog or from some cattle which were in the compound. Col. Sprawson wrote to me as follows:—

"Major Brodribb remembered to have seen an exactly similar case in a General there a few years ago. With these two cases in Europeans doubtless there are many more among Indians."

Is a tick responsible?

McKechnie's account and my own experience of the fever satisfy me that it belongs quite definitely to the typhus group, so the only point that will be discussed is as to whether it is likely to be louse-borne or tick-borne.

This point is of the greatest importance, as the steps to be taken to eradicate the disease will depend entirely on whether the louse or the tick is the carrier. If the tick is the carrier, steps directed against the louse will utterly fail to eradicate the disease.

The following facts and arguments are stated with the acknowledged object of making a *prima facie* case against the tick, in the hope that some

one who has the opportunity may be induced to investigate the disease, keeping in view the possibility that the tick may be responsible.

Some points which favour the tick hypothesis are:

I. The occurrence of a bite by a tick within the infected area in my own case. This tick fed on me for not less than 14 hours and not more than 20 hours. My wife, who was exposed to exactly the same conditions in other respects, was not bitten by a tick and did not suffer from the fever.

II. In the only other case that occurred subsequently and was reported to me, *viz.*, that seen by Lt.-Col. Sprawson, there was also a history of a bite by a tick.

III. The very similar fever of the Rocky Mountains has been proved to be carried by a tick.

IV. The fact that all the reported cases in India appear to have occurred under conditions in which tick bite would be very likely to happen.

Sat Tal was more severely affected than any other place. In Sat Tal the cottages occupied by visitors during the season are situated in the dense jungle, each having only a very small clearing round it. The residents are thus brought into close association with the animals of the jungle, and so with the ticks that are parasitic on them.

Sat Tal is a small hill station at a height of about 4,500 feet and is situated by the side of a small lake.

Bhim Tal, which is only about two miles distant from Sat Tal, is also situated on the shores of a lake, but while one part of the station consists of houses scattered in the dense jungle in the same way as the houses of Sat Tal, the other part is situated on cleared land. So far as I can make out from Lt.-Col. McKechnie's report nearly all the cases of the fever in Bhim Tal occurred among the people living in the "jungly" part of Bhim Tal.

Only four cases were seen by McKechnie among the Europeans of Bhim Tal; one of these was a lady who "had been for a fortnight's shoot ten days previously and had roughed it," so it is evident that she had been in close contact with the jungle within the probable incubation period.

Two of the others were children, one of whom is known to have roamed about constantly in the scantiest of clothing, and it is likely that the other child may also have wandered in the woods.

The apparent freedom of the neighbouring military encampment which is surrounded by cultivated land is worth noting, so is the freedom of Naini Tal, a large hill station a few miles distant from Bhim Tal and Sat Tal but at a height of about 6,500 feet and upwards. Naini Tal is a large highly developed summer resort, in which the conditions of life are much less primitive than in the smaller stations and the people are not brought into close contact with the life of the woods to any great extent.

V. The incidence of the disease appears to be quite different from that of diseases which are known to be carried by lice. It seems hardly conceivable that a louse-borne disease should have attacked one or two of the inhabitants in each of eight separate cottages and that the cases should have been spread over a period of two years without any obvious connection between the individual cases. Lt.-Col. McKechnie at first could not bring himself to consider the possibility of typhus under the conditions prevailing among the Europeans in Sat Tal, and in the end he was forced to the conclusion that he was dealing with typhus, only by the strongest clinical evidence.

It seems to me that if he had not regarded Rocky Mountain fever as being probably identical with typhus, he would have found that his difficulties in connection with the epidemiology of the disease were cleared away.

As it was, he was absolutely forced against his will to the conclusion that the disease was typhus, and having formed this conclusion he quite properly argued that the epidemiological evidence was not strong enough to combat the evidence in favour of typhus fever.

VI. Another very strong point is the fact that the disease appears to be strictly confined to certain localities year after year. If the disease were due to human-borne lice, it is hardly conceivable that it should remain localised in this way, as the Indian inhabitants of the affected places are migratory to a degree.

VII. The remarkable freedom of Europeans from louse-borne relapsing fever, though this is known to be very common in many places in Kumaon and elsewhere in India, appears to indicate that louse-borne infections are not readily communicated to Europeans who live under hygienic conditions such as occur at Sat Tal and Bhim Tal.

Against the tick being the carrier is the fact that neither McKechnie nor any other previous observer in India appears to have found any evidence of tick bite, but it must be remembered that no one seems to have thought of the tick. It is quite possible that previous tick bites may have been ignored by the patients and it is almost certain that enquiries regarding their occurrence were not made by the doctors.

It is not suggested that the tick has been *proved* to be the carrier of the disease, but only that a strong *prima facie* case has been made against it.

What Name should be given to the Disease?

Though it is premature to attempt to make a final classification of the disease, it is necessary to give it a provisional name. There is always a temptation to give a new name to a disease that has been found to exist in a place in which the condition was not known to exist previously, but such a course is justifiable only if there is definite evidence that the disease in question is *different* in some essential respect from all the recognised diseases.

If the Kumaon fever should turn out to be carried by the tick, there will remain no important point by which it can at present be distinguished from the tick-fever of the Rocky Mountains, and so it will naturally have to be classified provisionally with that disease, but, of course, the name "Rocky Mountain fever" will not be applicable to a disease which occurs in the Himalayas and other parts of India.

If it turns out to be the same disease it will be one further example to show the unsuitability of introducing the name of a place in the designation of a disease, and it will be necessary to change the existing name of the Rocky Mountain fever in such a way as to allow of the inclusion of cases of the disease which occur in other localities.

The whole subject would be greatly simplified if we were to group together all the fevers which are clinically undistinguishable from typhus under the term "typhus" or "typhus group" and then subdivide the group according to the arthropod carrier of each type of the disease.

Should further investigations show that the disease differs in some essential respect from all the recognised diseases of the typhus group, it will be time enough to add a new name to the nomenclature of disease, but in the meantime it is important to avoid unnecessary additions to the existing lists.

Acting on this principle, the provisional classification of the typhus group of diseases will be as follows:—

Provisional Classification of the Fevers of the Typhus Group.

TYPHUS GROUP.

I. LOUSE TYPHUS.	II. TICK TYPHUS.	III. MITE TYPHUS.
A louse-borne disease of filth, crowding, poverty, etc.	A disease of open air life in the wilds.	A disease of recently flooded places.
A. Severe typhus (mortality high).	A. Rocky Mountain fever	A. Tsutsugamushi (high mortality—up to 55 per cent.)
B. Mild typhus or Brill's disease (mortality low).	1. Montana type (high mortality—60 per cent.) 2. Idaho type (low mortality—48 per cent.)	B. Sumatra tick typhus (low mortality).
C. Tabardillo or Mexican typhus.	B. (?) Tick typhus of Kumaon and other places in India (low mortality—about 5 to 10 per cent.)	

It has now been proved by Wolbach that the virus of louse-borne typhus and of the Rocky Mountain fever are very closely related to each other, and his account of the two diseases shows that clinically they are almost undistinguishable

from each other; such differences as there are do not appear to be sufficient to justify their being placed in two separate groups, and if to the one is prefixed the name of the louse and to the other the name of the tick, there can be no possible confusion from the application of the name typhus to both. Even if it is proved that the two diseases are due to two distinct but closely related organisms, I am sure that the emphasis laid on their relationship would be a great advantage, from the point of view of the medical man and the medical student who will be able to obtain a clear mental picture of the diseases instead of being confused by a multiplicity of names and of descriptions.

When our knowledge of the disease becomes more complete, it will be possible to make a final scientific classification of the diseases, but in the meantime it is important that our provisional classification should be as helpful as possible to the student of the diseases.

Possible Human Origin of Tick Typhus.

Should further investigation show that the Kumaon typhus is essentially similar to the tick-fever of the Rocky Mountains, the question will naturally be asked as to how these two similar fevers come to exist in such widely separated places as the Rocky Mountains and the Himalayas.

One possibility is that the disease among animals has a world-wide distribution and has only affected human beings under exceptional conditions, such as prevail in the wilds of the Rocky Mountains and the Himalayas.

Another is that both of these fevers may have originated from human typhus and that the animals in the infected localities have become infected through ticks which had fed on human beings suffering from typhus.

The disease would thus have spread from its source, possibly in Europe, by human lines of travel eastwards and westwards.

Wolbach's remarkably complete and convincing reports on Rocky Mountain fever and typhus have made it clear that the virus and the essential pathology of these two diseases are remarkably similar in these respects resembling the clinical manifestations of the diseases. His latest work suggests that experimental animals show some differences when inoculated with Rocky Mountain fever virus as compared with those inoculated with typhus; whether these differences are of degree rather than of essential kind is not yet clear, and so far as human beings are concerned the organisms and the pathology appear to be remarkably similar.

In both cases Rickettsia-like bodies are uniformly found, and in both cases there is an endangitis, especially of the peripheral vessels.

There is no account of any attempt to test whether typhus immunises against the Rocky Mountain virus, but it is possible that Wolbach may already have carried out experiments on

these lines just as he did in the case of the Mexican typhus.

The extreme variability in the virulence of typhus and of the Rocky Mountain fevers is well known, and it might be suggested that the highly fatal Mountain fever may have originated from virulent typhus, while the milder Idaho fever may have come from the "Brill's" type of typhus which is widespread in New York, and which has so low a mortality that its identity with typhus was for some time unsuspected.

It is, perhaps, more likely that the two types of Rocky Mountain fever have had the same origin and that the difference in virulence is due to some unknown factor connected with the animals which are the reservoirs of the diseases.

Speculations as to the origin of these fevers are of no great practical importance, except for the possibility of animals in hitherto unaffected places becoming infected in the future in the same way as the rats of India and other countries have become infected with plague in recent times.

The point of immediate importance is to determine the means by which the virus of the Kumaon fever is conveyed to human beings so that some steps can be taken to convert the affected places into health resorts instead of plague spots which they are at present.

The methods of prevention that have already proved successful in controlling the fever of the Rocky Mountains are:—

1. Avoidance of the tick bite.
2. Careful examination of the body after exposure to the risk of tick bites. If the tick is removed within two hours, there is little risk of infection being conveyed.
3. Thorough removal of ticks from dogs, cattle and other domestic animals at frequent intervals, either by hand-picking or by "dipping."
4. Avoidance of the places known to be foci of the disease.
5. Poisoning the small mammals of the jungle, as these are likely to be the reservoirs of the disease.

Of the above precautions, the first two are easy to put into practice by people who visit infected localities, and it would be in the interests of the proprietors of the cottages in Bhim Tal and Sat Tal to carry out the removal of ticks from their cattle and other domestic animals.

Summary.

I. McKechnie's investigations have shown that a fever clinically similar to typhus exists in Sat Tal and Bhim Tal. He found it hard to reconcile the occurrence of typhus in these places with what is known of the epidemiology of typhus, but he was forced to the conclusion that the disease was really nothing but typhus.

II. My personal experience and a consideration of the available evidence have led me to form a strong suspicion that the disease is one affecting the animals of the jungle and that it is conveyed to man by a tick, and that the disease is either

the same as Rocky Mountain fever or at any rate closely related to it.

III. The disease is probably widely distributed in India and other parts of the world, but remains unrecognised because of its superficial resemblance to typhoid fever.

IV. Systematic research by a medical entomologist and pathologist is urgently needed to clear up the doubtful points in connection with the disease, which will probably be easily preventible when the source of infection is demonstrated.

V. In the meantime it would appear to be worth while to take precautions against tick bite in the affected localities on the lines that have proved successful in the Rocky Mountains.

A NOTE ON THE TWELVE-DAY FEVER OF NIGERIA.

By J. W. D. MEGAW,

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IN the number of the *Journal of Tropical Medicine and Hygiene* of July 1921, there is an article by Dr. Wynne Davies and Mr. Johnson, F.R.C.S., of the West African Medical Staff; this is entitled "Notes Upon the Occurrence of a Twelve-Day Fever of Dengue Group in Nigeria."

By a curious coincidence this article came to my notice just after I had sent to the press the foregoing note on "A Typhus-Like Fever seen in India."

The fever described by Davies and Johnson shows so great a resemblance to this fever that a short note regarding it will be a fitting supplement to my article.

The following is a brief summary of the authors' description of the Nigerian twelve-day fever:—

"The fever occurs during the months of July to October, is of twelve days' duration, and shows many similarities to dengue fever. There were 15 cases in Europeans and 3 in natives.

The prominent symptoms were fever, rash, intense headache, insomnia, muscular pains and pain or weakness in the back. The illness was severe with prolonged convalescence, but no fatal cases occurred.

Summary of Symptoms.—Pyrexia with rapid onset or rapid step-like rise (as shown by the charts; the authors' statement is "not sudden").

Duration.—Ten to thirteen days, ending by lysis; the maximum temperature is reached in five to seven days.

Pulse.—Slow for the degree of pyrexia.

Rash.—Rubeolar, slightly raised, all over body, profuse, never hæmorrhagic, appears on fourth to sixth day, lasts for two weeks, and is visible though faded for several weeks.

Digestive System.—Anorexia and constipation.

Urine.—Slight albuminuria, appearing on the second to the fourth day and clearing up during convalescence.