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General Secretary for India and the East,  
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## Original Communications.

### PROPHYLAXIS IN MALARIAL FEVERS.

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Fort Tregear, Lushai Hill Tracts.

THE following observations extend over a period of five months, from 1st May to 30th September 1890, and include the two seasons of the year when malarial fevers are most prevalent in Lushailand, *viz.*, (a) just before and at the beginning of the rains; (b) towards the close of the rainy season. From Fort Tregear (altitude 5100 feet), a guard composed of 14 riflemen and 2 non-commissioned officers belonging to the 2/2 P. W. O. Gurkhas, was sent twice a month to the post in the Kolodyne River Valley (altitude 800 feet), distant from Fort Tregear about 11 miles. Thus, each man was exposed to great heat and highly malarious conditions for 16 days,—before and after which period he lived at Fort Tregear, where the climate is healthier, colder, and less malarious. Each man was inspected at Fort Tregear prior to his going to the Kolodyne, and again after his return. During his stay in the valley he was under the care of a hospital assistant, and for a fortnight after his return he was watched at the fort. Therefore, each man was under observation for one month.

Table I.

It was discovered that the men of the 1st

Date of admission into Hospital for—				
May.	Intermittent Fever.	Remittent Fever.	Diarrhoea.	Total.
17	5	2	..	7
18	1	..	1	2
19	1	..	..	1
21	2	..	..	2
Total..	9	2	1	12

being slight and the duties light, they did not apply for admission into hospital. It is to be noticed that most of the admissions occurred on the day after their return to Fort Tregear, and that all the men of the guard who became ill were admitted during the first week after their

return. No prophylactic measures were adopted for this guard.

Table II.

It was discovered that both 1st and 2nd

Date of admission into Hospital for—			
June.	Intermittent Fever.	Remittent Fever.	Total.
3	6	1	7
4	6	..	6
Total ..	12	1	13

Guards were in the habit of bathing in the river, and of paddling about in boats or on rafts during the hottest part of the day. This was put a stop to in the case of subsequent guards. A good many of the 2nd Guard suffered from fever while at the Kolodyne; but they merely got medicine as out-

patients. It is to be remarked that all of the 2nd Guard, who were admitted into hospital, became ill very soon after their return. In one case of intermittent fever the spleen was much enlarged. No prophylactic treatment was given.

Thus, it will be seen that out of the 32 men of the two guards for the month of May 25 men were ill. Twenty-four of them or 75 % suffered from malarial fevers, *viz.*, 21 from intermittent and 3 from remittent fever. All cases came to hospital during the first week after their return to the fort.

Table III.

Date of admission into Hospital for—			
June.	Intermittent Fever.	Remittent Fever.	Total.
18	1	..	1
20	3	..	3
21	1	1	2
22	1	..	1
23	1	..	1
Total ..	7	1	8

Very few of the 3rd Guard had fever during their stay at the Kolodyne. This improvement may probably be attributed to an intelligent havildar, who took good care of his men and carried out all orders concerning water-supply, exposure to heat or chill clothing, &c. No prophylactic treatment was used.

Table IV.

Date of admission into Hospital for—			
July.	Intermittent Fever.	Remittent Fever.	Total.
4	2	..	2
5	1	..	1
6	2	..	2
7	2	..	2
8	1	..	1
9	1	..	1
10	3	..	3
11	1	..	1
Total ..	13	..	13

Among the 4th Guard there was no admission for remittent fever, but the intermittent fever assumed a more severe type than formerly. The temperature rose rapidly to a greater height; but fortunately the pyrexia proved amenable to antifebrin. The following temperatures were noted:—

One case 103.4°F.; one case 103.8°F.; three cases 104.0°F.; one case 104.2°F.; two cases 104.4°F.; and one case 105.0°F. In one case of intermittent fever the spleen was much enlarged. No prophylactic issue of quinine was made.

Thus, out of 32 men of the guards for June, 21 or 65% were admitted into hospital, and 20 were cases of intermittent, while 1 was remittent in type. The majority of the sick for both guards for June were admitted during the first week after their return, and the admissions were more scattered, *i.e.*, fewer were admitted on any single day. Whereas, in May, the admissions tended to be more *en masse*, owing to previous illness while at the Kolodyne post.

Table V.

On inspection of the 5th Kolodyne Guard

5th Kolodyne Guard of 16 men from 1st to 16th July.				
Date of admission into Hospital for—				
July.	Intermittent Fever.	Remittent Fever.	Total.	
18	2	..	2	
19	2	..	2	
20	4	..	4	
21	1	..	1	
22	1	..	1	
Total ..	10	..	10	

after their return half a dozen of the men who looked most sickly were ordered 5 grains sulphate of quinine daily for five days. In this case also there were no admissions for remittent fever; but the temperature was uniformly high in the intermittent fever cases. In several cases the thermometer recorded temperatures of 104.0°F. and over, and in four cases the temperature rose to 105.0°F. or over, *viz.*, one case 105.0°F.; two cases 105.2°F.; and one case 105.4°F. In four cases the spleen was much increased in size.

Table VI.

Of the 6th Kolodyne Guard, six men, who

6th Kolodyne Guard of 16 men from 16th to 31st July.				
Date of admission into Hospital for—				
August.	Intermittent Fever.	Remittent Fever.	Total.	
1	1	..	1	
2	2	..	2	
6	1	..	1	
10	1	..	1	
Total ..	5	..	5	

looked ill on their return, were given 5 grains of quinine daily for a week. There were no cases of remittent fever nor of enlarged spleen. One man had a temperature of 105.2°F., and the general run of temperatures was high. Among the 32 men of the two guards for July, there were 15 admissions for intermittent fever, *i.e.*, 46%. This improvement may be attributed to several causes,—*e.g.* (a) The climate being less unhealthy after the rains were in full force; (b) the barracks, &c., at Fort Tregear rendered more habitable, fewer hardships; (c) greater precautions taken against exposure to malarial influences; (d) quinine issued to the men who looked most in need of it after their

return to Fort Tregear; but not enough quinine was given, nor was it begun soon enough.

Table VII.

The 7th Kolodyne Guard received prophylactic treatment. The

7th Kolodyne Guard of 16 men from 1st to 16th August.				
Date of admission into Hospital for—				
August.	Intermittent Fever.	Remittent Fever.	Gleet.	Total.
18	..	..	1	1
24	1	..	..	1
26	1	..	..	1
27	1	..	..	1
31	1	..	..	1
Total ..	4	..	1	5

hospital assistant in the presence of the havildar of the guard administered to each man, morning and evening, the following pill:—

B. Quineti sulphatis grs. 5. Mucilaginis acaciæ q. s.

There was only one case of enlarged spleen, none of remittent fever, and only four of intermittent fever. The

highest temperature recorded was 103.6°F. It will be noticed that the four cases of malarial fever occurred singly during the second week after their return.

This seems to indicate that the prophylactic treatment during residence in the Kolodyne Valley tended (a) to prevent fever while the men were there; (b) to diminish the intensity and frequency of the fever after their return to Fort Tregear; (c) and to postpone the incidence of the ague attacks to a later period.

Table VIII.

The same prophylactic treatment was given

8th Kolodyne Guard of 16 men from 16th to 31st August.				
Date of admission into Hos- pital for—				
Septem- ber.	Intermittent Fever.	Remittent Fever.	Total.	
9	1	..	1	
10	1	..	1	
11	1	..	1	
13	..	1	1	
Total ..	3	1	4	

to the 8th Kolodyne Guard during their stay in the valley, *viz.*,—10 grains of sulphate of quinetum daily, divided into two doses. There were only 4 admissions for malarial fevers,—3 intermittent, and 1 remittent, and these did not occur until the second week after their return. The spleen was much enlarged in all 3 cases of

intermittent fever, and of these 3 cases 2 had a temperature of 104.0°F., and 1 of 105.0°F. In the case of remittent fever the temperature rose to 104.0°F.

Among the 32 men of the two guards for August, 8 or 25% were admitted for malarial fever. It is at once apparent that a marked reduction in the number of admissions occurred, and that these all happened in the second week after the men returned. At the same time the proportion of cases with enlarged spleen was greatly increased.

Table IX.

The strength of the 9th Kolodyne Guard

9th Kolodyne Guard of 20 men From 1st to 16th September.			
Date of admission into Hos- pital for—			
Septem- ber.	Intermittent Fever.	Remittent Fever.	Total.
27	1	..	1
Total ..	1	..	1

was increased to 20. Each man got ten grains of sulphate of quinetum daily for 16 days while in the valley, and five grains daily for 7 days after returning to the fort. Out of these 20 men none were ill at the Kolodyne, and only one was admitted at Fort Tregear in the middle of

the second week after returning. This man was admitted with a temperature of 104.4°F. and his spleen was enlarged.

The inference to be drawn from these observations, as expressed in the above tables, seems to be that—

I. There is a period of incubation for the malarial poison.

II. Prophylactic doses of quinine tend to prolong this period of incubation, *i.e.*, the onset of the fever is postponed.

III. Prophylactic doses of quinine (*a*) either counteract the malarial poison and thus lessen the liability to ague, or (*b*) when this fails they tend to modify the virus and produce a milder type of fever.

At first the Kolodyne Guards neglected the ordinary precautions regarding drinking water, solar heat, and chill, &c., consequently they suffered from fever during their stay in the valley. When reasonable care was taken later on, the men did not suffer from fever during their stay at the Kolodyne; but they got intermittent fever very soon after their return to the more temperate climate at the fort. Next, the men who looked ill on their return were given quinine for a few days, and the number of fever cases was reduced. Then prophylactic doses of sulphate of quinetum were given morning and evening during the half month that the men were at the Kolodyne Post. The result was that (*a*) the actual number of cases of fever was still further decreased; (*b*) the incidence of the fever was deferred to the second week after their return, *i.e.*, to the fourth week under observation; (*c*) and the average duration of stay in hospital was shortened. Finally, prophylactic doses of sulphate of quinetum, ten grains daily, were given during the half month at the Kolodyne, and five grains daily for one week after returning to the fort, *i.e.*, prophylactic treatment for three weeks consecutively; and we find the number of admissions reduced to one case, although the number of the guard was increased from 16 to 20. It may be asked,—“why was prophylactic treatment not commenced sooner?” My reply is that the treatment was commenced as soon as we had the medicines; but so great

were the difficulties of transport during the rains that the first box of our annual supply of medicines did not reach us until 17th July, and the last box on the 10th September, although they arrived in the country at the beginning of May.

The type of fever contracted at the Kolodyne was essentially intermittent; but was more severe than that which was contracted by the men at Fort Tregear, who had not been stationed at the Kolodyne. There was a tendency to sudden and high rises of temperature, which showed a disposition to continue high unless promptly checked. Fortunately, most cases proved readily amenable to antifebrin, of which ten grains frequently produced profuse perspiration in half-an-hour, and a diminution in temperature of 3 or 4° F. within a couple of hours. Frequently there was a tendency to secondary rises after the effect of the antifebrin had passed off; but these generally were easily controlled by small doses of salicylate of soda or by a diaphoretic and diuretic mixture containing salicylate of soda, acetate and nitrate of potash. Whereas this mixture, if given prior to the antifebrin frequently proved ineffectual.

In the January number of the “*Indian Medical Gazette*,” at page 1, there occurs an abstract of a lecture on “*Malaria v. more recognizable causes of disease*,” by Surgeon-General Sir W. Moore, K.C.I.E. At page 227 of the August number of the same journal, there is a resumé of the “*Recent Researches in Malarial Infection*,” by Surgeon W. B. Bannerman, M.D., I.M.S.

These two articles give admirable expositions of two widely divergent views on the etiology of malarial fevers,—the former representing the experience of the past as based on clinical observation, while the latter deals with the laboratory researches of the present. The not unnatural conclusion of the lay sceptic may be that the views propounded in these papers are irreconcilable; he may feel inclined to make ironical remarks about the proneness of doctors to differ, and may cynically inquire,—“which theory is right? Both cannot be true. Are both wrong?” Nevertheless, I think it is possible to show that there is truth in both views, and that the clinical experience of both past and present unite with recent laboratory researches to form one harmonious and practical working hypothesis. It appears to me that the difference between the “chill” theory and the theory of “a specific micro-organism” is analogous to the difference between the “primary” and “secondary” causes of any specific disease.

Exposure to solar heat or to sudden chill from great diurnal variations in atmospheric temperature very frequently is the precursor of an attack of ague in a person whose system is predisposed to fever by having absorbed the primary cause,—the malarial poison. Such an

individual's system is only too frequently below par from climatic causes, and is no longer able to resist the action of the malarial poison, which finds here a suitable nidus for its development; and the exposure to tropical heat, or to chill, merely fires the train ready prepared to cause the explosion.

Suppose a person to get the malarial poison, the specific micro-organisms, into his system through either the alimentary or respiratory channels, by the medium of drinking water or the atmosphere. The micro-organisms (1) may not find a suitable nidus, and may be eliminated by the excretory organs; (2) they may remain quiescent in such viscera as the spleen or liver; (3) or the periods and processes of incubation and invasion may be rapid. If they lie dormant,—then any exposure to great heat or excessive exertions or sudden chill will alter the conditions of the circulation and send the blood coursing to the periphery from the internal organs, or drive the blood from the surface and cause congestion of the viscera. In either case there would be a tendency for the micro-organisms to be dislodged and liberated from viscera such as spleen and liver. *The specific organisms, or the poisonous products of these organisms, may have a special action on the heat regulating mechanism.\**

The argument may be thus briefly stated—

I. The malarial micro-organisms, or some chemical products of these organisms, acting on the system, are the primary cause of malarial fevers.

II. Exposure to chill or to heat is the most frequent secondary cause of malarial fevers.

III. The malarial poison, along with exposure to heat or chill, act and react on the system by upsetting the balance of the heat regulating centres in the cerebrum and medulla oblongata.

*The thermotaxic centre, or mechanism, is the most readily upset by malarial or other poisons circulating through the cerebral vessels, and it is the centre most frequently affected. In its action it is the most complex part of the heat-regulating mechanism. It is also the least defined anatomically, latest evolved, and highest in the scale of development,—hence it is the most easily and frequently disturbed. It is also the most susceptible to the action of drugs. If the malarial poison be more virulent, the thermogenetic mechanism will be involved as well. This centre is better organized, earlier developed in the scale of evolution, and consequently more stable. It is susceptible to the action of antifebrin and antipyrin, though but little influenced by ordinary diaphoretics.*

If the malarial poisoning be still more intense,—then the *thermolytic centre* will also be involved. This centre presides over the vasomotor, sudoriporous, and respiratory mechanisms. It is the most stable, least affected by drugs, as well as the best defined anatomically, the best organised, the earliest and lowest in the scale of evolution. Hence, when its normal working is put out of gear, the morbid processes are most severe. Any one who has suffered much from intermittent or remittent fever in a malarious district must have observed how susceptible the body is to atmospheric influences during the period of convalescence. Such a convalescent often finds himself feeling hot or cold, chilly or perspiring without any apparent adequate cause. He may wake up during the night bathed in perspiration; his temperature oscillates up and down in excess of the normal physiological variations, he is much more susceptible to the morning and evening chills, and is obliged to wear more clothes than he would do in ordinary circumstances. In other words,—his heat-regulating mechanism is in a state of unstable equilibrium during convalescence.

#### COMPOUND FRACTURES TREATED BY CREOLIN IRRIGATION.

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A DOGRA sepoy fell from a temporary bridge over a canal near the town of Srinagar and fractured his tibia and fibula, the tibia protruding through an external wound an inch and a quarter in length. The patient was immediately brought to the hospital; the protruded corner being impossible to reduce was snipped off, and a dressing of sal-alembroth gauze applied. The leg was placed in a Salter's swing. Dressings were not disturbed for two subsequent days. On the third day the patient had high fever. Within 12 hours after the first change of dressing gangrene set in in the part below the wound. To amputate instantly or not was the question. I thought it better to wait. Next day graver constitutional and local symptoms manifested themselves. I regretted being conservative when the case was first admitted and reluctantly amputated just above the knee-joint, the lowest seat I could possibly choose. Strict aseptic treatment during and after operation was observed. Gangrene attacked the stump. I operated again on the upper part of the thigh, and the amputation then was performed at night. Again the dreaded gangrene appeared twelve hours after, and the man died 24 hours after the second operation. Two days after the death of this man, when my mind was still brooding over this case, an old woman aged 55 was sent up by the police for treatment with compound fractures of both bones of the leg. The frac-

\* r: On the Parallelism between the three Thermic Mechanisms and Dr. Hughlings Jackson's Three Levels, by W. Hale White, M.D., F.R.C.P., in *British Medical Journal* for 26th April 1890. Also "The Three Thermal Mechanisms and the Motor Levels," by Professor MacAlister in the *B. M. J.* for 3rd May 1890.