CERTAIN FORMS OF FEVER, AND THE CONDITIONS BEARING THEREON, IN THE HILL STATIONS OF SIERRA LEONE.

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In my Report on "The Distribution of Mosquito Larvae on War Department Lands in Sierra Leone," in 1901, which formed Appendix VIII. to the Army Medical Department Report of 1900, it was suggested that the prevalence of malarial fevers on the hills in dry weather was partly due to the breeding of anopheles in the mountain brooks, when the continued absence of rain had reduced the volume of water in the streams. For a little over a year (up to the end of December, 1904), I have inquired further into this important matter.

The Blood-sucking and other Insects of Mount Aureol and Kort-right.—The following insects have been found in the barracks or immediate vicinity:—

Mosquitoes.—Anopheles myzomyia funesta (Giles). Anopheles Smithii (Theobald)—a new species.1 Mucidus Africanus (Theobald). Cellia squamosa (Theobald)—not previously reported from Sierra Leone. Stegomyia fasciata (Fab.). Culex cinereus (Theobald). Culex viridis (Theobald). Culex Sergentii (Theobald). Ficalbia nigripes (Theobald)—a new species. Toxorhynchites brevipalpis (Theobald)—not previously reported from West Africa. Mansonia (panoplites) Africana (Theobald). Eretmapodites quinquevittatus (Theobald). Three or four more species which have not yet been identified, some of them believed to be new.

Tsetse-flies.—Glossina palpalis. Horse-flies.—Tabanus dorsivittata (Walk.). Tabanus fasciata (Fab.). Tabanus—new species? Tabanus—new species?

Anthropophagous fly.—Cordylobia anthropophaga (Blanchard).

Ticks.—An unidentified species.

Unidentified fleas, bugs, lice, crab-lice, chigoes, sand-flies and owl-midges.

Here I may take the opportunity of tendering my cordial thanks to the Director of the British Museum and his assistants for naming my specimens for me. More especially am I indebted to the kind-

1 The Entomologist, April, 1905.
ness and patience of Mr. E. E. Austen and Mr. F. V. Theobald, in identifying specimens. With regard to the distribution, prevalence, breeding places and habits of these insects: only one specimen each of *Mucidus Africanus*, *Cellia squamosa*, and *Toxorhynchites brevipalpis* was found in the barracks, none were found elsewhere, and I know nothing about their breeding places, &c.

*Anopheles funesta* is much the commoner anopheles on the hills. It breeds in all the mountain torrents, whether the streams are near to dwellings or not. I pitched my tent in the "bush," half a mile from any dwelling, and 250 yards or so away from a stream. The stream was perhaps, 200 feet below the level of the ground on which the tent was pitched; the tents could not be seen from the stream. Yet, in less than twelve hours after they were pitched, the tents contained *Funesta*. This was in dry weather (January). I found *Funesta* also on the banks of a stream in the jungle on the hills, three miles from any dwelling and a greater distance from any village. There is a hill which was selected by Stephens and Christophers for the segregation settlement for Europeans. It is described in the *Fifth Report to the Malarial Committee of the Royal Society*. There are many spurs on either side of this hill, and between the spurs are brooks. I traced many of these to their sources. There are anopheles larvae, mostly *Funesta*, in them all; and some of them begin 150 yards or so below the plateau forming the top of the hill. On two occasions I found *larvae of Funesta in old tins* in the jungle, within twenty yards of Mount Aureol barracks. The tins had been there a long time—two or three years probably—and had become partly covered with dead leaves. From the mosquitoes' point of view, these tins would be so many holes in the rocks. Nicol brook, however, is the main breeding place of the *Funesta* on Mount Aureol and Kortright. During the rains there are very few in the stream itself, owing to the frequent and sudden rushes of water, the rainfall being as much as two, three, four, five, and even six inches a day, and most of that falling in a few hours. At this time of the year larvae are found in moderate quantities in a few swampy overflows on the banks of the stream, and, occasionally, in grassy tangle at the edges of eddies. With the cessation of the rains the volume of water in the stream gradually subsides—breeding holes are left in the rocks; as these dry up fresh ones are left by the still receding water, until, finally, the stream becomes a series of little pools united by a mere trickle. *Larvae* may now be found in abundance in the stream itself, among collections of dead leaves and drift, in cracks of the
rocks, wherever, in short, they can escape the small fish, &c., which
inhabit the stream. The larva, then, are plentiful from December,
and are most numerous towards the end of the "dries," that is, in
February and March, and are still numerous in April and May.
In April the reverse process of the above begins; the early inter-
mittent rains fill the rock holes in the bed of the stream, larva are
bred in these holes. In June the rains are well established, the
stream is flushed frequently, and the larva are found only in the
overflow as described, and, occasionally, in tins in the bush. The
number of the adult insects in barracks rises and falls, mainly in
accordance with the number of larva present in the stream; but
the relation is interfered with to some extent by winds and by the
breeding in tins. It is hard to find mosquitoes in large, airy
barrack rooms, but it is fairly easy to find those which may be in
bell tents. Blood-fed female Funesta in small numbers (four
among twenty-one tents) were secured at the first visit to some
tents at Kortright in December, 1903. Daily visits resulted in the
capture of one, two, and three a day, increasing slightly in
February. In the first fortnight of March the number rose to six
and seven a day—always females and full of blood. The camp was
struck in the middle of March. During this time the barracks were
searched occasionally, but no mosquitoes were found. In April
one or two were found in Mount Aureol barrack rooms. Search
was then abandoned for a time during my absence. Early in June
we began to search again, and found Funesta in the barrack rooms
at Mount Aureol and Kortright. Search was now restricted to the
guard room, as an index to the prevalence at Aureol; at Kortright
the two barrack rooms (not so well lighted nor so high as those at
Aureol) were searched at intervals. The highest numbers were
taken during June, viz., at Kortright, on June 26th, nineteen fed,
female Funesta; and at Aureol guard room, on June 30th, twenty-
seven females. The numbers now dwindled to one and two per
diem in August and September, and none in October and November.
In December they began to appear again, from one to four per
diem. The numbers taken indicate that a great many anopheles
visit the barracks at night.

The rains were delayed this year, the fall for May being lower than for any
year since 1882. In 1901 the fall for May was 15'83, the average for twenty
years being 12'65. In the year now under review (1904) only 4'59 inches fell in
May. The rainfall average for twenty years, up to 1901, was, at Sierra Leone:
January, 0'54, February, 0'40, March, 1'11, April, 4'54, May, 12'65, June, 22'18,
July, 34'00, August, 38'27, September, 28'65, October, 13'91, November, 6'38,
December, 1'99. Total 165'60.
Males were found only occasionally, in ones and twos in barrack rooms and under culverts over the surface drains, but could always be found in cool, shady places among the rocks on the banks of the brook. They were found also, sometimes (chiefly in wet weather), on the trunks of trees in the bush, nearer the barracks. Females were very few compared with males in these situations, and those found did not always contain blood; females full of eggs, and not newly fed, were found once or twice on the trees near barracks in company with males. The *Funesta* would appear to be very cautious in approaching man. Like the larger carnivora, it shuns the light. I have never seen or felt anopheles in the mess room at Mount Aureol, though there is no punkah. It was the same when travelling in the “bush.” We dined in front of our tent on a still night. None of us noticed any mosquitoes. It was not till the lights were out that I was awakened by two or three which had got into my net. Next morning, in addition to two blood-fed *Funesta* in my net, there were scores of female *Funesta* on the walls of the tent. My companions, who had sound mosquito-curtains, had neither heard nor felt any.

*Anopheles Smithii*—A black mosquito—is much less common than *Funesta* on the hills. It breeds in holes in the rock, in the bed of the mountain streams. There the larvae are fairly numerous, more numerous than would be expected from the small number of the adult insects found in barracks. *Anopheles Smithii* also breeds occasionally in old tins in the bush, under the same circumstances as *Funesta*. The larvae are found all the year round. Adult female insects were taken in ones and twos very occasionally in tents and barrack rooms at Kortright and Aureol, from December to June. The insects so taken were generally full of mammal blood. Males were easily found among the rocks and in small caves on the banks of the stream all the year through, also blood-fed females more rarely. Like the *Funesta*, this mosquito is found breeding in the “bush” miles away from human habitations.

*Stegomyia fasciata*—This irritating pest is with us throughout the year to some extent, but is most prevalent during the rains. It is, of course, due in great measure to littering about pots and pans, cocoa-nut shells, preserved meat tins, bottles, milk tins, &c. Larvae were found also in disused boilers, disused latrine buckets, &c., siphon drain-pipes and so forth, on stock in engineer yards as well as in rock holes in the stream bed. The Stegomyia seems unimportant just now, but it is well to remember that grave epidemics of yellow fever occurred in Sierra Leone in old
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times. (One synonym for the disease in the West Indies was "Bulam fever." Bulam forms a boundary of Sierra Leone harbour.) In more recent times French Senegal has been visited by this disease.

Eretmapodites quinquevittatus.—This beautiful insect is found sometimes in barracks during the rains. Like the Stegomyia it feeds in the daytime. I saw one fill itself with blood from a man (indoors) at 11 a.m. Though it breeds in great numbers in the immediate vicinity of the camp, generally in collections of stagnant water or organically polluted water in or near to the shady "bush," this mosquito is not often found in barracks. Possibly it does not customarily feed on human beings.

Glossina palpalis (syn. "Tsetse," "Hog-fly," "Fōhi," "Tāpūp") is rarely found in barracks. I caught one in my tent. It can be found on the rocks in the streams, but, on the whole, we may say it is not often met with in the hill stations for troops, as compared with other places. The tsetse is in great numbers at the lighthouse, for instance, where there is a furnished residence for holiday-making European officials of the Government, military officers, and others. The lighthouse is on a sandy point, jutting out into the sea; there is no river near it, and there is very little fresh water about. I have been bitten at the lighthouse in the daytime. Natives say the tsetse sometimes bites at night. At Regent, too, a village situated in a mountain valley, the tsetse is always plentiful in the neighbourhood of a bridge over the stream which passes through the village. To get a supply it was enough to send a native boy there with a bottle, and tell him to catch the insects off his own legs. In the hill villages of Gloucester and Leicester, a mile or two from Kortright, this insect is met with along the brooks. The Sierra Leonian calls it the "hog fly," because it accompanies and feeds on the pigs.

The horse flies are uncommon on Mount Aureol. Two Dorsivitta, two Fasciata, and one new species were caught in my camp during the year. The generic name for horse flies among the Mendi people is kāra. On the Sierra Leone river entrance, a salt water creek running up to Port Lokko, the horse flies, like the tsetse, are in thousands, and bite men greedily. This creek and the plains below the hills are perhaps the sources of the small number of horse flies found from time to time in Aureol.

Ticks are not common, but are occasionally parasites of men who go much about the long grass and "bush," where cattle have been grazing and where wild antelope and other animals live, on
Kortright Hill. There are none, as far as I know, at Mount Aureol. My specimens have been lost, so I am unable to name the species.

Infected Insects on the Hills.—Dissections of anopheles have not been made in great numbers owing to pressure of work, but they were continued from time to time until the task of finding infected insects in barracks had been fulfilled. Three Funesta (one at Kortright, two at Aureol) were found to contain zygotes. There can be little doubt, therefore, that some of the Mount Aureol malaria is a local product, and this view is borne out by the figures below, as well as by histories of individual attacks.

The Incidence of Fever at Mount Aureol (with Kortright) and Tower Hill compared.—I have kept a record of the admission rates by companies, and have endeavoured to eliminate such sources of error as the moving of troops, custom of treating men out of hospital, &c., from my interpretation thereof. The rates for European troops are better indicators of place sickness than are those of the coloured troops, owing to the certainty that much of the sickness among the latter is contracted from the natives in Freetown. Taking first the period from December, 1903, to August, 1904, inclusive, we have the following:

<table>
<thead>
<tr>
<th>TABLE I.</th>
<th>EUROPEAN TROOPS.—PERCENTAGE ADMISSION RATE FOR MALARIA.</th>
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<tbody>
<tr>
<td></td>
<td>Mount Aureol and Kortright.</td>
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<tr>
<td>Average Strength</td>
<td>121</td>
</tr>
<tr>
<td>[The bulk of these men (150) arrived from Gibraltar on November 20th.]</td>
<td></td>
</tr>
<tr>
<td>December, 1903</td>
<td>4.1</td>
</tr>
<tr>
<td>January, 1904</td>
<td>16.0</td>
</tr>
<tr>
<td>February</td>
<td>25.0</td>
</tr>
<tr>
<td>March</td>
<td>6.4</td>
</tr>
<tr>
<td>April</td>
<td>4.3</td>
</tr>
<tr>
<td>On March 18, 113 men arrived from Tower Hill, causing sudden fall in rate.</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>10.0</td>
</tr>
<tr>
<td>Quinine rations prophylactically from middle of May.</td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>18.0</td>
</tr>
<tr>
<td>July</td>
<td>10.0 Gr. x. twice a week.</td>
</tr>
<tr>
<td>August</td>
<td>7.1</td>
</tr>
</tbody>
</table>

1 The rates for Tower Hill include a small proportion of men of the Engineers and Ordnance, who live in the town itself.
The smallness of the numbers dealt with depreciates the value of the above figures, but, as far as they go, they confirm the results given in the previous Report. Among individual cases are some trustworthy non-commissioned officers, who were able to give a history of their movements. They stated that they had not been out of barracks after dark for many weeks before their primary attacks of malaria.

**Percentage of European Soldiers attacked by Fever during a Year’s Service on the West Coast of Africa.**—The figures above given include re-admissions. With regard to first attacks: the 46th Company Royal Garrison Artillery arrived at Sierra Leone on November 20th, 1903, from Gibraltar, under the command of Captain (now Major) B. M. Bateman, R.A., strength, 6 officers and 150 men. The bulk of these were first of all stationed at Tower Hill, only 1 officer and 18 men being sent to Mount Aureol. On March 18th 5 officers and 113 men moved to Mount Aureol, and in July 12 more, so that 7 only remained at Tower Hill. Among 136 of these men, concerning whom information was obtained, 67, or 49.26 per cent., were attacked by appreciable fever during the first year of residence; 69 men, or, roughly speaking, half the company, escaped fever altogether, during a residence of one year on the Coast. All but ten of the attacks occurred after the removal of the company to Mount Aureol.

We have then the following factors: (1) *Funesta* breeding near the barracks; (2) presence of *Funesta* in barracks; (3) presence of infected *Funesta* in barracks; (4) greater prevalence of fever at Mount Aureol (an isolated hill station) than at Tower Hill (in the centre of the town), during some part of the year; (5) statements of individual patients that they have not visited the town at night. It appears clear that a good deal of fever is contracted at Mount Aureol and Kortright. That fever prevails in the hill valleys has been known for a long time, as regards the villages of Leicester, Gloucester, Regent, &c. Mount Aureol, however, is not in a valley, but on a wind-swept spur, and on the highest point of the spur is Kortright. The hill villages are badly sanitated, swampy, and full of native children. The hill stations are comparatively well sanitated, dry, and without other human inhabitants than the troops. Residents in the hill stations are loth to believe that the fevers there are due to any local conditions except chills, the harmattan, the mist, &c. Ross (1st Report of Liverpool Com-
mission) thought that Mount Aureol malaria was contracted in Freetown.

The Source of Infection at Mount Aureol and Kortright Anopheles.—In spite of what has been said there can be little doubt (assuming that human malaria is always from a human source) that fever at Mount Aureol is indirectly derived from the native town, and the flame is kept alive by frequent fresh material from the same source. The immediate source of malarial fever, in the first instance, as regards residents in the hill stations, is the non-European soldier in the hill stations. The relative station incidence of fever among the non-European troops corresponds, in the main, with that of the European troops, but is complicated by the fact, noted in my 1901 Report, that the non-European soldiers “are in the habit of spending two or three nights a month in the houses of natives in Freetown.”

Incidence of malaria on negroes who are not natives of Africa.—As will be seen from reference to the following table, the West India soldiers, during their first year of service on the Coast, sometimes suffer more severely than do Europeans in their first year.

<table>
<thead>
<tr>
<th>TABLE II.</th>
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<tbody>
<tr>
<td>PERCENTAGE INCIDENCE OF FEVER ON COMPANIES OF THE WEST INDIA REGIMENT.¹</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Companies</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>January, 1903</td>
<td>2:7</td>
<td>...</td>
<td>4:3</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>2:5</td>
<td>4:4</td>
</tr>
<tr>
<td>February</td>
<td>6:2</td>
<td>5:1</td>
<td>3:4</td>
<td>3:3</td>
<td>2:9</td>
<td>1:7</td>
<td>4:1</td>
<td>7:8</td>
</tr>
<tr>
<td>May</td>
<td>7:9</td>
<td>31:2</td>
<td>24:8</td>
<td>24:3</td>
<td>50:5</td>
<td>14:1</td>
<td>16:4</td>
<td>46:0</td>
</tr>
<tr>
<td>August</td>
<td>9:9</td>
<td>10:8</td>
<td>18:0</td>
<td>12:2</td>
<td>22:1</td>
<td>13:0</td>
<td>6:0</td>
<td>7:9</td>
</tr>
<tr>
<td>September</td>
<td>8:4</td>
<td>9:3</td>
<td>9:2</td>
<td>2:6</td>
<td>17:3</td>
<td>12:5</td>
<td>12:4</td>
<td>9:0</td>
</tr>
<tr>
<td>November</td>
<td>11:2</td>
<td>1:9</td>
<td>5:5</td>
<td>3:3</td>
<td>14:1</td>
<td>17:6</td>
<td>12:4</td>
<td>5:4</td>
</tr>
<tr>
<td>January, 1904</td>
<td>6:6</td>
<td>13:0</td>
<td>1:8</td>
<td>7:2</td>
<td>7:0</td>
<td>14:4</td>
<td>6:6</td>
<td>8:4</td>
</tr>
</tbody>
</table>

The admission rate for imported negroes decreases in the second and subsequent years of residence, but remains higher than the

¹ Four companies arrived on December 30th, 1902, and four on February 3rd, 1903. Average strength is roughly: Battalion, 978; companies, 121 each.

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rate for native troops. Whether the diminution in the rates is all real, and not due to the disease becoming more chronic in character, and thus enabling the men to remain at their duty, though suffering from fever, is uncertain. The results of a few blood examinations were as given below.

Captain L. F. Smith, R.A.M.C., gave me much help in examining these films.

Examination of Peripheral Blood of Men at their Duty. West India Regiment. One Company. Negro Troops.—Eighty-three men were examined by means of Leishman's stain; seven of these had malarial parasites.

Forty-sixth Company Royal Garrison Artillery. (European Troops).—Dried blood films of 136 men were stained by Leishman's method and examined. Only two men showed malarial parasites. These two companies were selected for comparison because they had been some time stationed together. The comparative percentage of men harbouring malarial parasites while still at their duty was greater among the non-European than among the European troops of these two companies at Mount Aureol, the proportion being 8.43 per cent. of the former to 1.47 per cent. of the latter. (It should be noted that during the period when the examinations were made, the troops of both classes at Mount Aureol and at Tower Hill were undergoing regular quinining).

Description of the Locality.—The situation of Mount Aureol and Kortright in relation to Freetown and Tower Hill may be best understood by a glance at the map on page 697.

Tower Hill barracks are 400 feet above sea level on a conical hill (Tower Hill) in the centre of Freetown, but separated on all sides from the town by a belt of clear grassy slope of some 200 yards in width at its narrowest part.

There are no Breeding places of Anopheles Mosquitoes on Tower Hill.—There are many breeding places in the town around Tower Hill. During the rains the larvae may be found in the gutters or surface drains, in holes in the rock which forms the streets in some parts of the town, in wells, &c. In the dry weather they may be found in the portion of Nicol brook which runs through the town, in Highbury brook, in the various tiny tributaries of these brooks, in such of the open drains as contain water all the year round, at the back of the Government Wharf, here and there under leaking joints of the town water pipes, and in the swampy patches around the public hydrants.
Anopheles, then, are breeding in Freetown within a few hundred yards of Tower Hill Barracks all the year round; but during the dry weather there are more large breeding waters near Mount Aureol barracks than there are near Tower Hill barracks, owing to the proximity of Nicol brook to Mount Aureol. The breeding places near Tower Hill, moreover, are among the natives' houses (where there is abundant food and material for the infection of the adult insects), whereas those near Mount Aureol are in the "bush" and in closer proximity to Mount Aureol barracks than to any other inhabited buildings.

Mount Aureol is east of Tower Hill, from which it is separated by a deep valley some two-thirds of a mile across. The bottom of the valley contains native houses, and its sides are clothed with grass on the Tower Hill side, trees and grass on the Mount Aureol side, which is far the longer and steeper of the two. The nearest native dwelling houses to Mount Aureol buildings are (as the crow flies) about half a mile distant down hill from the Station Hospital, in the western and northern directions. To the east and south there are no native villages for over a mile. (There are two or three farmhouses on the eastern slope from the ridge...
Objects of interest on the hill from left to right:
1. Block of buildings, Station Hospital, Mount Aureol
2. Block of buildings, Officers' Mess and the Barracks, Mount Aureol
3. Square building on the sky line, Headquarter House, Kortright
4. Depression indicating the valley in which Nicolbrook rises.
near the Station Hospital, but they were not occupied at night, nor by children). Some idea of the isolation of Mount Aureol is given by the photograph (fig. 2).

The summit of the hill forms a ridge running north and south; nearly all the buildings are on or close to the top of the ridge. At the northern end of the ridge, on the slope from the 600 to about the 700 feet contour, is the Station Hospital. About 150 yards (as the crow flies) to the south and up-hill (to 800 feet above sea level) are the quarters of the officers and men. Some 400 yards further up is Kortright, the highest point of the spur (1,100 feet above sea level). Here are Headquarter House, some officers' quarters, and barracks for one company. There is a slight depression, or saddle, between Aureol and Kortright. It will be seen on the map that the mountain stream, known as Nicol brook, after running along the western side of both Kortright and Aureol, passes on through Freetown to the sea. This stream is perhaps 150 yards from Mount Aureol and 250 yards from Kortright, some 100 feet below the one and 150 below the other at the nearest points. The brook, until it reaches the native town, is fringed by a wide dense margin of trees and natural undergrowth, jungle in fact. The bed of the brook is of a very irregular rocky nature.

The Wild Animals around Barracks.—The bush surrounding Mount Aureol and Kortright is occupied by a moderate number of monkeys, two or three breeds of antelope, civet cats, porcupines, and many smaller animals, as well as birds, reptiles, batrachians, and fishes. A local frog (a new species named Petropedetes natator) contains trypanosomes. Halteridia and drepanidia, of course, are found in their appropriate hosts.

What should be done to make Mount Aureol and Kortright healthier.—The sanitation of Freetown itself may be left out of consideration as far as the troops are concerned, for it is not likely that the military authorities will usurp the functions of the municipality in this regard. For that matter, I am not at all sure that it would be kind to the coloured population of Freetown to render their town malaria-free. The Sierra Leonian is, at present, engaged almost entirely in trading with the natives of the interior. Owing to his having acquired a certain amount of immunity to malaria, he is enabled to go fearlessly into the hinterland, and to reside permanently in places where the white man can only, with risk of death and the certainty of ill health, remain for a year or two. To deprive the Sierra Leonian and his posterity of the means of serving an apprenticeship to malaria would but diminish their capacity for
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earning a livelihood and, incidentally, extending the area of civilisation in Africa; for the interior is not in the least likely to be any different than it is now, as regards the malarial conditions, for centuries to come.

We can do nothing with Nicol brook at present; the magnitude of the undertaking is prohibitive on the score of expense. The breeding places of anopheles might be reduced to a slight extent by clearing the bush around barracks of old pots and tins, and taking steps to prevent the deposit of such articles in the bush. The bush itself might also be cut, and the grass kept short to a further distance from barracks than at present. The carrying out of these measures, however, is not so simple as it may seem. Labour is expensive. The civil authorities have already complained about the cutting down of trees. They are afraid that the rainfall may be reduced thereby.

Mosquito-nets and Mosquito-proof Houses.—One of the principal reasons why men get fever is that Sierra Leone is not, so to speak, a mosquito country, especially as regards these hill stations. Some of the officers do not use nets and others use them carelessly. It is a pity there are not more ordinary culex mosquitoes to make officers take efficient cover and see that those under their command do the same. It is desirable that every soldier on these hill stations, not only the whites but the West Indians, should have a mosquito net. Something might also be done in the way of mosquito-proof houses. The civil authorities have for some time had houses of the railway employees fitted up with wire gauze to keep out mosquitoes.

Segregation of European Troops.—Over and above adequate treatment of cases, use of mosquito nets, and so forth, the most practical means of dealing with malaria is to avoid allowing malarial persons to be on the hills to infect the mosquitoes. If the European troops were segregated as the European officials of the Colonial Government Service now are, and debarred from spending their nights in town, there would probably be little or no malarial fever among them. In 1901-2 and in 1903-4 the Artillery were prevented from visiting the native town at night. The men of the West India Regiment find guards in the town. If these guards could be done entirely by the native troops of the West African Regiment and the Colonial Forces (W. A. F. F.'s), and if the men of the West India Regiment were kept out of the town at night, the West India Regiment might also be free from fever, provided always that native troops are not stationed on the hills.
Isolation of the Sick.—The custom of detaining the fever case in hospital for a day and then sending him back to duty among his fellows ought never to be allowed. Every man with fever should be admitted, treated until he has been some time free from fever, or demonstrable parasites, and then put on a roster for a weekly inspection and blood examination. There should be no difficulty about this, now that every medical officer is a microscopist.

Quinine as a Prophylactic (and as a Cause of Fever?).—To what extent quinine is beneficial as a prophylactic, and in what doses, has not yet been settled. A series of experiments on a large scale is desirable. For over a year and a half, in West Africa, during my first tour, I took five grains daily, and was under the impression that I owed my comparative freedom from fever to the quinine, inasmuch as I was careless about the net, and often unable to use it when on active service.

At the beginning of my second tour I tried an experiment with one company of the West India Regiment at Tower Hill, intending to parade the beneficial results as an inducement to others to adopt the practice of taking a daily dose. I personally administered five grains of quinine to each man of the company daily. Unfortunately, the company which got the quinine had more fever than usual during the month, and more than the companies which did not get quinine. So I discontinued the experiment for the time being.

This brings me to the question of quinine fever.—Men of the West India Regiment not infrequently complain that the administration of quinine gives them fever. I have hitherto ridiculed the idea. It seems, however, to be beyond doubt that quinine occasionally gives rise to hemoglobinuric fever. This being the case, I see no reason why the drug should not bring about a febrile condition falling short of hemoglobinuria appreciable by the naked eye. The occurrence of such a condition at the outset of quinine treatment would explain my failure with the experimental company. It would not detract from the value of the drug as a prophylactic.

A Note on Blackwater Fever Studies, in Association, as to the Later Part of the Work, with Captain L. F. Smith, R.A.M.C.

Eleven negroes and three Europeans suffering from blackwater fever were dealt with. Only one of them was examined before the appearance of the blackwater. The cases occurred in various parts
of Sierra Leone, three of them came from Kortright, one had recently come from Kortright, and four were at Mount Aureol—that is to say, about half the cases in the station occurred on the hills. They cropped up at odd times throughout the year. Five cases were spleno-punctured. In none of the spleens did I find any parasites. Of the fourteen cases, two showed malarial parasites of the quartan type; in the remainder, no parasites were found. Of the two men in whom they were found, the first had very few parasites. The second man had been examined by Captain L. F. Smith before the appearance of the blackwater, and in the blood were found quartan parasites in abundance and at various stages of development. It does not follow that all the cases would have shown parasites before the onset of blackwater, for *quartan parasites continued to be plentiful in the man's blood during the whole course of the disease*, and for some time after all signs of blackwater had gone.

Facts of interest noted by Captain Smith were that: (1) there were many parasites in this man's blood while his temperature was normal morning and evening and when he appeared to be convalescent, and (2) the parasites disappeared spontaneously, no quinine having been given.

Three monkeys and two guinea-pigs were inoculated with blood, and three monkeys were fed with faeces of blackwater cases. Agar and broth were inoculated with blood from the spleens and from the veins of some of the patients and experimental monkeys.

The experiments threw no light on the causation of the disease.