

*Some Public Works.*—The *Markets* are very good, simply constructed of iron, and with concrete floors. They are kept clean. The meat market presents no special feature, as at Bathurst. The *Slaughter-house* at the end of the First Avenue is built on the beach.

The *Public Wash-houses* are a great advance. That in First Avenue is an iron-roofed structure with concrete floors and concrete tanks, through which a stream of water continually flows. There is accommodation for about twenty people at one time.

The *Hospital Ballay* is a very fine modern structure, carefully planned, and when complete will consist of four pavilions, each containing twenty-eight to thirty beds, in addition to the blocks set apart for the staff, management, and nurses. The pavilions are connected together by raised covered galleries. The situation has been well chosen in the most airy part of Conakry, and at some distance from the town. The hospital also comprises a large pharmacy, a small microscope and post-mortem room, and a disinfecting chamber. Separated from the European hospital there is a block devoted to the treatment of the natives; it contains accommodation for about thirty in-patients. The native ward did not appear to us to be as well-equipped nor as comfortable as those at Bathurst and Freetown.

At the present time the question of nurses is a difficulty, as the Sisters of St. Joseph no longer officiate.

*The Health of Conakry.*—Table I shows the number and variety of diseases which were treated in the hospital in 1902. Table II indicates the death-rate amongst Europeans for the years 1900, 1901, 1902.

TABLE I

GENRE DE LA MALADIE		Janvier	Février	Mars	Avril	Mai	Juin	Juillet	Août	Septembre	Octobre	Novembre	Décembre	Totaux
Fièvre paludéenne ...	Européens	1	2	6	1	2	3	2	13	16	14	9	6	75
Anémie palustre ...	Européens	...	1	2	3	3	2	1	1	1	1	4	...	19
Accès pernicieux ...	Européens	1	...	...	...	...	...	...	...	2	...	...	...	3
Fièvre bilieuse hémoglobinurique ...	Européens	...	...	...	...	1	1	2	2	...	3	1	...	10
Congestion du foie et hépatite ...	Européens	1	2	1	...	1	1	2	2	6	1	2	2	21
Dysenterie ...	Européens	...	...	1	1	...	...	1	...	...	...	1	...	4
	Indigènes	...	...	...	...	...	...	...	...	...	...	...	2	2
Diarrhée endémique	Européens	...	...	...	...	...	...	1	1	...	...	...	...	2
	Indigènes	...	...	...	...	...	...	...	...	...	...	1	...	1
Insolation ...	Européens	1	...	2	...	...	...	1	...	...	...	...	...	4
Ténia ...	Européens	...	...	2	...	...	...	...	...	...	1	...	1	4
	Indigènes	...	...	...	...	...	...	...	...	1	1	...	...	2
Maladies sporadiques	Européens	...	1	...	1	...	1	...	1	...	1	3	5	13
	Indigènes	...	...	2	1	...	1	...	...	1	2	...	1	8
Maladies chirurgicales	Européens	1	...	1	1	2	2	...	1	1	1	1	4	15
	Indigènes	1	...	1	...	1	1	...	1	1	1	4	2	13
Maladies vénériennes	Européens	1	...	1	1	2	...	2	...	...	3	...	1	11
	Indigènes	...	...	1	...	...	...	...	...	...	...	...	...	1
TOTAUX ...	...	7	6	20	9	12	12	12	22	29	29	26	24	208

TABLE II

GENRE DE MALADIE	1900		1901		1902	
	Entrées	Décès	Entrées	Décès	Entrées	Décès
Fièvre bilieuse hémoglobinurique ...	15	4	8	3	10	...
Accès pernicleux ... ..	4	4	2	2	3	3
Anémie palustre ... ..	8	...	10	1	19	...
Fièvre typho-malarienne ... ..	2	1	...	...	...	...
Dysenterie ... ..	5	1	...	...	4	...
Maladies sporadiques ... ..	15	5	9	2	13	1
Maladies épidémiques ... ..	...	...	1	1	...	...
Autres maladies ... ..	104	...	93	...	128	...
TOTAUX ... ..	153	15	123	9	177	4

From these tables it will be seen that there is a very considerable number of malaria cases, especially at the end of the rainy season—probably as many as one hundred and twenty amongst the Europeans. It is the most formidable disease amongst them; dysentery and diarrhoea are rare, no doubt, owing to the excellent water supply. ‘Of the one hundred and seventy-seven entries of Europeans, one hundred and seven, or two-thirds, were due to malarial infections: these were not all primary cases, as very many preferred the advantage of the new hospital rather than be nursed at home.’ Very many of the cases also came from the interior.

Blackwater fever is comparatively common; there were ten cases in 1902, but none terminated fatally. The statistics for 1903 are not yet available, but from the information which we obtained neither the simple cases of malaria nor the blackwater cases show signs of decrease; the tendency is the other way. When we visited the hospital there were two cases of blackwater fever in the wards, and one death occurred in a Syrian. The treatment of blackwater in the hospital consists in raising the blood-pressure by normal saline intravenous injections, and the administration of quinine.

A case of *Yellow Fever* occurred in 1901, but rigorous isolation directed towards the prevention of mosquitoes having access to the case, no doubt, prevented spreading. Yellow fever is always a disease to be feared along the coast, for *Stegomyia* is very generally found.

In 1902, cases of leprosy and elephantiasis were noted amongst the natives, as also one case of Madura foot. Conakry is, especially, to be congratulated upon the comparative rarity of dysentery.

*Diseases in Animals.*—There are very few horses, as the *Trypanosome* is said to kill them.

*Opportunities for Investigation.*—Conakry affords the student a very large field for investigation, especially in the various forms of malaria, such as blackwater. In the large hospital every convenience could be obtained, and it is to be hoped that the French authorities may decide to establish there a research laboratory for the investigation and prevention of malaria and other tropical infective diseases in Guinea.

*Anti-Mosquito Measures.*—It is impossible to ascertain from the various health returns published by the Sanitary Department what are the total number of cases each year of primary malarial infection in Conakry itself. A large number of those who enter the hospital have contracted their malaria elsewhere. It is a very great disadvantage that this analysis is not made, for until it is done it is difficult to say definitely whether malaria is increasing in the town of Conakry or not. We were led to infer that it was on the increase. During our visit in January the disease had appeared amongst the Douaniers, and in one man especially, who had not left Conakry. We made enquiries and found that the customs men did not make use of mosquito nets, and that there were the usual uncovered wells in the yard. Mosquitoes made their appearance at night, but the men did not notice their bites.

It is of interest to note, as indicating the attitude of the authorities to malaria in Conakry, that it is stated in the 1901 Report on the French Guinea (dated June, 1902), that Conakry, like other West African towns, affords all the conditions favourable to malaria—such as nature of soil, growth of vegetation, heat, and moisture. On the contrary, we are of opinion that there ought to be little excuse for malaria. In the 1902 Report, Dr. TAUTAIN, Colonial Secretary, refutes the soil theory of malaria, and states that the malaria cases in 1902 were on the whole less serious than in previous years, in spite of the fact that owing to laying the water-mains ‘never was so much fresh earth disturbed along the Boulevards in Conakry, and that, too, in the rainy season.’ Dr. TAUTAIN now regards the mosquito as the transmitting agent, and he is directing attention to them.

**With model water supply under the control of the authorities, no streams, a good porous soil, and perfect sanitation, mosquitoes should be got under control, and the freedom of the Europeans and of the natives from malaria guaranteed.** Mosquitoes are present in Conakry, and both *Anopheles* and *Stegomyia* have been found, and no doubt the disused wells and the overflow from the stand-pipes are the chief sources of supply—the increased vegetation is also a matter of concern. In our opinion the wells should be closed and vegetation kept well under control, and the use of the net might also be much more rigorously enforced.

The merchants and their assistants enjoy very good health, and from personal knowledge we know that the net is largely used amongst them.

Although we were unable to obtain definite figures of the proportion of malaria in the young native population, cases do occur, and observations similar to those conducted at Bathurst, Freetown, and other West African towns would no doubt reveal its presence in the proportion of 80 per cent. It is, however, a matter of great importance to have this point settled.

#### RISKS IN CONNEXION WITH PUBLIC GARDENS

*The Experimental Garden at Camayen.*—For this very extensive garden irrigation is essential, and there are several wells from which water is pumped. There is a pavilion for the director and his assistants, and there is a well close at hand. We found *Culex* larvae, and no doubt with more extensive searching we would have found *Anopheles* larvae also. The European employees suffer from malaria. It appears to us that the wells and the system of irrigation employed in gardens around public buildings and hospitals, in botanical and experimental gardens in tropical countries, should be more closely watched in order to prevent mosquito-breeding.



## SIERRA LEONE

## FREETOWN

Freetown may be seen from two aspects. Looked at from the steamer in the harbour it gives the impression of some small English seaside town, well situated with its cathedral and churches, warehouses, and private residences. Upon the numerous wooded hills, which form a magnificent background to it, are advantageously placed the barracks, officers' quarters, and military hospitals; in the distance high up on the right is the recently established European cantonment, and dotted about are numerous private villas. Everything looks green and homely without any overcrowding (Plate IV).

Viewed, however, from the hills above and behind the town, a totally different impression is produced. It appears as an extensive and irregular town, crowded with houses and buried in a luxuriant tropical vegetation (Plate V).

Freetown is a city with a municipal council, a mayor, and a population of more than thirty-four thousand beings. Native life is everywhere prominent as well in the various professions as in trade. It possesses a Protestant cathedral, numerous churches of various denominations, and Church of England and Nonconformist colleges and schools. The work of the city council is like, in many respects, that of an English town council. Much has been accomplished by it in the past, but it is also aware that a great deal remains to be done.

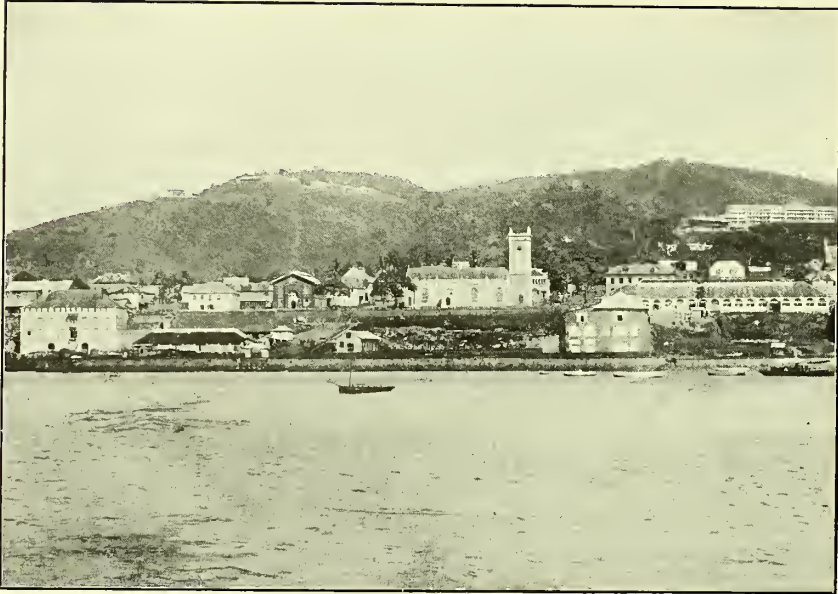
However closely the life of the city of Freetown may be modelled upon that of an English town, great differences must continue to exist. Whilst the native in the interior of the Protectorate naturally follows out the simple laws and customs which have been handed down to him by his ancestors, the Sierra Leonian has adopted, with very little training, complex western methods which bring with them corresponding responsibilities. He cannot, unaided, at once reap the benefits which he expected from them, nor will he at once realize his responsibilities; only under the patient direction of the white man will this be made possible.

Considerations like these are to be borne in mind in any analysis of the sanitary progress of Freetown. Those who are familiar with the difficulties of health administration in European towns must be prepared to be confronted with still greater ones in a community which has only comparatively recently adopted Western methods. Let every credit be given to the city of Freetown for what it has already accomplished and let it be encouraged to further work.

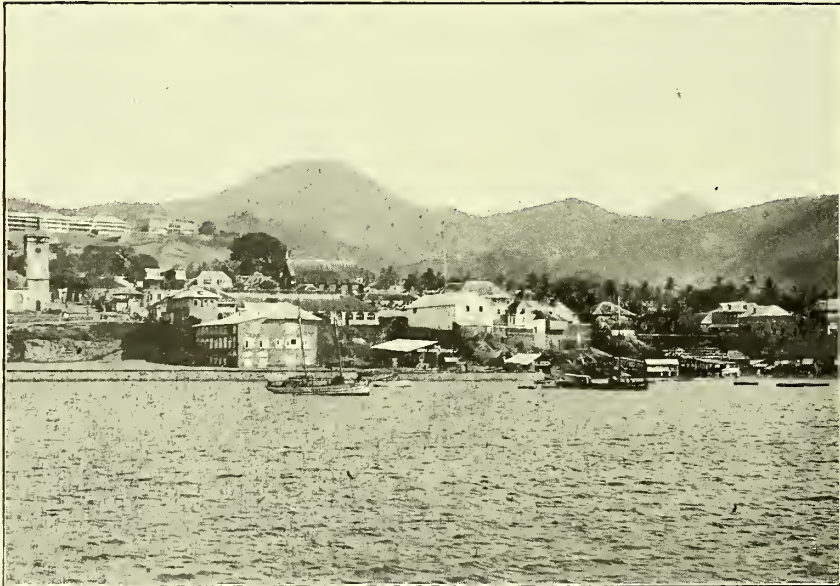
Freetown is not regularly laid out as in the case of Conakry or Bathurst. The houses are mostly constructed of wood; many appear well built, but there is a very



PLATE IV

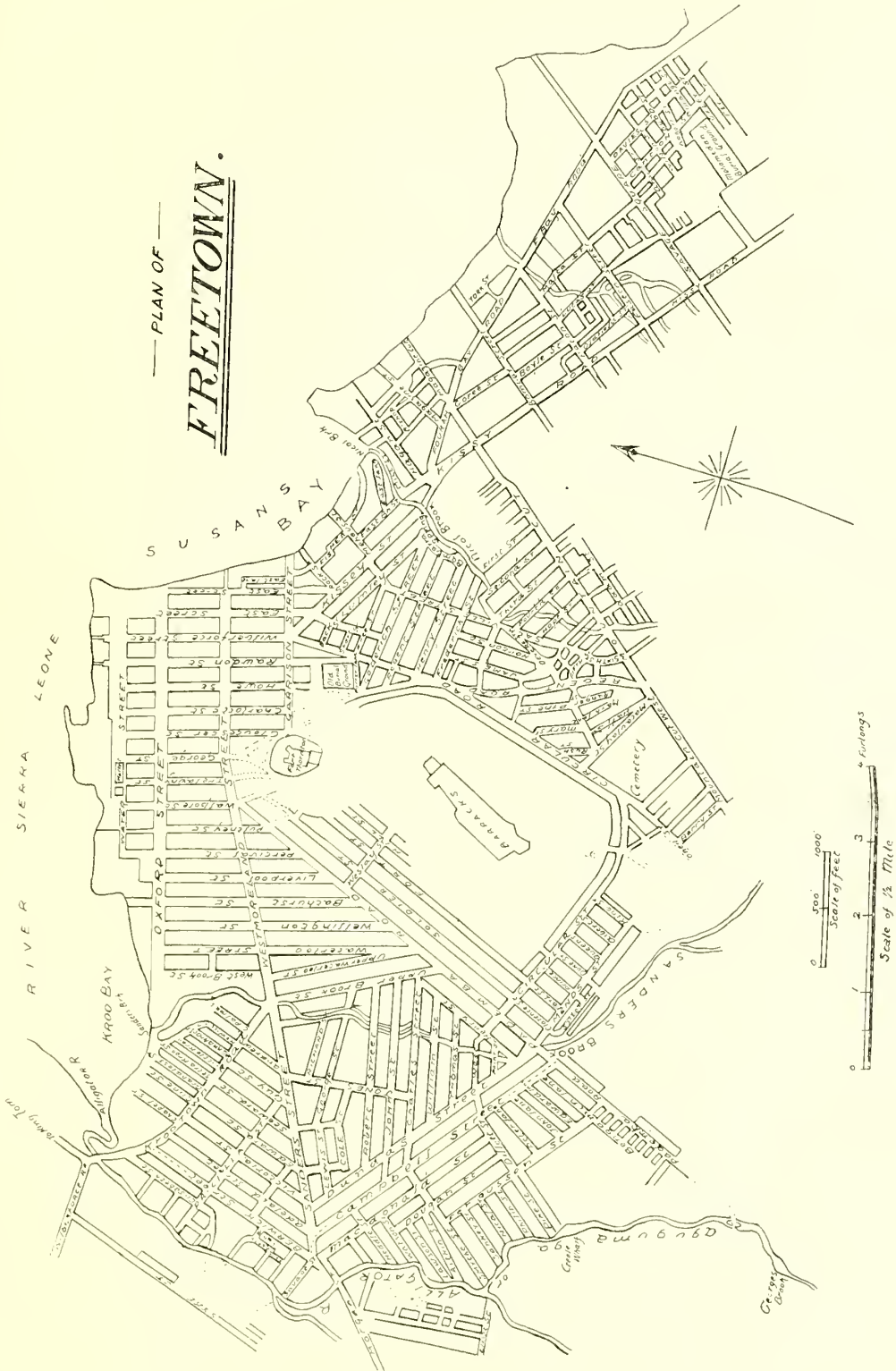


FREETOWN, FROM THE BAY. TOWER HILL BARRACKS ON THE RIGHT ABOVE ; MOUNT AUREOLE AND KORTRIGHT HIGH UP ON LEFT



ANOTHER VIEW MORE TO THE WEST ; HIGH UP ON THE RIGHT IS PLACED THE NEW EUROPEAN SETTLEMENT





distinct English influence in the construction of the better ones which is not at all suitable to the tropics. There is no uniformity in size or style, and houses that are well kept may be found side by side with others running to decay; indeed the impression produced by dilapidated property is not good (Plate VI).

The surface of Freetown is very uneven; one part of the town is built upon a steep slope extending from the hills to the sea, and many streets are in consequence steep; on the other hand, those which cross them may have very little fall. The houses upon one side of a roadway may be considerably lower than those upon the opposite side, and the road itself may be higher on one side than on the other (Plate VI). Parts of the town are flat. The result of this irregular configuration is that in the wet season the storm-water either rushes down the steeper streets and overflows the drains and cuts up the roadway, or many of the side streets and the houses on the lower levels, as well as the lower portions of the town, become flooded and sodden.

*Streams.*—There are three which serve as the natural water courses from the hills to the sea; during the heavy rains they are converted into torrents. There are also numerous small streams and springs. The three large streams pass through the city, and in doing so they become sewage contaminated. We found the sewage fungus (*Sphaerotilus*) present in many places, nevertheless the streams are in constant use for washing purposes.

*The Soil.*—The soil is, in some districts, porous and sandy, but more often hard laterite is found. Many of the roadways consist of this hard material and their surface is in consequence irregular, and contains very numerous pockets in which water remains after the rains.

*The Sub-Soil Water.*—The height of the sub-soil water must vary considerably in Freetown owing to the configuration of the land and the nature of the soil, and during the wet season there is a very considerable rise; in some places the water will drain away easily, in other places it will pocket. Wells abound, they are usually deep and the water in them varies according to the height of the sub-soil water.

*The Vegetation.*—The soil and moisture favours an abundant vegetation. The hills are covered with dense bush which penetrates into the town. Vegetation is everywhere overgrown and requires to be checked.

*European Quarters and Social Life.*—The sites which have been chosen for the military appear to us to be excellent, for they are all high above the town. The buildings on Mounts Aureole and Kartright are some eight hundred to one thousand one hundred feet above sea level; the barracks at Wilberforce are six hundred feet and those nearer to the town, on Tower Hill, some four hundred feet high. Around Tower Hill the bush has been cleared for a considerable distance, and efficient drainage carried out. These sites are all cool and airy, and the native houses are at a considerable distance. The military hospital on Mount Aureole appeared to us, both on account of its situation and sanitation, to be a model of its kind.



VIEW OF FREETOWN, FROM THE HILLS AT THE BACK ; SHOWS THE CROWDED NATIVE TOWN AND DENSE VEGETATION



A STREET IN FREETOWN, SHOWING DRAIN AT SIDE AND NUMEROUS GANGWAYS OVER IT. HOUSES ON RIGHT SIDE ARE LOWER THAN STREET LEVEL.





A great improvement has also been effected in the life of the European population. A site for a cantonment was selected on a high ridge, nine hundred feet above sea level, far from native houses, and in 1904 some twenty-two model bungalows were finished. These have been occupied by the Government officials, and an adjacent area has been reserved for the erection of merchants' houses. A pure water supply is laid on to each house, and a most convenient highland railway, five and three-quarters miles long, carries the residents to and from Freetown to Hill Station. The bungalows are raised up and supported upon iron pillars upon concrete beds, and a concrete platform has been constructed beneath each bungalow. With stringent and careful sanitary regulations this colony should prove a very great success, and no effort should be spared to make it successful. The European merchants have not as yet taken advantage of this site. It is, no doubt, difficult for them to leave their warehouses at night-time, but we feel sure that the advantages which would be gained by the change of fresh air in the evening and during the night, or the rest at the week end, would outweigh any inconveniences, which, moreover, we venture to think are not insuperable. Furthermore, we feel convinced that social life would be promoted between the various elements of the white population, and this is a matter which is rightly considered of great moment where there are only some two hundred and seventy Europeans in a vast population of thirty-four thousand. The government has made a great experiment, which in the light of all modern knowledge and of the local conditions existing in Freetown, is a wise one, and one which it behoves, therefore, all those who are interested in the promotion of the health of the colony to help. If it is permissible for us, as the result of our short visit, to make comparisons, we think that both in Bathurst and Conakry the merchant draws a more strongly marked line between his business and his social life than is the case in Freetown, and we can well imagine, with no loss of profit to business and certainly with greater benefit to health and well-being, conditions which, in the long run, are best for business. When comparison is made of the density of population, of the sanitary conditions, and of the accommodation for the merchants in the three towns, it is clear that Bathurst and Conakry lead, and that until Freetown itself is rendered more sanitary it is wisdom for the merchant to avail himself, in the meantime, of every help that is offered. The European is slowly appreciating the fact that endemic malaria exists to the extent of at least eighty per cent. in the young native population of the West Coast, and that it must take a considerable time and most vigorous anti-mosquito measures before this figure is measurably reduced. The European cannot, therefore, make a wiser move than to follow the first steps which would be taken in every civilized country to avoid an infectious disease; these precautions, moreover, do not interfere with full intercourse and the conduct of business with the natives during the day, and, therefore, with the primary object of the merchant. The government has also set another example and taken a wise step in erecting mosquito-proof houses for the railway officials at Cline



Town. It was necessary for these officials to be close to their work, special houses were, therefore, constructed in an area at some distance from the native quarters ; the ground has been cleared all round and recreation arranged for. Although the site is low the soil is sandy and water does not remain.

*Recreations.*—For its size, in comparison with Bathurst or the French town of Conakry, Freetown seems not to have paid much attention to outdoor games. But this will no doubt be soon remedied, as a golf course has already been laid out ; but a lung in the town such as McCarthy Square, in Bathurst, would serve a most useful purpose. There is a public garden, but it is not so large as that at Conakry. It is a matter of great regret that there are no horses. It is said that they would die from Trypanosomiasis ; but we think that an experiment might with advantage be made of introducing horses free from blood parasites and determining definitely how long they do survive. The experiment could be tried at one or other of the military stations.

*Climate.*—In the dry season the air on the hills is very fresh and cool ; in the wet season some of the hills are said to be damp owing to the condensation of the moisture in the air due to the fall in temperature at night of some 6° to 7°. Owing to its being shut in by the hills, the air in Freetown itself is close, except at points along the bay. The average shade temperature is 80° F., and there is little diurnal variation. The rainfall is exceedingly high ; it varies from one hundred and twenty to two hundred inches per annum and from five to ten inches in one night. The rainy season lasts from May to October.

#### DISPOSAL OF EXCRETA AND REFUSE

*Excreta.*—**The great abomination of Freetown is its foul system of cess-pits.** In 1897 Dr. PROUT made a most careful survey and found that there were some two thousand six hundred and fifty cess-pits and two hundred and eighty-six open pits in the various yards. As many as one thousand two hundred persons had no accommodation of any kind, and the occupiers would have been obliged to seek the shore or waste places. Since that date the number of cess-pits has increased.

In addition, pits when they become full may be covered over and new ones made. They vary in depth ; some are twelve feet deep. Dr. Prout estimated that seven hundred and fifty tons of faecal matter and over two million gallons of urine were deposited in these cess-pits during the year. A more objectionable method of the treatment of excreta could not be found, and to it must be attributed a very large proportion of the diseases prevalent amongst the native population.

In company with Serjeant Walker, the chief sanitary inspector, we had many opportunities of examining the cess-pits. They all presented the same bad features :

they were close to the house and usually within a few feet of the well, they swarmed with maggots, and they had a most objectionable smell.

The dangers of the cess-pits may be classified as follows :—

1. Pollution of the atmosphere.
2. Pollution of the ground-water and wells ; leading to  
Intestinal diseases, such as dysentery and diarrhoea, typhoid,  
cholera.
3. Breeding of mosquitoes.
4. Breeding of flies.

1. *Pollution of the Atmosphere.*—In a tropical town seven hundred and fifty tons of dejecta in the year left to decompose slowly in half-closed cess-pits must poison the air. It has been shown that sewage gas is harmful, and there can be little doubt that the health of Freetown must suffer in consequence.

2. *Pollution of the Ground-Water.*—Seven hundred and fifty tons of excreta and two million gallons of urine slowly soaking into the earth and mixing with the ground-water must infect the water. The cess-pits are not so deep (ten to twelve feet) as the wells (twenty to thirty feet), and often in the sloping portion of the town they are placed above the wells, so that in the rainy season when the cess-pits become flooded, the diluted contents of the latter may be washed into the former. Analysis has shown that the water is not good, and it never can be free from danger. To this fouled water must be attributed the numerous cases of diarrhoea and dysentery, and probably a large proportion of the infantile mortality. If cholera was introduced the consequences would be disastrous. By means of the new pipe line the dangers from drinking water have been mitigated, but until cess-pits and wells are abolished a vast amount of preventable disease must occur.

*Breeding Mosquitoes.*—Both in the wet and dry season *Culex* mosquitoes have been found in abundance in the cess-pits, urinals, and privies. Dr. LOGAN TAYLOR reported ‘that in the privies erected over the cess-pits large numbers could always be found, and on kicking the wood-work they would fly up in large numbers.’ The cess-pits and sewage water are therefore responsible for breeding a very large number of the *Culex* of Freetown. The *Culex* is not a harmless mosquito ; it has been shown to transmit *Filariasis*, and it is possible that other diseases may be associated with this blood-sucking insect.

*Breeding Flies.*—Enormous numbers of flies breed in the cess-pits, and as they are close to the houses there is every opportunity for direct contamination of the food.

As far back as 1897, the principal medical officer—Dr. PROUT—in a report to the Municipal Council upon the sanitary condition of Freetown, said, in dealing with the cess-pit system, that the only course was the *closure of all cess-pits*, and that it be made a punishable offence to make new ones. He then analysed in detail under the

wet system and the dry system the best substitute for cess-pits, and concluded that a dry method, such as the pail system, was the best. To-day, Dr. PROUT is of the same opinion, and in his official report to the Government for 1902, states as follows :—

#### THE PAIL SYSTEM

‘Some modification of the dry system appears to be the most suitable ; and the one which I have recommended, after careful consideration of all the facts, is the pail system. The initial outlay in comparison with the water system is comparatively small, consisting of pails, sanitary carts, mules or oxen, etc., and the annual upkeep would not be extravagant. I need not go into details here, but a regular system of house-to-house visitation would have to be organized, and the question of the disposal of the night-soil thus collected by hoppers or by depositing it in the soil would have to be carefully considered. A series of experiments which I made at the lunatic asylum showed me that by emptying excreta in very shallow trenches three or four inches, mixing and covering with soil, the whole disappeared in the course of a few days and created no nuisance. With the assistance of the railway the transport should not be a matter of difficulty, and this method of disposal is worthy of consideration. I may quote in conclusion the report already referred to :— “An examination of Ismailia certainly predisposes one in favour of a dry system of sewage for the tropics, especially if sand is available. The wet underground tank system in the European houses has shown me the dangers of this plan in a clearer light than I ever saw it before ; this, and the state of the Arab quarter, has enhanced in my mind the suitability of the dry system for small tropical towns where, for any reason, a perfect water-borne system may be unobtainable.” “I am convinced that if some such system were adopted here it would do much to improve the health and diminish the discomforts of Freetown. I venture to express the hope that now the water supply is in course of completion, it will be found possible to provide funds to take the matter in hand at an early date.’

We thoroughly agree with Dr. PROUT that for a tropical town the dry method is the best. It works well where it has been tried ; Conakry, as we have shown, is a model, whilst one of us can endorse what Sir WILLIAM MACGREGOR has said concerning the mosquito breeding capacity of the water-closets and *puits perdus* at Ismailia. Unsatisfactory, for other reasons, is a water system of sewage disposal, *tout a l'égout* will not work in a tropical town. The cost would be prohibitive, the water supply would have to be increased on a vast scale, and the difficulties to its efficient working in the hands of a native population of thirty-four thousand would be immense.

We would suggest the increase of latrine accommodation ; there are already six, which is an insufficient number, and the setting apart at selected places in

the town of night-soil areas, consisting of at least three feet of good porous and sandy soil, thoroughly and freely underdrained. These areas to be used for burying the night-soil in shallow trenches, the pails being brought in the early morning or night-time by the natives themselves, just as at Bathurst and Conakry they are carried to the sea and emptied. It would materially lessen the burden of the municipality if the native population were obliged to assist, as in other towns, in the disposal of the night-soil. If this is impossible, a special staff would have to be employed for collecting the pails. The extent of ground necessary at each selected place would have to be calculated on the number of persons using it and upon the rate of disintegration of the faecal matter, which should be determined by laying out an experimental plot and watching it for a year. On account of the very great rainfall in the wet season, great care would have to be taken to ensure efficient drainage so that the soil would dry quickly, as a sodden, saturated soil would be worthless and retard disintegration. It would be necessary to keep the plots under constant supervision and railed in, and a water supply should be laid on for the necessary cleansing of vessels. Both at Bathurst and Conakry the night-soil problem is a simple one, on account of the proximity of the shore and its comparative ease of access. In Freetown the shore is more difficult to reach, and disintegrating plots are necessary.

From direct experimental observation we know that the method of mixing organic matter with loose dry soil is one of the most rapid biological methods of sewage disposal, where faecal matter and urine are concerned.

*Slop-Waste.*—For the most part this is kept out of the cess-pits; it is also thrown upon the ground to soak in as best it can, and it then tends to become a nuisance. Very often a stone-faced or cement gutter carries the waste from the yard to the drain in the street. Owing to their irregularity and bad fall they very frequently contain foul water and offend both the sense of sight and smell, they also act as breeding-grounds for *Culex*. The disposal of slop-waste is a serious difficulty; in Bathurst and Conakry it can readily soak into the porous soil, but a definite means of disposal has to be found in Freetown. Under Conakry we mentioned that the French authorities had discussed the advisability of establishing a separate conduit system for the slop-waste to run side by side with the storm-water drains. This plan, however, had not been carried into effect, and we are under the impression that to get over the difficulty the waste from the factories has, in certain instances, been conducted in cement channels to the storm-water drain. But it is very objectionable and altogether unsuitable, if it can be avoided, to use the storm-water drains for the slop-waste in countries subject to immense rainfalls. In the dry season the drains are very large empty channels, and the slop-waste from the houses let into them simply produces a trickle or a sewage puddle. Either a small open cement drain should be constructed along the roads of sufficient size to take the slop drainage and to allow of flushing, or else the main storm-water drains must be reconstructed, rendered water-tight, given proper



falls and a proper shape in section, and be kept flushed ; the latter consideration, however, raises the question of drainage of Freetown, a subject which will be dealt with further on.

*Dry Refuse.*—There is too much refuse in Freetown, the overgrown bush furnishing a very large proportion. Special shoots and dust-bins have been set apart, but it is very evident that no place is sacred in Freetown as the youngsters pitch refuse away at the most convenient places. To our mind simple incineration should be more frequently made use of, but we cannot do better than quote the report of the Chief Medical Officer upon the *Removal of Refuse from Houses and Yards*. ‘The duty of removing refuse and keeping yards clean devolves by the local laws upon the occupiers, and to facilitate this being properly done dust-bins are placed in various parts of the town, and shoots have been constructed in one or two places on the shore. When yards are found to be in an insanitary condition, notices are served on the occupiers. In this way three thousand eight hundred and thirty-six notices were served in 1902, the majority of which were complied with. Seventy-eight summonses were taken out for non-compliance and for offences against the sanitary laws. Special attention is given to the removal of old tin pans, etc., which are capable of retaining water and harbouring larvae, and people have been warned against keeping collections of water in their yards sufficiently long to breed mosquitoes. It is absolutely imperative, however, that it should be made a punishable offence to have receptacles containing larvae in any yard, and the provision of proper covers for all vessels intended to store water should be made compulsory. This is provided for in a consolidated Sanitary Ordinance, which is now in the hands of the printer.

The refuse from the yards is emptied by the occupiers into the dust-bins referred to, which in their turn are emptied by the carts as frequently as the limited number will allow. Over 3,000 loads were removed during the year. I cannot regard the present arrangements as altogether satisfactory ; it requires a very persistent system of inspection, which is expensive and should be unnecessary, and the formation of collections of rubbish at the dust-bins in various parts of the town is not only unsightly but at times insanitary (Plate VIII). In my opinion the time has now come for the municipality to consider the advisability of establishing a regular sanitary service for the removal of household refuse. A sufficient number of carts should be provided to allow of every street in the town being visited daily, or tri-weekly, at stated hours. Householders should be compelled to provide themselves with proper receptacles for household rubbish, which would be emptied by the sanitary carts, and the rubbish deposited in the various shoots or in selected places outside the town. It would be still more satisfactory if a destructor could be erected to deal with the enormous mass of vegetable and other refuse which accumulates so rapidly in a tropical town.’ We agree with Dr. PROUT, and are of opinion that it would be impossible to keep the yards, roads, and waste places of Freetown free from accumulations with a staff

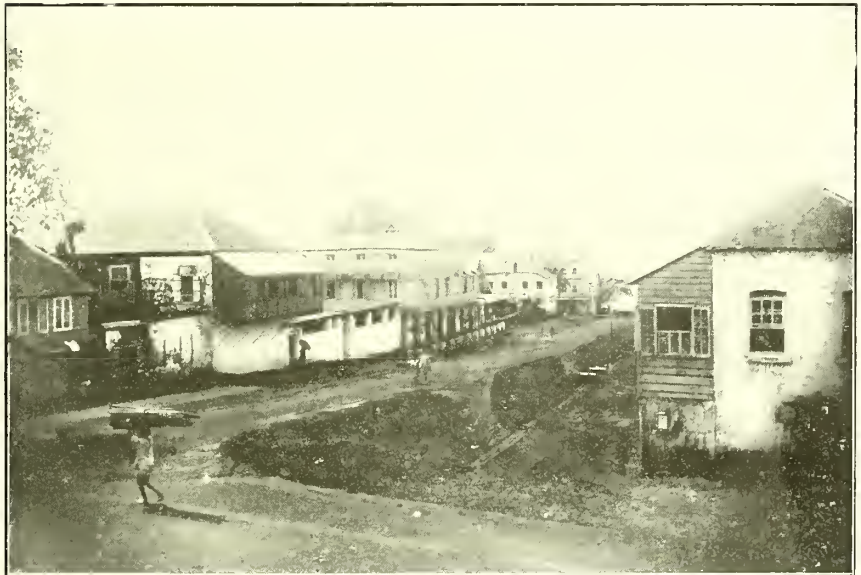


PLATE VI



A STREET IN FREETOWN, SHOWING A DRAIN ON THE LEFT. NOTE IRREGULAR SHOPS

*Photo—Dr. Logan Taylor*



A STREET IN FREETOWN. HOUSES ON RIGHT SIDE IN BIG DEPRESSION AND LIABLE TO BE FLOODED

*Photo—Dr. Logan Taylor*





PLATE VII



A STREET IN FREETOWN CONSISTING OF ROCK SURFACE, IN WHICH THERE ARE INNUMERABLE POOLS BREEDING ANOPHELES (RAINY SEASON)

*Photo.—Dr. Logan Taylor*



ANOTHER ROCK-POOL STREET SHOWING GROWTH OF WEEDS AND IRREGULAR HOUSES

*Photo.—Dr. Logan Taylor*

of sixty men and three carts. Bathurst, with a population of 8,000, has forty men. The remedy is to largely increase the staff and equipment and change the methods, as pointed out by Dr. PROUT, and if possible to obtain the services of additional trained sanitary inspectors. In English towns a great improvement has taken place since inspectors have been properly taught.

*Water Supply.*—A great improvement has taken place in the water supply. Pure water has been brought from a protected source in the hills to a covered reservoir on Tower Hill, from whence it is distributed to various parts of the town, stand-pipes being fixed at convenient places. The leakage which we described as taking place from the stand-pipes at Conakry also occurs in great abundance in Freetown, and leads to the formation of pools. Unfortunately, the whole of the city is not yet supplied from the new source, and therefore well-water is also used. Before any scheme of efficient drainage can be carried out, the town must be in possession of its new water supply, for one of the first essentials is to fill in all wells. We have before alluded to the fact that if there are two sources of water supply, observation shows that the one which is nearest runs the chance of being most frequently used in spite of the impurity, and the experience of Conakry demonstrates that the advantage of a pure supply are counterbalanced if the disused wells are left unfilled to act as mosquito breeding-grounds. Therefore the completion of the pure water supply of Freetown can be bracketed with the abolition of the cess-pit from the point of view of immediate urgency.

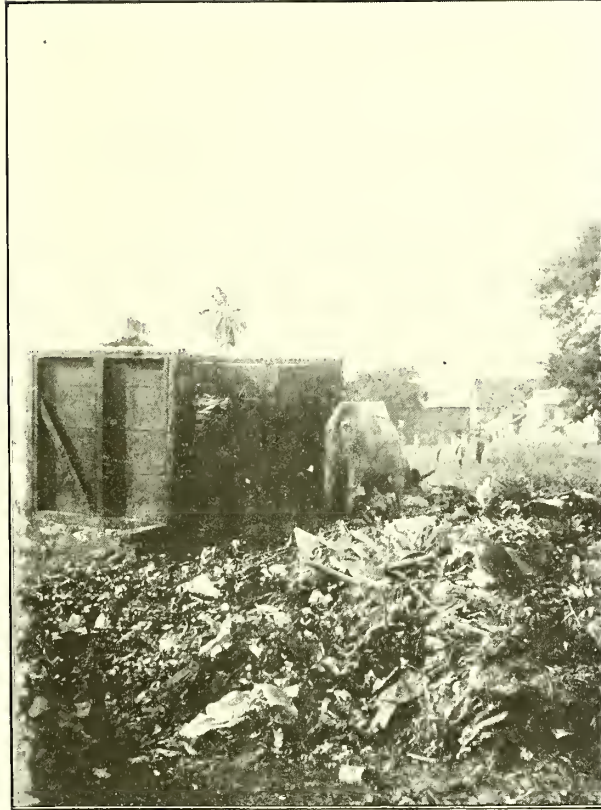
*Wash-houses.*—At present the streams are extensively used for washing. They are polluted, and we have noted the presence of the sewage fungus in one which was being used. The evil results of washing clothes in sewage polluted water are no doubt mitigated by the sterilizing action of the sun, but nevertheless, from the point of view of cleanliness and order, it would be better to abolish this system and introduce the model washing places as in Conakry.

*Drainage.*—In considering this question it is of interest to quote the following paragraph from the 1902 Report of the Principal Medical Officer upon the subject of drainage:—“This is a matter which I have advocated for many years as one intimately connected with the public health, and in my Report for 1898 I pointed out “the necessity for a thorough survey of the town, with the view of putting the surface drains in proper repair, and I would again recommend the advisability of taking this in hand as funds permit. Should the theory that malarial attacks depend upon infection by the mosquito be generally accepted—and proofs are already not wanting that this, at least, is one of the methods by which malaria is contracted—the importance of at once removing all surface water and thus depriving mosquitoes of their breeding-places is evident.” Since the above was written, the causation of malaria has been so definitely proved to be dependent on the presence of a particular variety of mosquito, that the surface drainage of a malarious locality has become one of the prime factors in all schemes of tropical sanitation.’



Since 1902 many new drains have been constructed, and these have led to an appreciable diminution in the number of *Anopheles*. But now, as in 1898, a thorough survey of the town is even still necessary with the view of dealing with the drainage in a comprehensive manner. Very little need be said by us upon the present drains in Freetown, as they have been described more than once in the reports of previous expeditions which have visited Freetown. They are open drains ; they run on both sides of the street ; in section they are either saucer, **U**, square, or **V**-shaped ; they may be faced with stone, made of cement, or cut out of the soft or hard laterite. They require constant supervision ; they become frequently choked, especially where they dive under the roadway. Their falls are very various and, in some places, it would be very difficult to discover any fall ; pools therefore readily tend to form in many of them, and in these *Anopheles* have been shown to breed in abundance.

What is the remedy ? No doubt a vast improvement could be made as suggested by Dr. PROUT, in pushing on with new drains, and we would further suggest with what appears to us to be equally essential, namely, the employment of a larger staff of labourers under very strict European supervision to see that the drains are respected by the inhabitants, and not made convenient receptacles for rubbish, and that they are kept in thorough repair. But unfortunately this will not bring about efficient drainage in all cases. Many of the roads as we have pointed out have a hard rock surface (Plate VII) in which there are numerous rock pools, the steeper roads are often channelled in the centre by the great rains and secondary drains are formed, some roads are higher than the houses along the side (Plate VI), and the latter receive the overflow. There is no question of gentle turtle-back slopes as in Conakry, the gradients vary very greatly, some streets are very steep, whilst other portions of the town are flat. The rainfall is excessive, and in the steeper streets the loose soil is readily washed out and the surface of the roadway soon becomes grooved and irregular. The problem therefore is a most difficult one, and must necessarily involve considerable expenditure. The road making and drain making are part of the same problem ; at Conakry we have shown this has been the case, and in Freetown both require to be dealt with in a comprehensive manner by a skilled engineer. It appears to us very essential that particular attention should be given to the form of drain, and that one form should be adopted throughout. The drains in the wet season have to be prepared to carry away the maximum storm-water flow, whilst in the dry season they will only receive the comparatively small trickle of slop-water from the yards ; these two extremes have to be met. If in the dry season it could be arranged to divert the water from the streams and to make it circulate through the properly constructed drains, with absolute certainty of not increasing the breeding of *Anopheles* thereby, a constant cleansing of the latter would result at that portion of the year when it was most desirable ; and, at the same time, the great disadvantage which attaches to the streams in the dry season, viz., that they constitute in Freetown, at that period,



A DUST-BIN AT FREETOWN

*Photo.—Dr. Clarke*



A STREET IN GRASSFIELDS, FREETOWN, SHOWING DRAIN CUT OUT OF THE ROCK AND ROAD MADE UP, SO ABOLISHING STREET POOLS

*Photo.—Dr. Logan Taylor*



the chief sources of *Anopheles* supply, might very materially if not entirely be removed, because we are of opinion that, under the new circumstances, it would not be difficult to deal with the small pools remaining in the bed of the streams either by clearing the bed or by the use of paraffin. In the wet season the streams would follow their natural course; at this season it has been shown that the rapid current prevents *Anopheles* breeding, and that in consequence they are harmless.

*The Streams.*—We have pointed in the preceding paragraph—with a reservation—to a possible method of utilizing the water of streams in the dry weather. In October, 1901, Dr. DANIELS, in a letter from Freetown to Professor Ross, suggested either the formation of a central channel in the bed of the streams, with larger collections of water in sufficient number of places for drinking purposes, and lower down the stream other places for washing, or to dam up the streams so as to obtain a sufficient head of water to flush out the whole of the channels at intervals. He was further of opinion that the number of streams could be reduced, and some of the smaller diverted into the larger channels, and the number of breeding-grounds thus diminished. Since Dr. DANIELS wrote the drinking-water question has been practically solved, and it now only remains to deal with the public washing which goes on in the streams. We have pointed out that what Conakry has done in this respect can be repeated at Freetown with, we believe, comparatively small outlay. Admitting then that the streams are no longer used for drinking purposes, and are not necessary for washing purposes, then, as we have pointed out, the water might in the dry season be diverted into the street drains for cleaning purposes. If this is impossible, owing to the difficulty of obtaining suitable falls and to the liability to the formation of sluggish corners where *Anopheles* could breed, then **the bed itself of the stream has to be remade and converted into a well-made drain, in which it will be impossible for collections of water to form in dry weather.**

Summed up, the alternative schemes appear to be as follows .- -

1. Reconstruction of the bed of streams.
2. Diversion of water for flushing of town drains in dry weather.
3. Construction of dams in streams and flushing of beds at intervals.

*Some Public Works.*—As in the case of the other two towns, we visited the principal public works, such as the hospital, barracks, prison, markets, and slaughter-houses.

*The Barracks.*—We have already commented upon the excellent quarters provided for the military. If there is anything which we would venture to urge in connexion with them it would be a more stringent use of the mosquito net. The military hospitals, containing, as they invariably do, cases of malaria, should be rigorously isolated by the net. The streams in the neighbourhood should also be most carefully watched, and the breeding of *Anopheles* prevented.



*The Colonial Hospital.*—An immense amount of good work is done in the overcrowded building which serves as the hospital. As at Bathurst, it has been found that the ‘advantages of a trained European nurse are incalculable.’ The number of in-patients in 1903 was one thousand four hundred and ninety-three, and out-patients six thousand five hundred and ninety-three. Forty-three major and three hundred and nineteen minor operations were performed in 1903. It was extremely gratifying to find the medical officers and the nurses devoting so much of their life and energy to this large hospital. On the other hand, we did not hear that the natives themselves, for whose benefit these sacrifices are being made, did much to help to maintain the institution. In addition to the hospital there is a nursing home, under the charge of European nurses, where Europeans are attended; this has been a success.

*Princess Christian Hospital.*—This hospital is under the patronage of Her Royal Highness the PRINCESS CHRISTIAN, and was opened in 1892. The number of out-patients in 1902 was 7,046. In addition to treating the sick poor, both in its in and out-patient departments, the hospital accomplishes excellent work in training nurses.

*Opportunities for Investigation.*—The laboratory accommodation in connexion with the hospital is quite inadequate to the requirements of Sierra Leone. The large clinic affords abundant opportunity to the student of medicine for the investigation of tropical diseases. A small, suitably equipped laboratory would be a great acquisition, especially if it were put in charge of a Pathologist, acting under the Principal Medical Officer. The scientific investigation of the diseases of man and animals in the colony and protectorate would repay the comparatively small outlay. In countries where disease in man plays such an important share in limiting the extension of commerce, we venture to think that there can be little difference of opinion upon the practical good which would result from the establishment of a small scientific station.

*The Markets and Slaughter-House.*—For the size and trade of Freetown the market accommodation is small, and compares unfavourably with Conakry and Bathurst. More market accommodation is needed, and we would suggest, from the degree of efficiency which we observed at Conakry and Bathurst, the construction of the simplest style of building—an iron roof, open sides, and a concrete floor, with proper falls in order that it could be readily flushed. The slaughter-house is not in a good place—King Jemmy’s wharf is overcrowded and very public—we saw the cattle tethered to the slaughter-house on one side, whilst on the other there is a public latrine.

*Health of Freetown.*—Dr. PROUT, in his 1902 Report, has carefully analysed the death-rate in the native population, and the death and sickness rates amongst the Europeans.



The following table, taken from the report, shows the death-rate from 1896 to 1902 :—

Year	Estimated population	Total Deaths	Death-Rate
1896	32,142	878	27·2
1897	32,570	871	26·7
1898	32,998	866	26·2
1899	33,427	923	27·6
1900	33,855	895	26·4
1901	34,284	959	28·9
1902	34,712	865	24·9

The average death-rate is 26·8, a figure which Dr. PROUT does not regard as high for a tropical town, but he is of opinion that it can be lowered by the adoption of the sanitary improvements to which we have alluded to previously.

The largest number of deaths occur in January and June, and he points out that there are two periods of good health—one immediately preceding the rains, and the other immediately succeeding or during the period when they are very heavy. At both these periods the causes which produce malaria diminish. The dry season will cause a diminution, and in the very wet season the torrential rains will wash away the larvae. Dr. PROUT is further of opinion that efforts to exterminate the mosquito should be made during the dry season and early part of the rains, at which time breeding-places are less numerous. In the early part of the year there is a rise in the mortality which may be due to changes in temperature, for the causes of death are mostly to be attributed to the respiratory system. The infant mortality is high, and Dr. PROUT regards malaria as the chief cause after that attributable to labour.

The following table shows the mortality due to different diseases at all ages—(Medical Report, 1902).

TABLE V. SHOWING THE MORTALITY DUE TO DIFFERENT DISEASES AT ALL AGES

Diseases	January		February		March		April		May		June		July		August		September		October		November		December		TOTAL
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
General Diseases :—																									
Fever, Intermittent	4	10	4	4	8	4	6	6	5	7	5	13	8	7	6	8	3	8	7	6	4	6	5	5	147
Fever ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Fever, Remittent	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Syphilis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Debility	11	5	6	5	5	9	4	8	5	3	4	8	4	7	8	5	2	3	5	4	3	5	4	12	135
Rheumatism	2	1	3	1	...	...	1	...	...	1	3	...	2	...	1	1	1	1	2	...	...	...	1	3	23
Tubercle	2	4	3	3	3	1	1	1	1	...	2	1	1	2	2	...	1	1	1	1	1	1	1	...	34
Other Diseases	2	3	7	1	8	6	2	1	3	1	3	5	3	3	1	1	3	3	6	3	2	1	...	3	71
Local :—																									
Nervous System	2	3	3	...	2	4	2	5	4	5	5	4	5	1	4	4	3	3	6	1	4	2	5	2	79
Circulatory "	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Respiratory "	9	5	7	9	10	8	5	1	8	2	5	7	6	1	3	5	1	4	...	2	2	...	1	2	20
Digestive "	6	6	5	6	4	2	3	2	8	4	3	4	6	3	4	5	1	2	5	3	8	5	12	3	130
Lymphatic "	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Urinary "	1	1	...	...	1	...	1	...	1	...	1	...	5	...	3	...	4	1	1	...	3	1	1	2	104
Generative, Male	...	...	...	...	...	...	...	...	3	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
" Female	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Affections connected with Pregnancy	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	2
Affections connected with Parturition	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...	1	3
Connective Tissue	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Skin	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Injuries	...	2	...	1	...	1	...	2	...	...	1	...	3	...	...	...	...	...	...	...	...	...	2	1	17
Unclassified	6	1	5	5	2	2	1	...	...	4	2	2	4	1	...	2	1	2	3	2	3	2	1	2	53
TOTAL	45	42	42	37	44	38	26	28	41	29	40	46	47	25	34	31	23	34	42	26	35	31	38	41	865

*European Death-Rate and Sickness-Rates.*—Table showing the number of deaths since 1886 amongst the residents :—

Year	CAUSE		Total
	Climatic	Otherwise	
1886	...	...	...
1887	...	2	2
1888	1	3	4
1899	3	6	9
1890	3	1	4
1891	3	2	5
1892	6	2	8
1893	4	4	8
1894	13	2	15
1895	4	2	6
1896	5	2	7
1897	13	...	13
1898	8	4	12
1899	3	6	9
1900	8	7	15
1901	8	2	10
1902	3	2	5

Dr. PROUT calculates that, assuming the European population has remained about the same since 1899, the death-rate would be—

1891	...	...	25·6
1899	...	...	33·3
1900	...	...	55·5
1901	...	...	37
1902	...	...	18·5

He states that we are hardly justified in attributing the diminution to a permanent improvement in sanitation, allowance has to be made for individual susceptibility and new arrivals. But he adds, 'The greater knowledge of the causes which produce malaria and the precautions which are taken are undoubtedly having their effect,

while there is no doubt the nursing home has had an appreciable effect in reducing the number of deaths.' In 1900, amongst Government officials it was 5·8 per cent., in 1901, 4·9, and in 1902, 4·8 per cent. It is a great pity that this return is incomplete and does not embrace all Europeans, but Dr. PROUT hopes to remedy this defect. A return is badly wanted showing the nature of the illness, and in the case of malaria whether due to infection in Freetown or elsewhere.

These figures are encouraging, and with the additional measures of safety which have been taken in 1903-4, more especially the construction of mosquito-proof houses, and the erection of the Hill Station, there is no doubt that there should be a further diminution in sickness, especially from malaria.

*The Anti-Mosquito Measures.*—As the result of an almost continuous series of expeditions from 1899 to 1903, one sent by the Royal Society, and the others by the Liverpool School of Tropical Medicine, the mosquito breeding-grounds of Freetown have been worked out in a most thorough and comprehensive manner. For convenience we summarize from a report by Dr. LOGAN TAYLOR the distribution of *Culex*, *Stegomyia*, and *Anopheles* throughout the year.

No.	Breeding-places	WET SEASON			DRY SEASON		
		<i>Culex</i>	<i>Stegomyia</i>	<i>Anopheles</i>	<i>Culex</i>	<i>Stegomyia</i>	<i>Anopheles</i>
1	Tins, bottles, and small waste receptacles in yards and compounds ... ..	present	present	...	...	...	...
2	Gutters and flower vases ...	present	present	...	...	...	...
3	Receptacles in houses, filters, and water jugs ... ..	present	present	...	...	...	...
4	Water casks and cisterns ...	present	present	...	present	present	present
5	Wells ... ..	...	...	present	...	...	present to a limited extent
6	Water from hydrants ...	...	...	...	...	...	present
7	Cess-pits ... ..	present	less frequently	...	present	...	...
8	Sewage and slop drains ...	present	less frequently	...	...	...	...
9	Rain-water pools in street drains ... ..	present	...	present	...	...	...
10	Rain-water pools in compounds and streets ... ..	...	...	present	...	...	...
11	Water at sides of streams and springs, and rock pools ...	...	...	present	present	present	present



This table shows that in the dry season the supply of *Anopheles* is kept up by the natural streams and a few springs passing through and in the neighbourhood of Freetown, and also to a much less degree by the wells when full, and by the waste water collections from the hydrants.

That in the wet season the chief sources of *Anopheles* are the rain-water pools in the streets, both on the irregular rock surface of the roadways and in the side-drains, also the wells, and to a less extent the streams.

In the case of *Culex* and *Stegomyia* these are abundant in all collections of still or dirty water in all sorts of receptacles. In the privies throughout the year, in cisterns, casks, slop water, and the streams in the dry season. Because of the greatly diminished breeding area of the *Anopheles* in the dry season, it has been suggested to commence comprehensive anti-mosquito measures first in the dry season, by abolishing wells and preventing leakage from the hydrants, and above all by dealing with the streams which are the major source of *Anopheles* supply. We have already alluded to methods of treating the streams in order to prevent mosquito breeding. There is no question that they constitute at present a real source of danger to all those living within a considerable range of them, and the further European quarters can be removed the better; the Hill Station possesses a great advantage in this respect.

In the wet season the breeding grounds of *Anopheles* are enormously increased owing to the totally incomplete state of the roads and drains, and the pools and wells in the compounds. The getting rid of the wells will do something, but the cure is roadmaking and drainage; we have already alluded to both.

It is surmised that were it possible to get rid of the *Anopheles* in the dry season, that there would necessarily be an absence of them in the wet season. It is quite conceivable that there would be a marked diminution, but it would be very rash to prophesy a disappearance.

*Culex* and *Stegomyia* can be diminished and abolished by domestic sanitation, abolishing cess-pits and wells, and by keeping the yards and compounds perfectly clean.

The anti-mosquito measures which are at present employed consist in the gradual construction of suitable drains, a work which was commenced in 1902, and the supervision by the Municipal Sanitary Staff of the yards and compounds with the view of enforcing cleanliness.

Mosquito nets are very generally used, but whether in all cases they are properly used and looked after it is difficult to say.

We have already alluded to the mosquito-proof houses at Clinetown for the railway officials, and to the excellent hill cantonment for the Europeans. The latter constitutes the most extensive anti-mosquito measure which has been so far carried out in Freetown.

It is evident that a great deal remains to be done before there can be any appreciable diminution of malaria in the native population. To sum up, the measures required in Freetown are :—

1. The reconstruction of the bed of the streams.
2. The abolition of wells.
3. The closure of the cess-pits.
4. The reconstruction of the roads, the repairing and making of new street drains, and the draining of the compounds.

*Results of the Anti-Mosquito Measures.*—We think that it is beyond dispute that as at Bathurst and other places the anti-mosquito measures in Freetown have made people think and become more careful.

From personal knowledge we know that a great number of the merchants insist on the use of the mosquito net, and the establishment of a separate European colony at Hill Station is proof that the danger of living amongst a population which harbours malaria to the extent of eighty per cent., at least in the children, is fully realized. We think also that there is every justification for believing that the health of the Europeans has improved during the last few years—whether this is to be attributed solely to anti-malarial measures or to better selection of the men it is perhaps difficult to say, probably both are at work in a good circle.

We feel convinced that the money which has been spent so freely upon Freetown in organizing expeditions of investigation, and in actually conducting anti-malarial operations has been of the greatest good in demonstrating the hopefulness of success and the practical good of anti-malarial measures.

GENERAL SANITATION AND ANTI-MALARIAL  
MEASURES IN SEKONDI, THE GOLDFIELDS  
AND KUMASSI





LIVERPOOL SCHOOL OF TROPICAL MEDICINE—MEMOIR XV

GENERAL SANITATION AND  
ANTI-MALARIAL MEASURES IN  
SEKONDI, THE GOLDFIELDS  
AND KUMASSI

AND A COMPARISON BETWEEN THE CONDITIONS OF EUROPEAN  
RESIDENCE IN THE GOLD COAST WITH THOSE  
EXISTING IN INDIA

BY  
LIEUT.-COLONEL GILES

**PRICE 7/6 NETT**

PUBLISHED FOR  
THE UNIVERSITY PRESS OF LIVERPOOL  
BY  
WILLIAMS & NORGATE  
14 HENRIETTA STREET, COVENT GARDEN, LONDON  
SEPTEMBER, 1905



*At the University Press of Liverpool*  
*No. 62. September, 1905. 500*

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Mr. A. R. MARSHALL	} <i>Shipowners' Association</i>
Mr. W. ROBERTS	
Mr. STANLEY ROGERSON	<i>West African Trade Association</i>
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## 2 SANITATION AND ANTI-MALARIAL MEASURES IN SEKONDI

ago it was a mere group of fishermen's huts lying beside the quaint old Dutch fort ; but now it has become a considerable town, mustering perhaps 150 Europeans and over 10,000 natives. The European population fluctuates greatly, being mainly composed of Civil officials and railway staff, whose duties require them often to be absent for several days together on inspection duty ; and the representatives of mercantile houses concerned in the supply of the mines, who equally have to make frequent trips to meet their customers, so that any attempt to trace infection of any kind definitely to Sekondi itself could hardly fail to be fallacious. The native population is growing so rapidly that it can only be surmised. At present the control of the town is in the hands of the Civil authorities, but it is understood that it is proposed to institute a Municipal council. Let us hope that West African experience of native control of sanitary matters may be more favourable than experience in India, where the plan of local self-government has had a long trial, the last ten or twelve years of which have been largely occupied in trying, with indifferent success, to modify the worst evils of the system.

Viewed from the sea, Sekondi and the shore we coasted for some hundreds of miles, much resemble Burmah. In both countries there are similar ranges of hills of moderate elevation, but with abrupt slope, reaching almost to the beach, and on landing one finds that these hills are in each case separated by marshy valleys. As a natural result, however, of the rather less moist climate of the Gold Coast, the West African jungle has not the same impenetrable character of that of Burmah, though the magnificent cotton trees lend it a dignity which is wanting in the uniform height of the masses of foliage of a Burmese forest.

### **Topography.**

The old Dutch fort, which forms the nucleus of Sekondi, is perched on a small hill forming a headland, which is continued out to sea to form a reef which affords considerable shelter for the handling of lighters and boats, and so gives to Sekondi whatever claims it may have to be considered a port. To the west of the fort is a straight exposed beach, while to the eastward the shore curves and forms a broad, shallow bay, the steep hillsides coming down absolutely to the beach, so that the hills bounding it form particularly favourable building sites. The beach to the westward is bounded by lower ground, interrupted by a low hill. A few hundred yards to the westward of the fort a small stream, almost dry except during the rains, runs into the sea ; but its mouth is obstructed by the piled-up beach. The bed of this stream runs directly through the most closely inhabited part of the town, forming a troublesome marsh, soft at all times of the year, and generally goes by the name of "No. 1 lagoon." Further to the west a similar stream bed forms "Lagoon No. 2," and is contiguous to a growing native portion of the place, though at present no European residences come to any extent within its influence.

Between the fort and the shore end of the reef lies a closely-packed native village, inhabited mainly by fisher-folk, and as the District Commissioner's house is placed just to the west of the fort, it almost overlooks and is in close proximity with this most undesirable neighbourhood. During our visit

steps happened to be undertaken with a view to the formation of a club, and, most unwisely, as it appears from a sanitary point of view, it was proposed to adopt a site close to the fort and the District Commissioner's house. But this is close to the fishing settlement; and moreover, the fort hill is bounded on the other side by "Lagoon No. 1." . . . There is probably no time of the day when people are so liable to be bitten by mosquitoes as when resting after the evening game of tennis, billiards, or cards, in the dusk, and if the intention of placing the club on this site is maintained, the result will be that the European residents will, for the most part, assemble each evening in a place where a free supply of mosquitoes is insured by the proximity of the "lagoon," and their infection rendered a very simple matter by that of the crowded native village. Undoubtedly a more salubrious site would be the hill to the eastward, on which the railway settlement is placed, and where there is still plenty of room. The objection raised is that the climb to the top of the hill would be hard on the mercantile community, who mostly live on the low ground, between the fort and railway hill. There is no doubt that the commercial and departmental offices must continue to be placed in this locality, and there is little danger in its occupation during the day; but the sooner the merchants recognise that this site, however necessary for office work, is a most dangerous one to sleep in, and remove their private residences to the high ground to the eastward, the better it will be for their health, for the business part of Sekondi is already closely packed with European and native establishments, inter-mingled in a manner which cannot now be remedied. It appears very doubtful indeed, if it be at all practicable, under the conditions of trade on the Coast, to maintain any separation between the business premises of the two races, nor is there any particular necessity for its being attempted, always provided that the office and private residence of the European merchant be kept separate.

"No. 1 Lagoon" and the low ground round it form a large space in the very midst of the inhabited area, and the line to Kumassi leaves the town, by way of the valley that feeds the swamp, the railway station being situated on its southern bank. It was, I understand, at one time proposed to fill in the swamp, and utilise it as a site for the station, and it is most unfortunate that the idea was not carried into effect, as it would have at once done away with one of the greatest sanitary defects of the site of the town. As matters stand, on the contrary, the engineering works in connection with the railway have, as is so often the case in the Tropics, greatly intensified the sanitary difficulties of the case. The embankment of the permanent way and the borrow-pits on its sides, now form permanent breeding-places for mosquitoes; whereas, but for this, after the prolonged drought that Sekondi had experienced at the time of our visit, there would have been no natural breeding places whatever on the site. Dr. Collier, the sanitary officer, told us that, during the rains the "lagoon" swarms with larvae, and that owing to its considerable extent, and the amount of vegetation, it is most difficult to deal with it by means of kerosine. This I can well understand, and it is clear that the filling in or drainage of this swamp is a *sine qua non* to the sanitary salvation of Sekondi, and the same remark applies to "Lagoon No. 2," though it is a more urgent matter to deal with "No. 1."

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Apart from these marshes, the site of Sekondi presents many advantages, as the hills have a considerable slope, and they are composed of porous material throughout, consisting of a considerable thickness of gravelly soil, over-lying a pervious conglomerate rock. Most of the official residences are placed on the summits of these ridges, the hotel and railway quarters being situated on the ridge to the south of "Lagoon No. 1," while the hospital and medical quarters are on that to the north of it.

##### **Housing.**

Most of the houses are built of wood and corrugated iron, and are ill-suited for any tropical climate. Their best point is that they are for the most part well raised above the ground. In the business part of the town are some buildings of more substantial construction, but they are even worse planned, as they differ but little from the ordinary type of European dwellings. As, however, I propose to return to this point later on, it is needless to allude further to the point in this place.

##### **"SEGREGATION."**

The separation of the European residences from the native quarters of the town is far from satisfactory. As already noted, in the business portion of the place, no attempt appears to be made to secure this, and the Fort-hill is quite close to native habitations on two sides. In the Eastern portion of the town some attempt at segregation exists, in the case of the railway quarters, but even these are far too close to an extensive native quarter which is growing up between them and the railway line. Worse than this, the railway authorities themselves were building quarters for native clerks close to those of the European staff, and the fact that the former are doubtless people of education, and quite inoffensive neighbours from a social point of view, cannot alter the fact that they and their families are as dangerous, from the point of view of harbouring the malarial parasite, as their less cultivated countrymen. It is unfortunate that the attempts to utilise recent West African experience in the planning of this rapidly growing town have been so incomplete, as it is hard to remedy accomplished facts, but as the entire surroundings of Sekondi are practically unreclaimed jungle it is to be hoped that its future extension will be regulated, and some definite plan laid down whereby the institution of an European residential quarter, well separated from the houses of natives of all ranks may be secured.

##### **CONSERVANCY.**

There are no earth closets or special contrivances, the closet, in the case of European houses being usually furnished with an old paint drum, on the top of which is fitted an annular wooden seat; and a receptacle containing sand.

The native quarters are fairly well furnished with latrines, worked on much the same principle, though, of course, the receptacles are of a more special nature. The night-soil is removed daily by prison labour, as there appears to be a difficulty in obtaining free agency for this purpose, and is



carried out on to some rocks in the East bay, and thrown into the sea. This plan seems to answer well for the present, but would be inadequate, should the place increase in population to any great extent ; under which circumstances, the building of a pier, furnished with an improvised tramway, would be imperative. The success of so primitive a plan, as that of the sand-box and shovel, depends entirely on the individual care of each household, but even under the best of circumstances, the retention of the soil in the privy for 24 hours is very undesirable, and in large establishments, such as the hotel, almost unworkable, as long as decent cleanliness depends on so troublesome a plan as that described. The sand, too, was often damp, and the quantity supplied inadequate, and it is obvious that the provision of proper earth closets, operable by a simple pull-up valve, is urgently required ; and should be insisted upon by municipal regulation in all houses, whether European or native, in which a private closet is allowed to exist on the premises. It must be remembered that, in a properly planned earth closet the soil receptacle can be ventilated in a way that is impossible with the rough and ready appliance in vogue at Sekondi. Another desideratum is the provision of sheds for the storage of dry earth, as it must be impossible, during the rains, to obtain anything but wet sand. Simple structures of jungle poles and thatch would be quite adequate for the purpose, so that the cost of such an improvement should be very trifling.

There are, I understand, but 17 paid scavengers, and the remarkable cleanliness of the town, with so small a staff, speaks highly for the excellence of the sanitary supervision of the place, and the natural cleanliness of the inhabitants, but it is obviously out of the question for so small a number of hands to attend to anything outside the first rudiments of sanitation, so that the clearing of jungle and superfluous vegetation during the rains cannot possibly be attended to in the way it should be.

### **Water Supply.**

This very essential sanitary requisite is most unsatisfactory. No natural water of good quality is obtainable on the site, the very porous strata of which are so infiltrated with sea water, that all the wells that have been made are brackish to a dangerous extent, so that unless artesian borings be adopted, it is most undesirable that any further wells should be constructed. The results of artesian borings, however, are always uncertain, and the expense of making them is very heavy, and as there is said to be excellent water obtainable about six or seven miles up the line, it seems most undesirable to spend much money in attempting borings, which very possibly might only result in disappointment. At present, practically the entire supply of drinking water depends on the storage of a very limited and capricious rainfall. Observations are only available for the last two years, the average of which works out at 32 inches, that of 1904 being 26 in., and of 1903, 38 in. In each year the rainfall between October and April was inconsiderable, and it is clear that, to be on the safe side, storage should be provided for a possible drought of seven months. To provide anything like an adequate supply for so long a period, must necessarily involve an immense

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expenditure on tanks, and when all has been spent, such a system can never be satisfactory, as the roofs from which the water is gathered must necessarily gather also a certain amount of organic and inorganic dust, and when left stagnant and unaërated for such long periods, such water necessarily offers considerable facilities for the multiplication of pathogenic germs, and must needs become unwholesome. I am informed that each of the large cast-iron tanks recently adopted for Government quarters costs something like £200, and there can be no doubt that the sum already expended on tanks by the Government and the general public, would have gone far to meet the cost of a reliable and constant piped supply of filtered water.

At the time of our visit, the wells were yielding only a few gallons daily of brackish mud, and the tanks were reduced to their last few inches. Salt water is absolutely useless for washing clothes, and, if used for washing the person, in the case of Europeans at any rate, is almost certain to give rise to a most intractable form of tropical lichen with the usual sequelae of abrasions and boils. To be reduced to a gallon or so of fresh water *per diem* would be considered almost intolerable even in Europe, and only those who have tried it can well realise what is implied by such a state of things in a tropical climate; so that there can be no doubt that the provision of an adequate supply of pure water for Sekondi, is a matter of acute urgency. At the same time, it must be remembered that an ample water supply is by no means an unmixed blessing in tropical towns, unless proper care be taken to prevent the formation of wastage puddles. In India, for example, enormous sums have been spent in providing some of our larger towns with water systems on European lines, and the result has been that, without exception, the death-rate of these towns has increased simultaneously with the introduction of the piped water, and has failed to return to the old level. Cholera and other bowel complaints have, indeed, decreased, but the prolongation of the malarial season throughout the dry weather, through the agency of puddles around the stand posts, and other wastage accumulations, has more than neutralised the good results we hoped to reap by the provision of what is undoubtedly a first requisite of sanitation in all climates. In India, however, we labour under exceptional difficulties as to surface drainage, the average gradients in the Gangetic Plain being not much over a foot a mile, whereas in Sekondi for the most part it is difficult for puddles to collect, and, provided due care be taken that no standpost be placed in a situation where its drippings cannot drain away, no difficulties need be apprehended on this score. Where standposts must necessarily be placed where their wastage can possibly give rise to puddles, they should have constructed beneath them a blind well of fair depth, covered by a grating so arranged that the interior is quite dark, under which circumstances any drippings that may remain for any length of time unabsorbed cannot serve as breeding-places, because *Anopheles* larvae cannot live in darkness, and indeed, will rarely be found even in shady situations. On this account no danger is involved by the construction of underground drainage channels, though where they have to carry sewage water they are usually very objectionable in tropical climates, on other grounds than the formation of breeding-places for mosquitoes. It cannot, however, be too strongly emphasised that in the construction of water systems in tropical

towns the most minute care should be taken to prevent the possibility of the formation of wastage puddles, as it is an unfortunate fact that this point has not hitherto received the attention that it should from engineers.

### **Mosquitoes and Anti-Malarial Sanitation.**

It is said that mosquitoes are never very obtrusively common in Sekondi, and at the time of our visit they were extremely scarce: indeed, I have never met with any place where they were so uncommon, except at times of the year when these insects are all dormant from cold, and it is a literal fact that in most parts of the town one ran as little risk of being bitten as in a London square in summer, so that, save as a protection against malaria, no one would have found mosquito curtains necessary. In the hotel, although we were always on the look-out for specimens, we took only two or three individuals of *Stegomyia fasciata*, but this species did not appear to be breeding at the time, and probably here, as in India, only does so during the rains.

Dr. McConnell took a single *Anopheles costalis* in the hospital, but with these exceptions, we could find no mosquitoes beyond those we obtained by breeding out, though no doubt a few might have been found in the houses close to the "lagoons," but the remaining breeding-places were too limited to supply more than a limited area. In the puddles about the "lagoons" we found an amount of larvae, which, on breeding, proved to be those of *Anopheles costalis* and *Culex thalassion* (Theob.) The puddles in which these were found were very brackish, from the infiltration of sea water, one of them being undiluted (2,100 parts of chlorine in 100,000), while the other held as much as 545 parts of chlorine per 100,000.

The salter of the two puddles from which water was brought home was filthy to a degree, thick with a black deposit, and redolent with sulphuretted hydrogen. For the analysis of the specimens we are indebted to Professor Donnan, of Liverpool University, and it is obvious from his results that in these parts of the world nothing is to be hoped for from the flooding of marshes with sea water, which has been so successful in Italy, in the case of *An. maculipennis*, as it is clear that *An. costalis* can breed in undiluted sea water. Further, like *An. Rossii*, this species has no objection to filth, for one of the puddles was nothing better than salt sewage, while the other was none too clean. Under these circumstances, as might be expected, there was little or no active malaria to be met with in the town at the time. No fish were to be found in the marsh, probably because the water of the few small puddles remaining was too salt for fresh water species. It is possible, during the rains, that the water may become fresh enough to admit of their surviving, but, on the whole, unlikely, as it is well known that fish are extremely sensitive to variations in the properties of the water in which they have to live. As will be seen, these "lagoons" are in this respect a great contrast to those we met with above the level of the tide during our trip inland. The tolerance of *Anopheles costalis*, during the larval stage, to salt water, obviously offers an explanation of the great unhealthiness of African mangrove swamps, as contrasted with similar tracts in other parts of the world, which are not more unhealthy than other low-lying ground. Not only mosquitoes,



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but insect life generally, was remarkably scarce, house flies being so uncommon that in most parts of the town it was difficult to secure specimens. It is said that tsetse flies are to be found in the bush, at a short distance from Sekondi, and it is undoubtedly the case that horses and cattle cannot be kept there, so that this absence of house flies is probably an indirect outcome of the presence of the tsetse, on account of the absence of dung and stable litter, which are as necessary to the breeding of common flies as water is to that of mosquitoes. On this account the fly-proof *chicks* (mats formed of finely split bamboo), which are indispensable to comfortable existence in most hot countries, are quite needless here. Another point in the natural history of this region, which bears on the question of the propagation of malaria, is the singular absence of the semi-domesticated animals that insist on sharing the habitations of men, in the prolific climates of most of the hotter countries of the world. In India, last year, I was much struck, when examining a considerable number of gorged mosquitoes, to find that only a very small proportion of the insects had attacked the inmates of the bungalow, as by far the larger proportion were filled with the blood of birds, and, in some cases, of lizards. Now, on the West Coast, within the houses, there are none of the birds, lizards, squirrels, civet cats, etc., that swarm in and about human habitations in, I believe, most similar climates, and the result is that these house mosquitoes must needs attack man, or stay hungry, so that a comparatively small number of mosquitoes will perform a larger amount of duty in the transmission of malaria. On this account the real scarcity of the insects might be expected to produce a sense of false security, for the actual facts of the case are such that it is easy to understand anyone not specially trained to search for them, asserting the entire absence of mosquitoes; and it speaks well for the sound sense of the inhabitants, that although one can sleep in perfect comfort without mosquito nets, as far as ordinary annoyance is concerned, it was found that their use, as a protection against malaria was almost universal among the European part of the population.

With the exception of the "lagoons," the only possible breeding-places are the numerous water tanks, but there is a regulation in force that all of these shall be kept carefully covered, and this is enforced with such care by systematic inspection on the part of the health officer, that even in the native part of the town all tanks are provided with a cover of some sort. No doubt, in many cases, the covers do not fit as well as they might, and we were shown by one of the medical officers instances of how small a defect will serve to allow the passage of mosquitoes, but these cases were distinctly exceptional. Some time ago I noticed in a periodical a reference, which I cannot now trace, to a simple form of cover for water butts, devised by one of the Colonial medical officers of this coast, the adoption of which might very well be insisted upon by municipal regulation. The contrivance is described as being constructed of a circular piece of canvas or sacking, spread loosely over a heavy iron ring, such as a barrel-hoop; and, from the nature of the case, must securely close the top of the water cask over which it is placed. The objection alleged to its adoption appears to be the difficulty of contriving a simple way of locking it on to the cask; for water is so precious a commodity at times that security against theft is essential, but it ought not to be difficult to overcome

this objection. Empty tins and such-like dangerous refuse are systematically collected, and the lagoon is dealt with as far as possible by means of paraffin; but the density of the vegetation, and the considerable extent of these marshes during the rains, must make the successful application of this agent very problematical. Speaking generally, there can be no doubt that, as far as hand-to-mouth anti-malarial measures are concerned, about all that can be done is carried into effect; though it is obvious that a very much larger staff is required to bring them to their fullest efficiency. The efficiency of such measures, however, depends on the most constant vigilance, and, in view of the local conditions of Sekondi, can never amount to anything better than palliation.

The difficulties involved in the storage of water would, of course, disappear with the introduction of a regular piped-water system, and surface drainage is obviously being improved as rapidly as can be well expected; as there have already been constructed a very respectable length of masonry channels, which, it is understood, will before long form a complete system. In view of the long periods of drought, or little rain, it would be an improvement to construct these drains with a cunette running along the bottom of the channel, but this is a detail. The real problem to be faced, however, in the anti-malarial sanitation of Sekondi is that of how to deal with the "lagoons." As already pointed out, the level of these marshy tracts is below that of high water, and hence, under existing circumstances, no continuous outfall is possible.

I understand that it is proposed to run a masonry channel along the line of each lagoon, provided with sluice gates at the seaward end, but, personally, I doubt strongly if this will effect any improvement at all commensurate to the expense.

Infiltration from the sea must necessarily continue, and at the best a water-logged space will be left which, even after the most careful levelling, will be always difficult to keep clear of puddles; besides which, the outlet cannot fail to become periodically obstructed by the heaping up of the beach by wave action during spells of heavy weather. It is clear, moreover, that the site would be quite useless for building purposes. The only reliable method of dealing with the lagoons is undoubtedly to fill them in, and though the plan would certainly be costly it must not be forgotten that a large building site would be provided on the reclaimed ground, which, in view of the rising value of land, would probably go far to recoup the outlay.

Fortunately, abundance of material is available close at hand, as the marshes are bounded on each side by hills formed of easily excavated gravelly material, which, from its porous character, would form an ideal material for the purpose. A subterranean channel, would, of course, have to be left along the middle line, and it would be well also to place a system of ordinary agricultural sub-soil drainage pipes a foot or two beneath the surface, but above high water level at its lowest point. It may be objected that the outfall of the subterranean channel would be below high water, but the bulk of the flow would be over the surface, and along its surface drains, and the remainder might be trusted to flow out through the sand at low water as it does now.

Possibly, the sub-soil drainage pipes would suffice alone, but this is a matter which could best be answered by engineering experts. In dealing with



very similarly placed marshes in the Roman Campagna, after Prof. Celli's plan, no subterranean channel is constructed, but the lower layer of the spoil used for filling in the depression is formed of large rubble. through the interstices of which the water flows quite freely, so that it is very curious to see a considerable stream, springing at once from what appears to be the face of a solid bank. It is doubtful, however, if any material that could take the place of the broken tufa used for this purpose can be obtained from the hills beside the Sekondi " lagoons."

### **General Conclusions.**

Possessing, as it does, an exceptionally dry climate for a country so close to the Equator, a gravelly soil, and a site in many other ways favourable to natural drainage, with plenty of unoccupied favourable positions for the extension of a separate European quarter, there appear no good reasons why Sekondi should not be made at least as healthy as other towns similarly situated.

To gain this end, however, will involve considerable expenditure, as the two principal desiderata, viz., the provision of an ample, but well guarded water supply, and the filling in of the " lagoons " are each of them considerable undertakings. The more thorough separation of the European and native quarters also requires attention. The exact mortality of Sekondi is a matter that cannot be determined with any approach to accuracy, on account of the rapid growth of the population, and the short time for which records are available. All, however, seem agreed that the anti-malarial measures that have been adopted have resulted in a marked improvement of health ; but, in spite of this, there can be no doubt that the place remains decidedly unhealthy. Moreover, from the character of the local obstacles to the successful suppression of malaria, it is to be feared that little further improvement can be hoped for by the extension of what may be called " hand-to-mouth " anti-malarial measures.

As, however, there can be little doubt as to the future importance of Sekondi, it is to be hoped that, serious as the expenditure may appear, it will not be considered too high a price to pay for the improvement of health that must necessarily result.

### **The Line from Sekondi to Kumassi.**

Throughout the entire distance, the railway runs through what is practically unreclaimed jungle. Here and there small clearings, occupied by a few native huts, may be met with, or one may notice a path winding laboriously through the thick bush, but with these exceptions the country has been left to the forces of nature. With the exception of a few places where a low watershed or spur is crossed, the line always follows that of the valleys, and as the pace is very deliberate, the journey affords an excellent opportunity of observing the general physical characters of the country.

Throughout the entire distance the line winds among hills, usually no more than a few hundred feet high, but in a few cases reaching over a thousand feet. As a rule, the hillsides are so steep that no water could lie, even after heavy rain, and the general gradient of the valleys between them is

quite sufficient to admit of free drainage, assuming the channels to be unobstructed. These valleys are very narrow in places, widening out between the constricted portions, and as the result of floods it is natural that the narrow portions should become obstructed with material denuded from the hillsides above, and with branches and other vegetable detritus.

These accumulations, matted together by the luxuriant vegetation, then necessarily form a very efficient dam, which results in the formation of marshy tracts filling the wider parts of the valleys. As compared, however, with the hilly ground, these marshes form but an insignificant portion of the surface of the country, and from watching the gradients of the line, as it winds along the valleys, often keeping for long distances at an almost uniform height above the streams, it becomes obvious that in a large proportion of cases the marshy tracts could easily be drained, at comparatively little expense, by simply cleaning out and deepening the channel where it is obstructed. These facts have an important bearing on the question of the anti-malarial sanitation of the mining camps, which are scattered along the line and its neighbourhood.

From the point of view of the first-class passenger, the rolling stock of the railway might be easily improved, as the carriages give one the impression of having been designed in England, by someone quite unfamiliar with the requirements of tropical comfort. It is quite impossible to lie down, and not very easy to sit in any particularly easy position, and the lavatory accommodation extremely defective, there being no water, nor even basin for washing. I understand that in the case of sick persons it is customary to make use of a goods truck, with a tarpaulin spread for shade, but in hot countries, even when there is no night travelling, lying down accommodation is quite essential for even healthy European passengers. During the first day we were 12, and on the second, four hours continuously in the train, and the fatigue of maintaining a constrained position for so many hours in a climate of this sort was very trying; nor is an improvised ambulance, in a goods truck exactly ideal travelling for a sick person.

The third-class carriages, on the other hand, are at least as good as those in use on our Indian railways of similar gauge, and no doubt, as the present manager of the railway is an officer of extended Indian experience, in time the present uneasy contrivances will be supplanted by the more suitable type of tropical carriage in use on Indian metre gauge lines

### **Kumassi.**

Kumassi much resembles a small Indian station, consisting of the headquarters of the civil administration of the district, together with that of a native regiment. It is, of course, unavoidable that the quarters of the officers should be placed near those of the men of the regiment, but there is still a considerable space between them, and the native town is also fairly distant. In this native town, however, there are already settled a considerable number of European traders, and the place is growing up so rapidly since the restoration of law and order, that the number of these is steadily increasing. This is much to be regretted,

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but the remedy obviously rests entirely with the mercantile community, as it is clearly impossible for the authorities to forbid their living above their shops or offices. In some cases, no doubt, the establishments are small private enterprises in which the expense of maintaining a residence separate from the place of business is prohibitory; but the greater number are the agencies of important firms, and it would be well if the commercial leaders at home could realise how dearly the small economy is bought, at the price of the inefficiency that must necessarily result from the sickness and invaliding of their staff. The Yorubas, who form the least civilized portion of the community, are excellently placed in a separate town, on rising ground on the other side of the annular lagoon described below, and nearly a mile from the European settlement.

**Site.**

The hills surrounding Kumassi are lower, and the valley broader, than is met with anywhere on the line between there and the coast. The European settlement and the native town, with the exception of the Yoruba village, are placed on a slight elevation, almost completely surrounded by marshy land, and the entire area of the higher ground is too limited for any portion of it to be protected from the necessarily malarious influences of the marshes. This annular swamp drains by the valley, through which the railway reaches the town, and the station is placed on the low ground beside the marsh. Now, this valley has a considerable gradient, and, in view of this circumstance, it appears almost certain that the draining of the swamps around Kumassi should be a by no means impossible task, and until this is effected, it is perfectly certain that the place must necessarily remain unhealthy, for on account of the large area of the marshes, palliative measures such as the use of paraffin, are out of the question, and the employment of the ordinary anti-malarial measures, such as the closing of tanks, and the clearing away of empty vessels, too much of the nature of the "drop in the ocean" for them to be expected to effect any noticeable improvement. *Anopheles* and *Culex* larvae were found in considerable numbers in the pools of this marsh, especially in places where the water was foul from the proximity of native houses, the worst place being one where the natives were in the habit of washing their clothes. The *Anopheles* larvae were those of *An. costalis* (Loew), and, taken in connection with their presence in the exceptionally filthy pool at Sekondi, it appears probable that this mosquito has a predilection for dirty water as a nursery for its ova. The swamps are a mass of ferns and other dense vegetation, and even if drained their clearing and systematic cultivation would be essential to the success of any scheme of anti-malarial sanitation, and at best the large level area will be always difficult to deal with. The site is, in fact, a most unpromising one, with nothing but its historical importance to recommend it.

**Housing.**

Owing to the fortunate circumstance that European building materials are, on account of the cost of transport, very expensive at Kumassi, the houses are better suited to a hot country than is the case at Sekondi. Owing to this, shingles take the place of that most unsuitable of all materials, corrugated



iron, and rubble masonry of wood. The very practical plan, too, has been adopted of utilising the ground floor as offices and living rooms, and placing the sleeping chambers on an upper floor ; but the rooms are still too low pitched, and the verandahs too narrow to keep the sun from falling upon the walls of the building. It is well worthy of note that the "medical bungalow," which is one of the few in which this plan has not been followed, has the reputation of being the least healthy house in the station. That the accommodation for each officer is very limited is, perhaps, only to be expected in a place in so early a stage of development.

#### **Climate.**

Kumassi has a much heavier rainfall than that of Sekondi and the neighbouring coast towns, and it is much more evenly distributed, so that the place never, apparently, suffers from lack of water. On two of the mornings of our short stay the place was enveloped in a thick mist, which lasted till the sun was high above the horizon, and reminded one much of the cold season in Assam, where similar fogs often last till mid-day ; but the climate does not appear to show the extreme damp of the Brahmaputra Valley, as these fogs are said to only occur occasionally, whereas in Assam they are almost the rule at this time of the year for months together. The difference is due probably to the influence of the great Brahmaputra River, as the rainfall, the configuration of the country, and the surroundings of dense jungle resemble each other closely, and both, it may be noted, are notoriously unhealthy localities.

#### **Conservancy.**

The management of latrines and the removal of night soil are conducted in much the same manner as at Sekondi, with the exception that the latter is buried instead of being thrown into the sea. The general results are excellent, as even in the Yoruba Village, who are mostly Mahomedans, and tanners by trade, and are, for West Africans, a very dirty community, there is little evidence of fouling of the surface, and one can walk anywhere without annoyance to the sense of smell.

#### **Water Supply.**

The natives obtain their water partly from wells and partly from the marsh. For Europeans is reserved a sort of spring flowing from an outcrop of rock in the marsh not far from the railway station, but well removed from habitations. This rock is of a porous nature, and in the general sense of the word, no doubt it acts as a very efficient filter. The general quality of the water appears to be good. From the surface of the rock the water flows into a trough constructed to carry it away. In all probability the water, as it issues from the surface of the stone, is good enough, but it is obvious that the methods of collection and protection leave much to be desired. Naturally, being exposed, although the flow is continuous, it is liable to the usual forms of pollution. There is, however, some difficulty in suggesting any inexpensive and self-acting plan of improvement, as the out-flow lies so low that, if stored in a covered tank,

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provided with taps, it would be difficult to construct any approach at a lower level which would not be flooded during rainy weather. On this account, the only plan would appear to be to cover in the source, with its troughs, and to pump up the water to a service tank by manual labour. Of course, such a plan still involves the carriage of the water in buckets and barrels, and therefore cannot afford any ideal security, but it would be a great advance on the present arrangements, and, moreover, would cost but little to carry out.

### Prevalence of Mosquitoes and Other Insects.

Mosquitoes are much more in evidence at Kumassi than at Sekondi, as plenty may be met with at dusk, near the marshes, but on the higher ground, where the European settlement is placed, they are remarkably scarce, for a place so situated, and in point of fact, I was unable to discover a single *Anopheles* in or about the bungaloes, and even *Culices* were few and far between, so that, apart from the risk of malaria, no one would have felt the need of a curtain. The same was the case with other insects, house flies being very scarce. The mosquitoes taken included all species found at Sekondi. In the leather-worker's quarter, meat flies were naturally common. Tsetse flies, though often looked for by persons familiar with them, have never been taken near Kumassi, and a fly infesting the Yoruba cattle, which I thought might belong to the group, proved, when caught, to be *Hippobosca maculata* (*vide* Austen). These flies confined their attention to the cattle, while, on the other hand, the horses were pestered with clouds of *Stomoxys* belonging, Mr. Austen says, to two undescribed species brought by Vet. Captain Carr from Northern Nigeria, and believed by Carr to convey a trypanosome disease, very disastrous to horses there. Now several animals in the Kumassi "horse lines" were very ill, and Dr. Cowen, one of the local medical officers, had actually found that the blood of these ailing horses swarmed with trypanosomes. On dissecting out the intestine of a *Stomoxys* taken off a sick horse, I found its solid contents accumulated in the hind part, while a clear fluid filled the fore portion. In the former, examined fresh, no bodies clearly referable to any stage of a trypanosome were met with; but a smear of the clear fluid, stained since returning to England, is rich in both fixed and motile forms of the asexual stage of a parasite of this class. Several series of sections have also been since prepared, and a set from a female, in the oesophagus, close to the stomach, contains a few of what are almost surely ookinets, probably female, of a trypanosome; so that the culpability of the *Stomoxys* as the alternative host of the horse trypanosome may be taken as proven. Dr. McConnell was to have made some smears of the horse's blood for subsequent determination, but this, unfortunately, was not done; so that the exact species of trypanosome remains uncertain.

Horses can just live in Kumassi; that is to say, that the officers of the Gold Coast Battalion manage to keep themselves mounted, but that the horses rarely keep in condition for any length of time, and usually die in a few months.



It remains uncertain whether one or both of the species of *Stomoxys* is concerned, but they resemble each other so closely that their pathological relations are scarce likely to differ.

The *Stomoxys* seemed to attack only the horses, and were not seen on cattle, though some of the latter were grazing close to the horse lines; nor were any of these flies to be met with anywhere else than in close proximity to the horses. One of them bit me sharply on the ankle, while I was engaged in capturing a supply of specimens, but the grooms did not complain of being troubled by them, though this may only mean that they were indifferent to such attacks. Nothing seems to be known as to the life history of these flies, but it is highly probable that the larvae breed in horse dung, and the careful destruction of this by burning would be worth trying, in the hope of diminishing their numbers. They seem to bite only during the day, as a batch of specimens collected at dusk included a much larger proportion of non-biting flies than was the case in the morning. The only attempt at protecting the horses from their tormentors consisted in keeping a small smoky fire burning near their heads as they stood tethered in the open, but for all practical purposes this might as well have been left alone, as, owing to the drifting of the smoke and its small volume, it quite failed to keep the flies off, even from their heads, and the poor animals were literally covered with them. One horse, that was in worse state than the rest, was kept in the stable, but without any smoke protection, with the result that within the stable it was easy to catch a dozen or more of specimens, by a single sweep of the net. Now it is quite possible that the free use of smoke, within a confined space, such as a stable, would alone suffice to drive out the flies, but in any case there can be little doubt that by the use of smoke in a stable protected from the entry of flies as far as possible, it ought to be practicable to reduce the chances of being bitten to a minimum. That it is quite possible to protect the horses from the bites of insects by the use of smoke in their stables, even without any mechanical protection against their entry, has already been amply demonstrated by Mr. Henry Power, while working on the subject of "Horse-sickness" in Zululand, and Mr. H. W. Pitchford, the Government Bacteriologist (in Natal Government Notice No. 252, of 1903), regards this as so definitely proved, that even though he is still in some uncertainty as to the exact species of insect involved, he does not hesitate to recommend the adoption of the plan to agriculturalists and other horse owners in the colony. There is no need of going to any heavy expense in constructing an experimental stable for the purpose, as it ought to be perfectly easy to make a fairly fly-proof stable from the rough materials available on the spot. What I would suggest would be to build an ordinary round hut, such as is now in use at Kumassi, for sheltering horses; leaving the upper two feet of the wattling unplastered, for the sake of light and ventilation, and making it more secure against the entry of flies, if necessary by securing up to the thatch, pieces of split bamboo matting, such as are known as *chicks* in India, and which could easily be manufactured on the spot.

Closed by an ordinary door of rough planks, such a stable might be made practically fly proof, and with the aid of smoke protection, might be a safe refuge for the horses during the day. As far as possible the animals

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should be exercised after sundown, and should wear, when out, an ordinary fly net, such as is provided for every well-cared for horse in India, as a protection against ordinary flies. There is no reason why the net should not be worn while the animal is in use under the saddle, but, as a matter of fact, the flies do not appear to follow the horses from the lines, in the same way that is the case with the ordinary non-biting insects. These fly-nets are made of ordinary coarse cotton twine, and though the mesh is so large that the insects could pass through it with the greatest ease, are wonderfully effectual in keeping them off, the twitching of the threads imparted by the movements of the animal, apparently scaring the flies away. The disease does not appear to be as rapidly and surely fatal as the *Tsetse Trypanosome*, so that possibly much depends on the volume of the infection, and there is therefore the more hope that paliative measures might be fairly successful.

**General Conclusions.**

The site of Kumassi is so unfavourable to the success of anti-malarial operations, that undoubtedly the best solution of the difficulty, if it be in any way practicable, would be to remove the seat of the District Government to some more favourable position; but failing this, it is probable that a great improvement might be effected by the thorough draining of the marsh surrounding it; and it seems probable that a good deal could be effected in this way, at no very prohibitory expense.

**Remarks on the Possibilities of Anti-Malarial Sanitation in the Mining District.**

During our expedition along the line of rail to Kumassi, we passed through the heart of the district in which there is already settled a considerable European population concerned in the gold mining industry, and we passed a few days at Obuassi, and also at Taquah, at which places some of the most important and completely equipped mines are situated.

The sanitary possibilities of a mining camp necessarily vary greatly with the stage of development of a mine, for it is impossible for the most experienced expert to decide on the eligibility of a site, until several months have been expended in experimental borings, and until this has been done it would be out of the question to expect anything beyond the minimum possible expenditure on the development of the sanitation of a site that, as likely as not, may have to be abandoned. As a matter of fact, three or four years of preliminary work must needs be accomplished before the value of a mining concession can be thoroughly estimated, but after this, it may be fairly assumed that the site will be occupied by a considerable population of Europeans and natives, for a period which will warrant reasonable expenditure on sanitation.

Prospecting work is undoubtedly hazardous in the extreme, a good deal more so probably, than the chances of ordinary warfare; and the early history of any mine is usually darkened by a melancholy death roll; but the enlightened self-interest of the management of some of the largest mines is rapidly making them by far the least unhealthy spots in this unsalubrious

colony. On this account, no fair idea of the risks to life, in a fully-developed mining camp can be formed from the general average mortality of the mining population, but even when considered from that point of view the mortality but little exceeds that of officials, and is strikingly lighter than that of the trading community. In the Gold Coast colonial report for 1903, the death rates of the different European communities, per one thousand, is as follows: Officials 15.3, Mercantile community 35.8, Mining community 19.2, Missions 21.2; and the comparatively low rate for the miners is the more striking, when it is remembered that the rank and file of the mining community is drawn from a much lower social stratum of the home population. On the other hand, the invaliding rate is much higher than that of either of the other classes. This may be partly due to the vigilant care that is taken on most of the larger institutions, but is so much higher, that I was inclined to suspect that it may include dismissals from other causes of sickness, than those peculiar to tropical climates.

In one mining concern, of which the medical officer was good enough to furnish me with the statistics of a year, only two were invalided, in the ordinary sense of the term, one of which was for tuberculosis, while eleven were sent home on account of alcoholism. The average European strength of this group of mines was 130, and though there were no deaths, and no cases of black-water fever, the Medical Officer in question notes that those addicted to alcoholic excess were far more prone to malarial attacks than those who were temperate. It is obvious that a community including so large a percentage of intemperate persons cannot be fairly compared with a picked body of men, drawn from the most highly educated class of Britain, and the fact that the mortality of the entire mining community exceeds that of officials by so small a proportion, shows how very high a standard of sanitation has been attained on some of the longest established and best equipped mines. Whether any marked impression has been made on black-water fever it is difficult to say, as this inexplicable disease has a way of cropping up at irregular intervals, at times and places which are otherwise more healthy than usual; but at any rate Major Hickson, R.A.M.C., Retd., one of the Medical Officers of the Ashanti Gold Fields Corporation, informed me that in four tours of service, of over a year each, he had never seen a dead European.

As examples of the comparative healthiness of some of the older mines may be cited the following:—

The Obuassi Mine has an European population, served by its hospital, of about 100. The total admissions to hospital last year were 93, with one death (from black water). Of the total admissions, 55 were for malaria, and five for black water. The average stay in hospital of the malaria cases was 7.2 days, including convalescence, as in this concern, the cases are retained in hospital until returned to duty.

It is perfectly obvious that, with so short an average stay in hospital, the cases must necessarily have been, for the most part, of an extremely mild type, and, in fact, there was only one case in which the stay in hospital was so prolonged as to indicate really serious illness. Of course, here, as elsewhere, a certain number of admissions took place at all seasons of the



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year, though the hospital was empty at the time of my visit. This accords with experience of malaria in every part of the world, and is inevitable in a disease which is rarely cured, in the true sense of the word, but in which the seeds of the malady may lay hidden in the tissues for years, and are always liable to start into renewed activity, when their opportunity is found, in a lessened resisting power of the organism of their host, due to some other cause of depression of vitality. But here, as everywhere else, there are distinct malarial seasons, during which numbers of fresh infections, plus the usual quatum of relapses, swell the admissions to hospital in an unmistakable manner. The admissions for Black-water, on the other hand, show no relation whatever either to the seasonal prevalence of malaria or to any particular seasonal prevalence of its own. The dates of admission of the Black-water cases were as below :—

May 6th.—Relapsed, after apparent improvement, and died in 17 days.

July 23rd.—Cured in 24 days.

Oct. 7th.—Cured in 13 days.

Dec. 17th.—Cured in 17 days.

Dec. 17th.—Cured in 15 days.

Of the cases that recovered it will be seen the average stay in hospital was 16.75 days.

Dr. Hickson informs me that, during the seven years he has been connected with Obuassi there have been 5 deaths, one of which was the result of accident. The average European strength during this period may be put down at somewhere about 50, and, therefore, works out at about 16.5 per thousand, which is probably about the same as that of some parts of India.

The other case in which I have been kindly furnished with statistical information is that of the group of mines at Taquah, under the charge of Dr. F. W. Moir, which include a detailed statement of all sickness among the Europeans employed on the Abbontiakoon, Wassaw, Fanti, Effluenta, and Tamsoo Mines, and those of Bray Brothers, Diamond Borers; with an average strength of 130. The cases include also those of a few outsiders, belonging to the commercial firms at Taquah, who may muster perhaps another eight or ten persons. Unfortunately, they relate to the eight months of 1904, from May to December inclusive only, so that they cannot be made the basis of a calculation of the sickness of an entire year but for the period included they are very complete and detailed, and Dr. Moir tells me that about 50 *per cent.* of the malaria cases were verified by microscopic examination of the blood. There were no deaths, and no cases of Black-water fever, and this, I understand, may be said also of the entire year.

The following table epitomises the information included in Dr. Moir's monthly statements :—

Return of all sickness on the group of gold mines at Taquah, under the charge of Dr. F. W. Moir, for eight months of 1904, from May to December inclusive :

	Intermittent Fever		Remittent Fever		Influenza		Hepatic and Gastric Congestion		Respiratory Catarrh		Other Causes		Total Admissions	
	Number of Cases	Stay in Hospital	Number of Cases	Stay in Hospital	Number of Cases	Stay in Hospital	Number of Cases	Stay in Hospital	Number of Cases	Stay in Hospital	Number of Cases	Stay in Hospital	Number of Cases	Stay in Hospital
May ... ..	7	29	4	22	...	...	1	4	1	3	1	7	14	65
June ... ..	7	42	10	69	...	...	...	...	1	2	1	12	19	127
July ... ..	12	61	11	70	1	14	2	4	1	2	...	...	27	151
August ... ..	2	7	3	18	...	...	1	1	...	...	1	6	7	32
September ... ..	...	...	1	6	...	...	3	15	1	2	3	31	8	31
October ... ..	3	11	2	16	...	...	2	4	...	...	1	5	8	36
November ... ..	6	19	...	...	...	...	1	1	...	...	1	3	8	23
December ... ..	8	28	2	16	1	2	1	3	1	5	3	11	16	65
Totals ... ..	45	197	33	217	2	16	11	32	5	14	11	65	107	544
Average stay in Hospital	4.4		6.6		8.0		3.0		2.8		5.9		5.1	

The heading, "Other causes," includes 2 cases of Anæmia ; one of Pulmonary Consumption, twice admitted, and finally invalided ; and one each of Lumbago, Nostalgia, Suicidal mania, Fracture of Tibia, Diarrhœa, Ulcer, and Abscess.

The predominating importance of malaria, as a cause of sickness in tropical countries, could not be more forcibly illustrated than by this table, as, out of a total of 107 admissions, involving the loss of 544 days' work, no less than 77 admissions and 414 days' work are referred to this cause alone ; but here, too, as at Obuassi, it is clear that the type of malaria cannot be said to be severe, as the average stay in hospital was but 5.3 days. Putting aside malaria, it is evident that the state of the general sanitation of the miners must be a very high one, the practically entire absence of bowel complaints being conclusive on this point. Possibly some of the cases of malaria, in which the blood was not examined, may have been due to influenza, which appears to have been hanging about, but, with this exception, malaria is the only member of the zymotic group of diseases which is represented.



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Another point which is clearly shown, in spite of the incompleteness of the year's record, is that there are two maxima of malarial intensity during the year, the more important of which occurs in July, and the lesser in December, while the minima, as shown by records examined elsewhere, may be placed in September and February. When we had the pleasure of visiting Abbontiakon, indeed, the hospital was absolutely empty, and only 3 cases of malaria had been admitted during January. This distribution of malarial intensity, it may further be noticed, is only what might be deduced from the records of the rainfall, which, like those of all localities so near the Equator, shows two rainy seasons in each year, which here, as elsewhere, precede somewhat the dates of the malarial maxima.

The eleven cases of Gastric and Hepatic Catarrh were said to be mainly of alcoholic origin, and, excluding these and the broken leg, we are left with only 18 cases of ordinary sickness, involving an average stay in hospital of only 5.7 days each.

The only serious cases were one of Tuberculosis, contracted in England, and that of mania, which appears to have been of alcoholic origin.

It may fairly be said then that, but for malaria and the ever-present dread of the invasion of Black-water, these mines may be considered an exceptionally healthy place of residence for the tropics, and I think it may be said that the measures that have been adopted there have already greatly diminished this main cause of sickness, while those that are projected cannot fail to have an even more marked result.

#### **General Surroundings of Mining Camps.**

Although the number of mines visited was necessarily very small, the general character of the country along the railway, which passes at no great distance from by far the majority of the camps, is so uniform that there may be said to be a strong family resemblance running through all of them. The general character of the sites may, in fact, be deduced from what has been said with regard to the country, as seen from the railway line—steep, but not lofty hills, with intervening marshy tracts in the valley bottoms. Kumassi, which is placed in one of these valley bottoms, at a distance of a little over 100 miles from the coast in a direct line, has an elevation of 680 feet above the sea, and through the winding course of the valleys that drains it is doubtless a great deal longer than the direct line, it is obvious that so marked a fall is ample to secure an adequate outfall throughout their entire course. As a rule, the valley bottoms are so narrow that the areas requiring drainage are very limited, and the majority of them could undoubtedly be dried up, by simply cleaning out and grading their natural lines of drainage. Everywhere the country is a primeval jungle, unmodified by the presence of man, as the natural stage of civilisation of the native African is so low that the profound modifications of natural conditions brought about by the agency of man, over the entire surface of Asia and Europe, are absolutely wanting. A jungle remains a jungle, and a swamp a swamp, and the utmost of which the native seems capable is to slightly extend some natural clearing, where he can erect his hut and scratch the ground a little to supplement, by some rudimentary cultivation, the natural sources of supply.

On this account, when the European undertakes the task of reducing the country to habitability, he is not, as in most countries, the inheritor of a large capital of native work in clearing and improvement, but must needs start afresh, and it is this that makes his work so deadly until he has acquired absolute political control of the country, and can find the funds to effect in a few years the work that has elsewhere resulted from centuries of civilisation. Anywhere else these easily drained swamps, with their rich soil, would be the bones of eager contention, and every inch of them would be utilised in such a way that their dangers would be enormously diminished. The area of swampy ground, however, does not appear to be anywhere large, and good sites, alike for European and native locations, are everywhere available by clearing the jungle from the hills. It must be understood that a mining camp necessarily includes two distinct settlements, as the hard manual labour is everywhere performed by the native, and the European acts only as supervisor, or as a skilled mechanic. Each must necessarily be in close proximity to the mine-head, but they ought to be, and generally are, kept as far apart as possible. The mistake, however, that has very commonly been made has been to regard any site as good enough for the native location, so that very commonly it has been allowed to grow up at haphazard on the edge of marshy ground.

Now, apart from the importance of keeping the native labourer in a state of healthy efficiency, the European cannot gain the full advantages of a healthy site unless the native enjoys the same advantages, as it is from the latter that the European "catches" the tropical maladies, that cause so formidable a roll of sickness and mortality. Both at Obuassi and at Abbontiakoon the native villages were placed on low-lying ground, which no ingenuity could convert into really desirable building sites, and though, at both places, the managers had gone to great expense in laying out and almost rebuilding the villages, it was clear that the true remedy lay in the abandonment of the old and unsuitable site, and the clearance and settlement of one more suitable.

The Taquah Mining Co., on the other hand, has selected a much better site for their native labour, but can hardly reap the full benefit that might be expected from it, as the houses of the Europeans in their employ are almost as near the native quarter belonging to another mine as those of the mine itself.

There can be no doubt that the selection of suitable sites for the quarters of Europeans and natives alike is a matter of the first importance to the health of all concerned, and that the financial success of a mining company depends far more on this and similar points than is usually recognised, for at present the cost of paying and nursing sick men, and the heavy expenses involved in invaliding and replacement constitute a heavy drag on the industry that might be undoubtedly lessened by steady attention to sanitation, to an extent which would yield handsome interest on any money so expended.

From the character of the country, excellent sites are almost everywhere available, and the obstacle to their adoption is simply the expense involved in clearing the dense jungle. It appears that a useful step might be taken if the clearing and drainage of a certain area around the mine-head, within a certain number of years, were made one of the conditions in granting any new concessions. As a rule, the managers show an enlightened policy in the

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matter, but their efforts would undoubtedly become more continuous and systematic if their work in this direction could be triumphantly pointed out to the Board of Directors as so much accomplished towards securing their permanent tenure of the property they are engaged in developing.

**Characteristics of the Industry Bearing Upon Sanitation.**

The general plan and appliances of a gold mine closely resemble those of tin-mines. Unlike a coal mine, where the greater part of the spoil is at once removed, and directly saleable, the amount of mineral removed from the spot is infinitesimally small, in comparison with the bulk of ore brought to the surface and left there. Part of this is non-gold-bearing rock, which is simply sorted out, and thrown aside on the nearest convenient spot. This consists of coarse rubble, and would form ideal material for forming the lower layer of material employed in filling any marshy hollows that cannot be easily drained. The rest consists of the fine sand that comes from the stamps and cyanide vats, and from its porous character would serve well as an upper layer in such operations. This material, known as "tailings," is easily carried to some distance by a current of water, and I noticed more than one case where, either by accident or design, considerable swampy areas had been reclaimed in this way; while, in other cases, it had rendered matters worse, by interfering with drainage. Being composed of absolutely pure and insoluble mineral matter, it is almost impervious to the advances of vegetation, so that the land so covered becomes useless for cultivation, but there is little dearth of suitable garden sites, so that this is a small matter. There can be no doubt that if an eye were kept upon the filling in of dangerous hollows with these materials in the first place a good deal might be done in the way of anti-malarial sanitation, at but little cost as compared with that involved in re-excavating and handling the material anew, with this specific object. In each mine, their sanitary adviser should draw up a systematic plan for what the Italians call the "bonification" of the settlement generally, and with this before them, managers might often effect most important improvements without a penny of additional expense.

A second point in the industry that has an important bearing on sanitation is the enormous volume of water pumped up from the workings or brought in flumes from streams to feed the stamps. It is a matter of the most obvious importance that all water either brought to the surface or carried from higher levels on to the site, should be carefully and expeditiously conducted away, but this is, unfortunately, by no means the case, and at the time of our visit it was surprising to notice that it was in such collections alone that larvae were to be found, as the marshes so swarmed with fish that in several instances it was impossible to find a single larvae in marshy tracts that appeared ideal situations for their residence. Had anyone told me that these spots were barren of larvae I should certainly have regarded the assertion merely as so much evidence that the speaker did not know how to search for them. This is, however, no argument for neglecting to deal with the marshes, as whatever may be the case in the dry season, the reproductive powers of the mosquitoes during the rains must in all probability get the better of the destructive powers of the fish, and, in any case, they render the air and soil in their neighbourhood damp and unhealthy.



A third point involved in the industry is the large destruction of forest for the supply of fuel for the engines that work the various pumps, hoists, stamps, etc. To a certain extent, of course, this process is beneficial, by contributing to clear the site, but unfortunately a large proportion of the trees are of little use as fuel, and these are accordingly left untouched, while the disturbance of the surface that necessarily results from the felling operations has a tendency to produce depressions, which may result in puddles. Conducted with care, this should not be the case, and were this point attended to, the improvement of ventilation resulting from the thinning out of the forest, must needs be beneficial. It is highly desirable, however, that a considerable area around the habitations of all employed on the mine, whether white or black, should be thoroughly cleared from forest and bush, leaving only a few large trees for shade and ornament. If the superfluous trees are not good enough to be burned in the engine they should be burned on the spot.

Underground, the temperature of the air is usually somewhat higher than that at the surface, but was by no means oppressive, and the ventilation appeared excellent, large volumes of air being continuously driven through the workings. The character of these varies, being in places quite dry, and in others dripping with moisture, but as a rule the floor, though hard, was muddy, so that, given the necessary infection, it is clear that all the conditions that favour anchylostomiasis, though no offence was noticeable, the skips are not working continuously, so that some provision of the sort is certainly desirable, as the black miners work almost in a state of nudity, and it is difficult for an European to move about the mine without the muddy water getting into the boots, so that both classes would be liable to suffer should the infection of that disease once gain an entrance. The natives seen in the mine, however, did not show any signs of Anchylostomiasis, but the danger is, nevertheless, one that should be borne in mind and guarded against.

### Prevalence of Mosquitoes

As already mentioned, no larvae could be found in any of the large marshes, and but few of either these or imagines, were in evidence anywhere, a few *Culices* alone being met with in the house. It is difficult to account for this, as unregarded collections of water were extremely common, and the temperature of the air was in every way suitable to the breeding of these insects. A few *Anopheles* larvae were found in certain disused mining utensils containing water.

### Food.

As a rule, as elsewhere on the "Coast," too great dependence is placed upon tinned provisions, and the supply of vegetables is scanty and insufficient. Some of the mines, however, have already started gardens, and others are proposing to do so, and hence an improvement may be expected in this respect. There can be no doubt that a vegetable and fruit garden should form an item of the equipment of every mining community, as it is well known that preserved food of this description is in no sense a substitute for the

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fresh article. The methods of the native gardeners are, however, very rude, and it is a matter of common experience that the growing of European vegetables in tropical climates is a special business, and requires experience that is entirely wanting in the freshly imported European horticulturist, so that it would be well to import gardeners, accustomed to this sort of work, from either India or China, who could teach the native gardeners the special methods essential to success. In making a choice of such men, those should be chosen who have worked in the true tropics, such as Madrassis, as a man from Northern India would find himself almost as "at sea," as an European. Some attempts at melon cultivation are a case in point:—There are plenty of absolutely ideal spots for the growth of this most wholesome and delicious fruit, but the attempts were made in the wrong way. To anyone who had ever seen how this cultivation is worked in similar climates, indeed the attempts were absolutely farcial. As far as could be gathered, no attempts had been made in inarching mangoes, with the result that most seemed agreed that the fruit was not worth eating; while the local plantain, though possibly very rich in nutriment, is about as tempting as a dish of maize porridge.

Short as was our stay, I noticed several Europeans, with a spongy condition of the gums, which would certainly have elicited the wrath of an Inspector General of Prisons, if found in an Indian jail. In the matter of the supply of fresh meat, matters will, no doubt, soon be bettered, as more than one of the mines are putting up refrigerating plant, with the view to storing imported meat, and this, with the accompanying free supply of ice, will undoubtedly help greatly to improve the health, and therefore the efficiency, of the miners. There is one further point in this connection which I would desire to bring most strongly to the attention of the managing authorities of mines, and that is the desirability of instituting instalments for the production of aerated waters at a reasonable price. From personal experience, I know that such an instalment is very easily worked, and yields a good profit at a penny a bottle, but nothing but imported waters are to be met with on the "Coast." It requires a teetotalism of the most robust kind to imbibe the luke-warm flatness of tropical water, and with "soda" and ginger beer at 7d. and 9d. a bottle, it is much cheaper to qualify the uninviting fluid with something more than a modicum of spirit. There can be no doubt that nothing has done more for the cause of temperance, in the case of the British soldier in India, than the institution of regimental factories for aerated waters. It has been found to pay well with much smaller bodies of men than are employed on many mines, and there can be little doubt that the same step would have as beneficial effect in the case of the miner as it has with the soldier.

### Housing.

This varies greatly. Some of the huts used during the early stages of mines, but now abandoned, were mere shanties, constructed out of old packing cases and odd scraps of tin, and small and ill-ventilated at that. An ordinary Indian Kabul tent would form a sanitary palace, compared with the worst of these, and it is only surprising that the results of inhabiting such



structures in such a climate, were no worse than they were. In some other cases, the obvious ignorance of the designers as to the essentials of tropical domestic architecture, has resulted in the erection of an inferior type of workman's dwelling, on strictly English lines, but in the majority of cases, the newer quarters, though sharing in the almost universal faults of European buildings, in this country, are good of their sort.

The number of mines inspected was, of course, very small, but in each case this desideratum had received due attention, and though the necessities of the case demand that the miners, whether European or native, should live close to their work, they are kept better separated than in either of the two towns we had the opportunity of visiting. All of the mines are not, however, quite on the same footing as to their power of securing efficient sanitation in this and other respects, as the conditions under which concessions are granted have, it is understood, been modified of late years. The managers of the older mines, it appears, possess certain quasi-magisterial powers, which enable them to evict natives, for example, from undesirable situations, and to enforce general sanitation in a way that is precluded under present conditions, so that the reconstruction of a native settlement cannot be enforced in the same manner as is practicable under the older tenure. This seems unfortunate, for, though the English working miner may be somewhat of a "rough diamond," the managers must necessarily be highly competent and scientific men, who have too much experience of the tact necessary to work smoothly with native labour to be likely to be led into arbitrary or tyrannous measures, to say nothing of the fact that the native has always the right of appeal to the civil executive, who are always easily accessible, and might be trusted to prevent that tactless form of sanitary regulation which secures its own defeat, without rendering helpless the invaluable knowledge of the man on the spot. In questions of ordinary discipline, or those involving payments, it is, no doubt, inadvisable to give too free a hand to European employers of native labour, and it is more than probable that the withdrawal of really salutary powers in regard to conditions bearing on health was a mere oversight that might easily be remedied. In such matters, subject to the approval of the sanitary officials of the Government, the powers of the mine manager should certainly be as nearly absolute as possible.

#### **Conservancy and General Sanitation.**

Pit latrines are sometimes employed for the natives, and, in the case of Europeans, much the same system as that already described as adopted in the towns. In other cases regular latrines are provided for the natives also. That the general results are satisfactory is shown by the remarkable absence of bowel complaints and filth diseases generally.

#### **Medical and Sanitary Supervision and Hospitals.**

The mines are remarkably well provided with medical assistance, almost every mine having its own medical officer, who, in many cases, has passed through one of our schools of tropical medicine. Many of these gentlemen are keen and able sanitarians, and it is not surprising to find that mines under

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the guidance of men so well equipped with the necessary knowledge are rapidly improving in health, and are far safer places of residence than any of the towns. In stating this conviction, nothing is further from my intention than to institute any comparison between public and private medical officers, as the conditions under which they work are totally different, on account of the far greater power practically possessed by the mining official, whose only difficulties lie with outside native resident on or near the site of a concession ; all others, whether native or European, being easily controlled by the Managers' ordinary powers of dismissal. Both at Obuassi and at Abbontiakoon there were excellent hospitals. The former was, it is understood, originally constructed by the railway contractors as a temporary structure, which probably accounts for the fact that it might be greatly improved by the provision of better arrangements for bathing, though the accommodation is, in many respects, admirable. That at Abbontiakoon is, in many ways, one of the best tropical hospitals I have met with anywhere, and a trained nurse is included in its staff.

Although corrugated iron is the material of the roof, the inadequacy of this material as a protection against the heat of the sun has been neutralised by a wide and freely ventilated space between roof and ceiling, and the doors and windows are all protected with wire gauze. Against mosquitoes the protection afforded is but relative, as the doors are only single, and are not self-closing ; but this is a great advance on no attempt at protection whatever. The addition of a gauze-protected verandah, in which convalescents might sit out during the cool of the evening, without risk of being bitten, would be a great improvement.

### **General Conclusions.**

The managing authorities of most of the mines appear to thoroughly recognise, and, as far as means allow, to utilise our knowledge of the methods of the propagation of malaria, and of general sanitation ; and, owing to the more compact and manageable character of the communities with which they have to deal, have in many cases rendered their settlements far healthier places of residence than found elsewhere in the colony. There can be little doubt that the amelioration already effected can be more than maintained by a policy of steady improvement. It appears that the points that now require most attention are the drainage of marshy ground, the clearance of jungle, and attention to the details in the standard of comfort, which contribute so much to health in trying climates such as this.

## Part II.

### **A COMPARISON BETWEEN THE CONDITIONS OF EUROPEAN RESIDENCE IN THE GOLD COAST COLONY WITH THOSE EXISTING IN INDIA.**

The European nations have engaged in trade, and made attempts at settlement in both the above regions ever since a greater mastery of the sea has made long voyages possible ; but whereas, in the case of India, these attempts have resulted in the almost complete political domination of the entire peninsula, it is only lately that anything more than a precarious footing on the coast has been gained in Africa.

From this it results that, from the European point of view, our African colonies are still new and undeveloped countries. In both fields of enterprise, the same men have been engaged in the same task, but while India proved from the first to be fairly habitable to the new comers, in Africa they have been beaten back, again and again, and even now, keep their footing only at a heavy cost of life and suffering.

Broadly speaking, the reasons for this are not far to seek. The India opened up by the early navigators, was at least as civilized as the countries whence they came, and what is more, had been so for a far longer period ; so that, great as has been the advances of late years, there can be no doubt that could the Anglo-Indian of to-day be transported back to the court of Akhbar, he would find himself in by no means strange surroundings, and far more comfortably situated than he can be, even now, if he move but a mile or two beyond the limits of an Anglo-African settlement. In the one case, centuries of labour on the part of an intelligent, if not very progressive people had gone far to overcome the influences hostile to human life in the tropics, while in the other, a race of savages had left their country practically untouched. The detail of the points of difference, however, require separate consideration.

#### **The Comparative Unhealthiness of the Two Countries.**

In the first place, is there any great difference in the morbidity of the regions under comparison ? Here we are at once met with the difficulty of the different composition of the two European populations. In India the European population is far more permanent, and includes a fair proportion of children, and even a few old people, while in Africa, prolonged residence can scarcely be said to be attempted, and neither children nor elderly persons are to be met with. Again, outside the great presidency towns, the Anglo-Indian element is almost purely official, and even in Calcutta and Bombay, the traders are mostly important leaders of commerce, who are able to command every procurable comfort, and are very differently placed

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from the white man engaged in exchanging trade gin for oil nuts in a rickety shanty, on the banks of some muddy African creek. Shift the African trader's shanty to some backwater of the Hooghly, and still deny him all the comforts of civilization, and it may be doubted if he would be any the healthier, while he would certainly find the climate even more disagreeable. The number of European troops in West Africa is too small to afford any fair basis of comparison, and the only two at all fairly comparable bodies for which statistics of any sort are available are the civil officials. These are drawn from very much the same class of English society, and in both cases are necessarily prudent and responsible persons, able to take the best practicable care of themselves, and accustomed to do so.

At the same time, it must be remembered that the comparative healthiness of India is a matter of merely recent years, and that even in the earlier years of the 19th century, it held a deservedly bad reputation, so that at that time, service there was regarded in much the same light as that on the West Coast at present. Dickens, for instance, disposes of Mr. Bob Sawyer by "passing him over to Bengal, accompanied by Mr. Benjamin Allen, both gentlemen having received surgical appointments from the East India Company. They each had the yellow fever fourteen times," etc.

As to the serious danger involved in West African service, there can be no doubt, but neither in India nor in Africa are there any available statistics as to the exact character of sickness affecting officials. In the former an official is treated at his home, and unless so ill as to involve his appearing before a Medical Board, does not figure in any official return. Moreover, even if invalidated by such a board, it is as likely as not that the leave when granted, appears as "on private affairs" in the official gazette. In fact, unless an officer have exceeded his authorized proportion of leave, it is unlikely that he will appear otherwise. As a matter of fact, indeed, owing to the impecuniosity resulting from a depressed rupee, an officer usually serves as long as he can, and only takes his furlo' when compelled to on account of failing health; but even taking all Indian furlo' as equivalent to invaliding, it would not approach the combined leave and invaliding roll of West Africa by a third.

Up to recent years the death rate of our West African colonies has been very heavy. In an official paper, kindly supplied to me by H. M. Colonial Office (African (West) No. 727, dated June, 1903), the deaths among officials are subjected to actuarial investigation, with the following results.

Colony	Number of Persons	Number of year's service	Average length of service in years	Number of deaths during service	Death rate per thousand per annum
Gold Coast ...	554	1,307	2.4	99	75.8
Lagos ... ..	258	522	2.0	28	53.6



Colony	Average age at entering service	Number of persons on which average is based	Average age at death if during service	Number of persons on which average is based*
Gold Coast ...	nearly 30	390	34½	83
Lagos ... ..	„ 32	153	nearly 42	6

The column headed “Number of years’ service” contains the totals of the periods from the date on which each European arrived in West Africa to take up his employment under one of the two above-mentioned Governments to the date on which he ceased to be in the Government’s employ. In the case of persons whose employment falls partly outside of the years 1881 to 1897, the part before 1881 or after 1897 is not taken into account. Leave of absence to England has been regarded as incidental to the employment, and is included. Since 1883, and except in cases of invaliding, such leave of absence would ordinarily be for six months after every twelve months’ service, voyages to and from England being included in the six months.

Three women were employed in the Gold Coast, and four in Lagos. The remainder of the persons employed were men.

Dates of birth were only available for 390 persons in the case of the Gold Coast and 153 in the case of Lagos, of whom two, both in Lagos, were women.

#### PERIOD 1881—1897 INCLUSIVE.

The statistics have been compiled by Mr. T. E. Young, a former President of the Institute of Actuaries, from data collected from the records of the Colonial Office by Mr. C. D. Turton, a former Treasurer of the Gold Coast, and are as follows:—

In the case of the Gold Coast the 83 deaths during service in which the dates of birth were known were distributed according to age as follows—

Age.	Deaths.
20—30 ... ..	27
30—40 ... ..	39
40—50 ... ..	9
50—60 ... ..	8
Total ... ..	83

\* Note by Mr. Young.—The persons here mentioned include only those where some definite evidence existed of the age at death, but it seems not improbable, from a general examination of the returns, that as regards the Gold Coast the age at death here furnished may be regarded as fairly representative of the age in the cases also where no specific evidence appeared; while in respect of Lagos it may be reasonably assumed that the age at death of persons not included in the average was somewhat younger than 42.

In these and following comparisons, it should be borne in mind that the death-rate for corresponding ages in England is about 9 per 1,000, and

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this, too, in spite of the fact that it necessarily includes the maimed, halt, and blind, of all classes of the community, whereas both in India and on the West Coast, the official is carefully selected by medical examination, and almost without exception, is drawn from the well-to-do classes. On the "Coast," indeed, even the non-official community is very generally selected by medical examination.

These figures represent the state of health of the community previously to the introduction of antimalarial sanitation, and there is no blinking the fact that they are appalling, and this rate persisted right up to the date of the first attempts in that direction, the rates for officials in 1901 being :—

Number	Deaths	Invaliding	Death rate per 1,000	Invaliding rate per 1,000
188	15	18	80	95

The improvement between 1901 and 1902 is so considerable that it clearly can hardly be due to ordinary variation, still less to any sudden change in the habits of life of the community, as neither of these is likely to bring about a fall to less than half the previous mortality, as is shewn in the subjoined table taken from the Gold Coast Report for 1902.

Table of sickness and invaliding among Europeans for 1902 :—

How employed	Number	Deaths	Invalided	Death rate per 1,000	Invaliding rate per 1,000
Officials ... ..	286	10	24	35·0	83·9
Mercantile Firms, etc. ...	373	21	38	56·3	101·9
Mining Companies ...	778	18	98	23·1	126·0
Gold Coast Railway ...	297	6	20	20·2	67·3
Missions ... ..	96	2	1	20·8	10·4
Total ... ..	1830	57	181	31·1	98·9

Moreover, when a further, almost equally striking improvement takes place in the succeeding year, it is clearly out of all probability that the incident is due to the fluctuations constantly found in any series of figures, and still less to any sudden change in the habits of life of the community. I allude to this, because one very commonly hears the reply to the deduction that antimalarial measures have brought about this improvement, "Ah! the real reason is that a better and more temperate class of men are now tak-

ing service on the coast." Now social improvements of the kind suggested can hardly be other than gradual, and the improvement has been a sudden one and an immediate sequel to the introduction and development of anti-malarial measures. The corresponding figures for 1903 are as below.

Table of sickness and invaliding among Europeans in 1903.

How employed	Number	Deaths	Invalided	Death rate per 1,000	Invaliding rate per 1,000
Officials ... ..	326	5	25	15·3	76·7
Mercantile Firms, etc. ...	335	12	18	35·8	53·7
Mining Companies ...	1,043	20	92	19·2	88·2
Missions ... ..	92	2	2	21·7	21·7
Total ... ..	1,796	39	137	21·7	76·3

Still great as has been the improvement, the health of the European in India, as will be seen, compares very favourably with that of his brother-officer on the West Coast, and the difference is all the more striking, because it is not fair to compare Indian figures with the comparatively light mortality of the last two years. These years are the result of the systematic adoption of all such measures of anti-malarial sanitation as can be carried out without considerable capital expense, but in India for all practical purposes the possibilities of anti-malarial sanitation have been absolutely ignored. Up to 1903, at any rate, the futile so-called experiment at Mian Mir, was all that had been attempted in this direction, so that a fair comparison can only be instituted with West Africa previously to the adoption of anti-malarial measures.

The only branch of the Indian services for which information is available is the Covenanted Civil; and even of this only for certain provinces, which happen to publish the casualties occurring in that service in their Quarterly Civil Lists.

From these have been collated the casualties of the five years ending with 1903, on a total average strength of 607. For the reasons already mentioned no reliable information as to invaliding is obtainable for comparison. The results are as follows:—

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Table of mortality of the Indian Covenanted Civil Service, based on the five years from 1899 to 1903 inclusive.

Province	Average strength	Died	Death rate per 1,000
Bengal ... ..	233	17	14.4
United Provinces ... ..	217	10	7.4
Madras ... ..	157	8	12.7
Altogether ... ..	607	35	11.3

If available, it would probably be found that Bombay and Central India would not differ greatly from Madras, and that the Punjab would equal Bengal, while Burmah and Assam would be much higher than either, but it is perfectly certain that neither of these would show a mortality at all approaching to that obtaining on the West Coast, up to the last few years. It should be further explained that the death-rates of other branches of the service would certainly run higher, as the Covenanted Civil Service enjoys more favourable leave rules than any other branch of the service, and, what is even more to the point, are so much better paid that they can never be prevented from taking their full proportion of leave through impecuniosity. On this account, the circumstance that this service in the United Provinces has a death-rate lower than that of England is not so surprising, as the only fair comparison with the English data would be those relating, e.g., to clergymen of the Church of England, or the Bar, whose sheltered lives afford them a death-rate much lower than that of the community generally.

The general European death rate in India is difficult to compare with that of almost any other community, without laborious actuarial investigation, because it includes so small a proportion of children of school-going age, but an enquiry undertaken in the Bombay Presidency gives figures that confirm the impressions yielded by the records of the Civil Service.

Out of a total population of 18,804 (including soldiers) the death rate in 1901 was 13.5, and the birth rate 14.4, while in 1902 the birth rate fell to 13.4, and the death rate rose to 16.1. Amongst Eurasians the birth rate was 21, and the death rate 24 per thousand. For the native population, it need hardly be said, the rates, alike of births and deaths, are very much higher, their mortality in some years quite equalling that of Europeans on the West Coast, when at its worst, in some of the more unhealthy Indian towns.

The constantly sick rates, however, would certainly not work out so favourably to India, as, for malaria alone, about a third of the entire strength of British troops is admitted once to hospital yearly, although a



considerable proportion of the men are kept out of harm's way by being sent to the hills, while in specially malarious stations, such as Fian Mir, there have been years when every man was admitted, on the average, three times each.

### **Character of the Diseases Responsible for the Mortality.**

In India, the special causes of death that raise its mortality above that of England are Typhoid Fever, Cholera, Dysentery, Abscess of the Liver, and Bubonic Plague. As has been seen, malaria is responsible for an enormous amount of sickness, but is rarely directly fatal, although much of the malaria is of a very virulent type. As to West Africa, very little detailed information is available in a documentary form, but conversations with a considerable number of medical men, possessing experience of the Coast, elicited almost universally the same information, viz., that Typhoid, Cholera, and Plague were unknown, and dysentery and abscess of the liver comparatively uncommon. All were also agreed that the ordinary cases of malaria are by no means serious, involving, as a rule, only a day or two's confinement to bed. Further, it was difficult to hear of instances of death from any other cause than either what is called Black-water Fever, or another, equally inexplicable and rapidly fatal condition, spoken of simply as hyperpyrexia. It is quite useless searching for information as to the commonness of these two conditions in hospital returns, as both of them have hitherto been included in malaria. Another point equally striking is that almost unanimously my informants were agreed that all these cases, or, at any rate, Black-water, showed no seasonal prevalence. The exceptions were the men who served in Sierra Leone, some of whom were inclined to claim a prevalence for black-water parallel to that of malaria. Now, if black-water and hyperpyrexia be simply malignant malaria, it is, to say the least, strange that they are not met with in India or elsewhere where malaria is an excessively common disease. That the symptom of haemoglobinuria is occasionally met with I am quite aware, though personally 20 years of Indian service scarcely enables me to recall more than one or two, but where is there to be found a similar form of malaria killing one out of every three victims? That the malarial parasite is usually found in the earlier stages of the majority of cases proves nothing to anyone who has practised in a malarial country, as in such places the whole population carries about with it dormant parasites, which start into activity when favoured by any shock, or other depressing influence, so that it is exceptional rather than otherwise not to find the parasites in the epidemic pneumonia of India, and child birth and amputation of the leg might be demonstrated to be malarial in their causation by the same argument, for nothing is commoner than to have such cases complicated by the reappearance of malarial parasites in the blood. If "Black-water" be really malarial, its prevalence should coincide with that of mosquitoes, as otherwise it is clearly to no purpose to attempt to check it by measures directed to the diminution of their numbers. It must be admitted that the hypothesis of the malarial origin of Black-water Fever fails to cover the circumstances of the case, and as the discovery

of its true etiology and prevention will solve at once the problem of the unhealthiness of the greater part of Africa, it appears to the writer that a strong case has been made for a special investigation of this mysterious malady.

It will thus be seen that the causes of increased mortality, as compared with those of temperate climates, differ entirely on the West Coast of Africa from those met with in India.

#### **Comparison of the Climate of the Cold Coast with that of India.**

In speaking of climate, it must be clearly understood that the salubrity or otherwise of the places compared is not considered, but simply the records of the thermometer, hydrometer, and rain-guage. In the first place, however, it must be pointed out that India extends over so many degrees of latitude that almost every variety of tropical and sub-tropical climate is to be found within its limits, and on this account the climates of Southern India, Lower Burmah, and Ceylon alone resemble at all closely that of West Africa. In the next place, it may be well to consider what constitutes a "bad climate." Individuals differ greatly as to the discomfort experienced from damp or dry heat respectively, a few finding the dry heat the more intolerable, but, for the majority, damp heat is undoubtedly the more trying.

Fortunately for mankind, dampness is never found associated with really excessive air temperatures, that is to say, such as considerably exceed the temperature normal to the human body; but it is not a question of whether a dry heat of, say 90, is more harmful than the same temperature combined with dryness, but as to whether such a damp heat is or is not a more serious matter than a dry heat of 100 or over. The answer in all probability depends on the continuousness or otherwise of the unfavourable condition; in other words, on the diurnal range of temperature. Whether damp or dry, heat will be well borne provided that the nights are cool enough to permit of healthy and refreshing sleep, but unremitting heat extending over several weeks or months will undermine the resisting powers of the strongest, from lack of sufficient sleep, even if such serious direct results as heat stroke be escaped. Another point to be remembered is that for temperatures that approach the normal body-heat, every degree of closer approach or excess becomes increasingly serious.

As compared with India, the weather conditions of our West African Colonies are very uniform, all of them, with the exception of Bathurst, being in much the same latitude, the Gold Coast Colonies, Lagos, and Southern Nigeria all having a coast line that coincides pretty closely with 5 deg. N., while Sierra Leone is in 8 deg. 30 m., and even Bathurst only about 12 deg. N. All of them are, therefore, well within the tropical zone, and hence present the phenomenon of double rainy seasons. The meteorological returns for India are the results of many years' skilled observation, and may be said, therefore, to represent the actual facts. Those of West Africa, on the other hand, bear unmistakable signs of being the work of amateurs, and have been in some cases so obviously fallacious that Government has refused to publish them, with the result that no adequate series is available.

In some cases the instruments are wrongly exposed, as thermometer screens should never be placed absolutely in the open in a tropical climate, but should be installed under the shelter of a thatched hut with open sides. When placed in the open, the result is to exaggerate the shade maximum, and to disturb the correct readings of the difference between the wet and dry bulbs. Another result of amateur weather recording is to exaggerate the degree of relative humidity, through its constant tendency to forgetfulness in the matter of keeping filled the receptacle of the wet instrument.

No carelessness in the management of these instruments can result in recording too low a relative humidity, and every neglect to keep the water receptacle properly filled must give rise to too high readings.

An inspection of the detailed monthly returns, published in the Government gazettes, shows plenty of obvious instances where the wet instrument has been allowed to become quite dry, or nearly so. On this account, the records of relative humidity given below require to be discounted somewhat.

## MONTHLY RAINFALL OF GOLD COAST STATIONS

Place	January	February	March	April	May	June	July	August	September	October	November	December	Year	Number of years' observations
... Buri	1.20	2.88	4.01	5.55	6.72	6.67	3.06	2.74	2.74	8.01	3.89	2.21	49.68	11
... Witta	...	0.69	1.51	...	7.93	12.45	0.30	2.93	0.05	0.32	...	...	20.18	1
... Ambaga	...	0.43	0.12	2.31	3.19	4.56	8.65	10.22	6.08	3.05	0.23	...	38.56	2
... Sim	13.42	1.09	1.11	12.30	7.35	23.64	7.62	1.76	2.34	11.90	7.86	1.82	99.16*	1
... Kondi	2.73	1.06	2.30	2.37	5.87	8.40	2.74	0.58	1.23	3.40	1.12	0.86	31.98	2
... Ouassi Mine can of Eight Stations	0.86	0.14	2.54	4.54	7.33	13.47	5.86	5.13	5.65	6.90	4.09	3.16	61.11	2
... Stations	2.45	1.57	2.09	4.61	5.50	9.48	4.58	3.75	3.89	5.49	2.51	1.37	48.58	...

\* 99.16 as a second years' total rainfall only was available; the two years are included in the annual average.

## 36 TEMPERATURE OF WEST AFRICA AND INDIA COMPARED

The only at all continuous records available are those of Accra, and though misprints and other obvious inaccuracies are fairly numerous, such mistakes have a tendency to correct each other, and the following averages of the results of ten years' observations, with a slight discount on those of relative humidity, may be taken as a pretty close approach to accuracy. For the other localities, the series are too short to be considered as more than approximations to the truth, but they generally confirm the results of Accra.

Let us now compare the principal data for Accra with those of different parts of India.

Mean Monthly Maxima (Temperature) of West Africa compared with those of India and other Oriental Stations.

Month	Accra Gold Coast	Port Blair Andamans	Singapore	Moulmein Burmah	Madras	Bombay	Hoshangabad Central India	Sibsagan Assam	Calcutta	Allahabad	Jacobabad	Bathurst Mean 10 yrs.	Lagos Mean 10 yrs.	Old Calabar Mean 6 yrs.
January	86.3	86.4	85.6	88.4	84.7	82.6	86.3	70.1	77.1	74.4	73.6	83.6	87.6	86.4
February	87.8	88.1	87.1	91.5	86.9	82.6	85.4	73.1	82.0	86.2	77.9	86.2	87.7	89.6
March	88.7	91.1	88.0	94.1	90.0	85.7	95.7	79.1	90.8	93.0	91.1	83.4	89.5	89.7
April	88.3	92.5	89.0	94.6	93.1	88.5	104.8	82.5	96.6	103.8	163.1	85.5	88.8	90.2
May	83.9	89.0	88.9	89.3	98.5	50.7	107.6	85.9	94.5	107.6	111.6	83.7	86.9	91.0
June	83.0	86.0	86.7	84.6	98.5	87.6	98.1	89.3	91.1	101.7	112.7	86.6	85.0	86.8
July	81.4	85.4	87.5	83.0	95.7	84.4	86.7	90.0	86.0	91.6	107.8	85.6	81.6	83.5
August	80.3	85.3	86.3	83.0	93.8	84.0	85.0	89.2	87.1	89.8	103.8	85.4	81.0	82.7
September	83.7	85.1	86.9	84.8	93.0	84.5	88.1	88.1	87.7	91.5	103.5	86.3	82.8	84.2
October	84.0	86.9	87.1	88.4	89.0	87.5	89.6	84.8	86.7	90.5	98.6	87.7	84.6	86.1
November	86.9	86.8	86.1	88.4	85.1	86.9	84.3	78.3	81.4	83.1	86.8	86.8	87.5	87.2
December	87.2	85.9	83.2	87.2	83.3	84.5	79.3	71.5	76.5	77.7	76.7	83.0	88.1	87.2
Year...	85.1	87.4	86.9	88.1	91.0	85.8	90.4	81.8	86.5	89.8	95.6	85.3	85.9	87.0



## TEMPERATURE OF WEST AFRICA AND INDIA COMPARED 37

Judged by the maximum thermometer, it must be confessed that Accra has no claims whatever to any unenviable distinction. Next to Accra have been placed the records of the Andaman Islands and Singapore, which are, by common consent, recognised as two of the most pleasant of all tropical climates, and yet it is undeniable that one may find oneself a trifle hotter in either of them, while tropical India, and Burmah suffer severely in comparison. At the same time it is obvious that the dwellers in any of these localities must travel to Northern India should they desire to form any idea of the suffering involved in the endurance of a prolonged spell of really excessive heat. Taking the other side of the page, where have been placed the figures of some other West African localities, it will be seen that the climate of Lagos follows close, and though Bathurst can show some fairly respectable figures, an inspection of the following table of minimum temperatures shows that, owing to an enormous diurnal range, the nights are always singularly cool for a place so near the Equator. Old Calabar, on the other hand, is pretty steadily warm, having the same mean annual maximum as Madras, but, at the same time, it will be noticed that it has no month as hot as May, June, and July in the South Indian town.

## 38 TEMPERATURE OF WEST AFRICA AND INDIA COMPARED

Mean Monthly Temperature Minima of West Africa compared with those of India and other Oriental Stations.

Month	Accra Gold Coast	Port Blair Andamans	Singapore	Moulmein Burmah	Madras	Bombay	Hoshangabad Central India	Subsagan Assam	Calcutta	Allahabad	Jacobabad	Bahurst Mean 10 yrs.	Lagos Mean 10 yrs.	Old Calabar Mean 6 yrs.
January ...	71.8	75.6	71.7	65.2	67.4	67.9	52.3	49.5	55.3	47.9	43.3	62.9	73.6	73.9
February ...	73.8	74.9	71.6	67.7	68.0	68.7	56.0	53.3	60.4	51.8	48.5	61.4	76.0	74.5
March ...	73.8	76.6	73.3	72.7	72.2	73.4	64.6	60.0	69.5	62.1	59.6	65.1	77.6	74.6
April ...	72.2	78.8	74.8	76.4	77.1	77.7	73.8	66.5	75.7	72.4	69.7	66.6	76.1	75.0
May ...	73.5	78.4	76.4	75.8	81.1	80.7	80.3	71.7	77.4	79.5	78.2	69.6	75.8	73.3
June ...	71.1	77.8	75.6	74.8	80.7	79.5	79.0	76.4	78.5	82.5	84.4	73.5	73.9	71.9
July ...	69.0	77.4	75.4	74.2	78.7	77.5	75.2	77.9	78.5	79.4	84.3	73.8	73.1	72.1
August ...	68.0	77.2	74.9	74.1	77.3	77.0	73.8	77.7	78.3	78.6	81.4	73.4	73.6	71.5
September...	70.9	76.5	74.2	74.5	77.0	76.5	73.3	76.2	78.0	76.9	76.0	73.3	74.3	71.4
October ...	71.8	77.3	74.1	74.7	75.1	76.5	66.9	70.8	74.3	67.6	62.5	73.6	75.1	72.1
November ...	73.2	77.2	73.6	71.1	72.3	73.3	57.3	59.6	64.5	55.1	50.8	71.4	77.1	72.3
December ...	73.8	76.7	73.5	66.9	69.7	69.8	51.7	50.7	56.0	47.8	44.0	64.5	76.3	71.5
Year ...	71.9	77.0	74.0	72.3	74.7	74.9	67.0	65.9	70.5	66.8	65.2	69.3	75.2	72.9

An inspection of the above table shows even more convincingly the less uncomfortable character of the climate of West Africa as compared with either India or the other places tabulated for comparison, as it demonstrates that really hot nights are quite unknown in any part of the Coast, while everywhere in India there are prolonged periods of excessive heat unrelieved by any sufficient fall during the night. Fortunately, where the heat is most excessive, as in Northern India, some compensation is to be found in the existence of a more or less prolonged "cold weather," which in the far Punjab, may amount to as much as four months of really bracing weather.

A continuous year of the conditions of the "hot season" in those regions would be almost beyond human endurance, so that the excellent winter months are most dearly paid for. The only place within Indian limits that possesses a climate at all as mild as that of the West Coast is, indeed, Sibsagar in the Upper Brahmaputra Valley, and one of the wettest of our stations, but even there the nights are much hotter than anywhere on the "Coast" for several months together.

## RAINFALL OF WEST AFRICA AND INDIA COMPARED

Let us now consider the relative moisture of the compared places.

Monthly Rainfall of West Africa compared with that of India and other Oriental Stations.

Month	Accra Gold Coast	Port Blair Andamans	Singapore	Moulmein Burmah	Madras	Bombay	Hoshangabad Central India	Sibsagan Assam	Calcutta	Allahabad	Jacobabad	Bathurst Mean 12 yrs.	Lagos Mean 12 yrs.	Old Calabar Mean 6 yrs.
January ...	1.39	0.90	10.30	0.17	0.83	0.12	0.33	1.14	0.29	0.82	0.26	drops	0.60	1.47
February ...	0.96	0.96	6.18	0.13	0.28	0.02	0.21	2.16	1.02	0.48	0.27	0.01	1.62	2.91
March ...	1.99	0.34	8.41	0.23	0.37	0.01	0.21	4.74	1.14	0.38	0.25	...	2.79	7.21
April ...	5.13	2.94	8.39	3.12	0.65	0.05	0.01	9.88	1.54	0.14	0.17	0.04	5.92	11.45
May ...	6.43	16.73	5.58	20.33	1.96	0.55	0.53	11.47	5.60	0.29	0.15	0.36	8.90	12.83
June ...	3.11	17.95	6.37	37.68	2.06	20.56	6.82	14.14	11.04	5.09	0.10	3.38	16.68	19.43
July ...	1.15	15.46	7.74	44.45	3.80	24.56	15.42	15.89	12.31	12.24	1.21	13.15	11.20	21.36
August ...	0.92	14.81	6.83	42.74	4.66	14.91	13.58	16.29	12.69	10.88	1.25	19.78	3.68	18.19
September ...	1.25	18.85	5.83	29.65	4.84	10.93	9.59	11.77	10.40	6.32	0.19	9.50	6.18	12.10
October ...	2.95	11.68	8.61	7.90	10.93	1.76	1.31	5.17	3.87	2.40	0.01	3.99	8.30	12.20
November...	0.93	8.58	9.24	1.44	13.30	0.47	0.39	1.11	0.62	0.25	0.12	0.29	1.93	9.43
December...	0.72	5.55	10.84	0.03	5.25	0.05	0.44	0.59	0.31	0.23	0.15	0.04	0.82	2.86
Year ...	26.93	114.70	93.99	187.85	48.93	73.99	48.0	94.35	60.83	39.52	4.13	50.55	57.10	131.38

It will be seen from the above that the rainfall on the Gold Coast is very small for a littoral climate so close to the Equator, while that of Lagos is very much the same as that of Southern India. The rainfall of Southern Nigeria is, of course, heavy, rather exceeding that of the favourite tropical stations of Singapore and Port Blair, but not markedly so, while it sinks into comparative insignificance beside that of the Burmah coast.



## HUMIDITY OF WEST AFRICA AND INDIA COMPARED 41

It now only remains to consider the question of the relative humidity of the atmosphere, which cannot, however, be as definitely compared, as the data available for West Africa must, as already explained, more or less exaggerate the degree of moisture, and are noted at different hours.

The relative humidity of the air in West Africa compared with that of India and other Oriental Stations.

Month	Accra Gold Coast	Port Blair Andamans	Singapore	Rangoon Burmah Coast	Madras	Bombay	Hoshangabad Central India	Sibsagan Assam	Calcutta	Allahabad	Jacobabad	Bathurst Mean 10 yrs.	Lagos Mean 10 yrs.	Old Calabar Mean 5 yrs.
January ...	77	76	79	64	75	69	54	86	69	66	49	68	81	80
February ...	79	76	79	63	74	68	45	81	65	56	42	67	78	77
March ...	78	76	80	64	74	72	35	79	66	42	37	72	76	82
April ...	77	77	79	66	74	74	28	81	68	31	32	72	75	80
May ...	79	83	79	78	68	74	32	83	74	37	30	78	78	82
June ...	84	86	81	89	65	82	62	84	83	56	40	80	82	84
July ...	82	85	76	90	67	87	83	84	87	81	52	89	83	87
August ...	85	86	78	89	72	87	85	85	88	83	57	89	81	87
September	83	87	77	84	73	85	79	85	86	79	52	89	80	86
October ...	85	86	79	78	80	80	62	86	81	66	47	81	82	84
November...	80	82	82	72	81	70	54	84	73	62	44	75	81	83
December...	77	79	89	71	79	69	55	85	70	66	47	69	80	82
Year ...	81	82	80	76	74	76	56	84	76	60	44	77	80	83

## 42 CLIMATE OF WEST AFRICA AND INDIA COMPARED

A comparison of the above data again shows the superiority of the climate of West Africa with that of the regions under comparison, for it will be noticed, taken in conjunction with the tables of temperature, that the damp seasons of the year in West Africa are the coolest months, whereas, in such places as Rangoon and Port Blair, the highest humidity coincides with the severest heat. Even Old Calabar, in August, with a relative humidity of 88 per cent. and a mean temperature of 78 deg., can hardly be as uncomfortable a place of residence as Rangoon in July, with a relative humidity of 90 per cent., and a mean temperature of 80 deg., especially at night, when there is a difference of 6 degrees in the minimum temperatures in favour of the West African Station.

Sufficient evidence has certainly been adduced to make it clear that whatever may be the cause of the greater morbidity of West Africa, it can have no connection with climate, in the proper sense of the term, as that of India is undoubtedly much the more severe.

As the available climatic data of West Africa do not appear to have been hitherto collated, it may be well to conclude this section with the results obtained from drawing the averages of such records as are available.

The table for Accra is probably, except, perhaps in the matter of relative humidity, fairly accurate; that for Kumassi, on the other hand, may be, it is to be feared, none too exact, but is given in full, as it is the only place situated at all far inland, for which information is available.