A Contribution to the Study of Blackwater Fever.

Robert King. M.B. Ch.B. 1898.

Notwithstanding the great and growing importance of the subject, it seems strange that recent years have not added anything very important to our knowledge of African Blackwater Fever. From time to time various papers on the subject have been published in the Medical Journals but we are still awaiting the appearance of those who will do for this disease, what Manson and Ross have done for Malaria, and Dutton, Bruce, and Castellani for Trypanosomiasis and Sleeping Sickness.

The last great discussion of this subject was at the Annual meeting of the British Medical Association in 1898 when Dr Sambon's paper led to much conflict of opinion; and again at the meeting in the following year when an interesting paper was submitted by Dr Stalkartt R.N. The causes of this lack of knowledge are not, I think, far to seek. The disease is admittedly an obscure one; its exact relationship, if any, to Malaria is not yet determined; its parasitology is obscured by that of the last named disease, and even post mortem examination does not shed much light on the subject, it

being difficult to discriminate between the appearances due to Malaria, and those due to the Haemoglobinuria. Leaving to those who are qualified for the task, the working out of these interesting, if intricate, questions, I have thought that along other lines it might be possible to glean some useful information about the Condition, and it is with this end in view that I have written this contribution to the Study of Blackwater Fever.

The following pages embody the results of a two years residence in Duke Town, Old Calabar, West Africa, and a study of the records of Blackwater Fever cases treated in the Government Hospital there.

As the conditions obtaining in that town seem to have a close association with the Etiology of the disease, I propose in the first place to give a brief account of the country, climate, and conditions of life generally, and then to proceed to the special subject of this paper.

The name Old Calabar is given to a large tract of country, part of the Crown Colony of Southern Nigeria, situated on the West African

coast, about 5° north of the Equator, and extending from the coast for a varying distance inland. There are a number of more or less important towns, the chief of which is Duke Town, the present headquarters of the Southern Nigerian Government. The names Old Calabar and Duke Town are often used synonymously but ought really to be kept distinct, the former being the country, the latter the capital. The country is everywhere within the malarial belt, very flat and swampy, and covered for the most part with Mangrove trees and dense bush. Two chief rivers run through the country — the Cross river and the Calabar river, both of considerable size. These in their lower reaches are connected by a very complete network of creeks which divide the country into innumerable small areas. Here and there a rising piece of ground is met with, and on these in the majority of instances the native towns are built. The country is affected by the tide and when the latter is in flood all the muddy banks of the creeks and the swamps bordering are covered over, but as it recedes long stretches of foul-smelling mud, the haunts of

the Alligator and the Hippopotamus, are exposed, and across these the flooded swamps empty their turbid waters into the river again.
Duke Town, the capital, is better situated than any other town in Old Calabar with which I am acquainted. It stands on the Calabar river, 40 miles from the sea, and is the port town of the country. It contains a very mixed population of about 15,000 persons. The whites number about 120, made up of traders and Government servants in nearly equal numbers, and about a dozen missionaries. The ground on which the town is built consists roughly of two small hills with a hollow between, the whole forming the edge of a plateau, which on one side slopes almost perpendicularly down to the river, and on the side remote from the river, gradually merges into the surrounding country. The hills are occupied by the government servants and missionaries, in the hollow lies the native town, and on the river's edge the trading factories are built. In the early days no factories existed and trade was carried on from old sailing ships or "hulks" moored in the river. It became the fashion to have a factory on shore

and now only a solitary hulk is to be seen, while there are some fourteen factories along the river's side. To obtain sufficient space for building purposes, extensive cutting backwards of the sloping bank before mentioned had to be undertaken, and where this was difficult or impossible, the factories were built partly on shore and partly out over the river on iron piles. From each factory a small pier is run out so that native canoes may discharge their cargoes at all states of the tide. As the beach consists of mud and sand it is liable to be washed away, and to prevent this the portions occupied by the factories are extensively pegged with heavy beams and the latter backed with clay. Each factory employs a large number of natives who sleep in outhouses on the premises. The lower storey of each factory is used as a retail warehouse, and in the upper storey the white quarters are situated.

With houses built low on the river's edge, at the foot of a perpendicular bank about a 100 feet in height, filled with palm oil and sodden palm kernels, the atmosphere always

hot and steamy, and the soil always waterlogged, it is no wonder that the traders suffer so severely from the various diseases incidental to that part of the tropical world.

The manner of living does not call for any special remark, except that amongst traders and government servants there is a great consumption of alcohol, whilst everyone suffers more or less from the enervating effects of the climate as shown by anaemia, irritability of temper and disinclination for exertion.

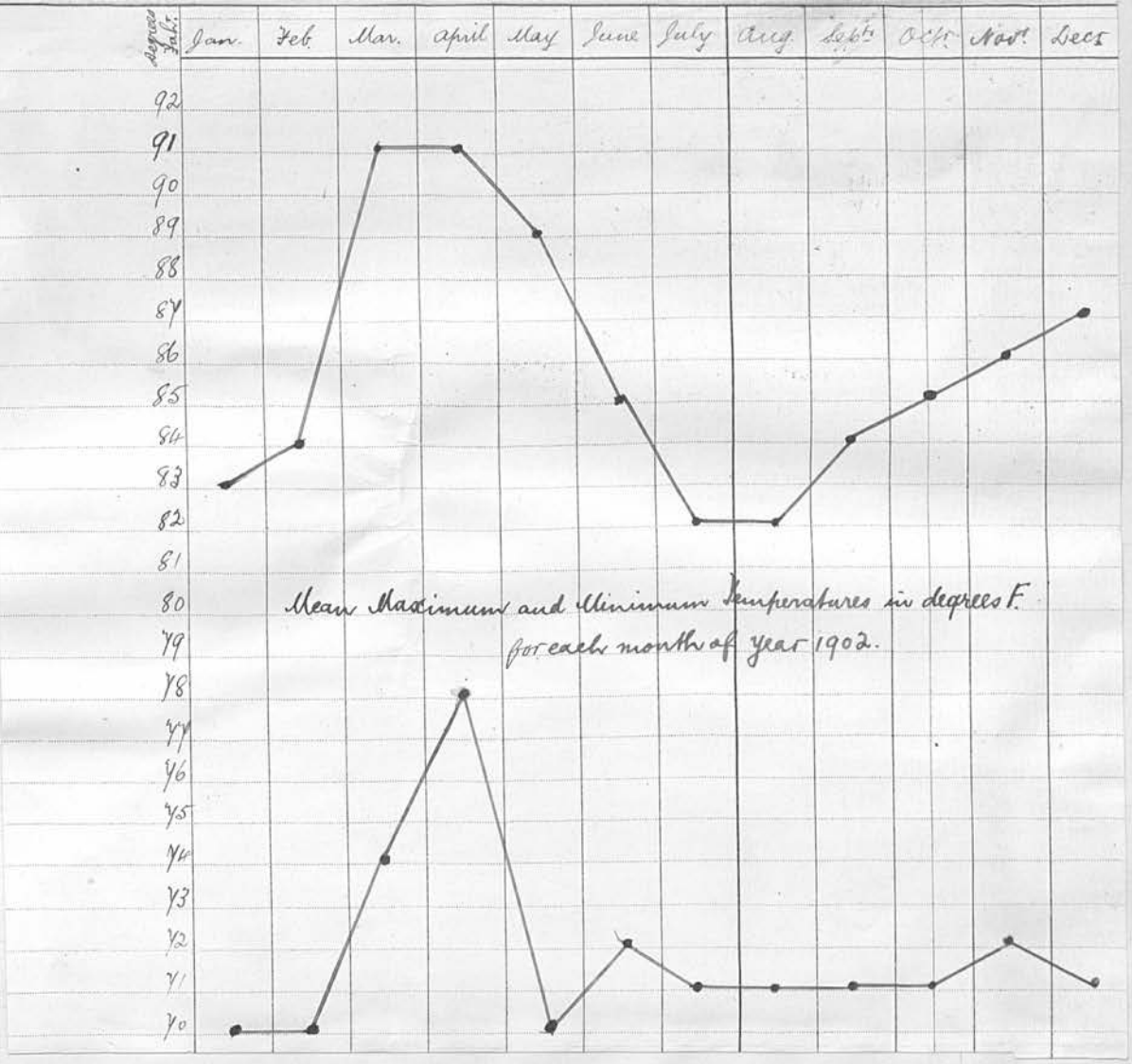
The period of residence on the coast is one year at a time for government servants, while among traders and missionaries two or three years are the common terms of service. Mosquito curtains are used though not invariably and after nightfall the Europeans seldom wander far. Sandflies cause more annoyance than mosquitoes.

Meteorological Conditions.

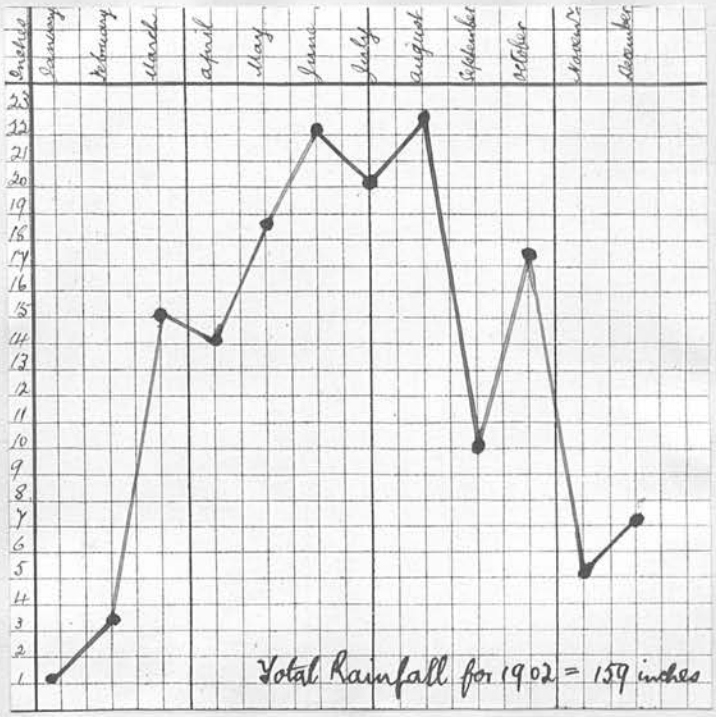
The climate of Old Calabar is a very trying one owing to the great heat, and the amount of moisture always present in the atmosphere. The wet season extends from

April to October and the dry season occupies the remaining months of the year. The changes of the seasons are always attended by severe tornadoes, and during two or more months of the dry season a heavy mist — "the smokes" — hangs like a pall day and night over land and sea. The rainfall is very great and for weeks at a time there will be a continuous downpour. As there are no rocks or stones in Old Calabar, the ground being entirely composed of a sandy soil, there is no chance for rain to collect in stagnant pools, and as soon as it has ceased to fall the plateau on which Duke Town is built is quickly dry again.

The lower of the two tables of the next page gives details of the rainfall for the various months of the year 1902. The upper table shows the seasonal range of temperature for the same year. It will be noticed that there is a fairly rapid fall till July and August are reached, and from the latter month a gradual rise till March and April. These two months are the hottest period of the year. There is an inverse correspondence between the rainfall and temperature, but during November, December and January though least rain falls the temperature is not at its maximum. This is caused by the "mist" above mentioned, which acting as a screen, obscures the sun and keeps the air comparatively cool. When this has cleared away there is a rapid rise in temperature.



Total Rainfall in inches for the various months of 1902.



Mosquitoes in Duke Town.

During my residence on the west african coast I had the good fortune to be visited by two members of the Malarial Expedition of the Liverpool School of Tropical Medicine. These gentlemen reported that they had experienced great difficulty in finding the Anopheles variety of Mosquito. The Culex variety is abundant and their larvae swarm in every water tank and other collection of water.

In two situations were Anopheles larvae found.

I. In a few old disused canoes lying on the native beach which contained some putrid water.

II. In some small pools of water found on the path which runs behind the factories the whole length of the beach, and which is much used by Europeans and Natives in going from one factory to another.

The conclusion reached by these gentlemen was that Old Calabar was one of the least unhealthy parts of West Africa.

With this introduction we now pass to the subject of Haemoglobinuric Fever or Blackwater Fever as it is commonly named on the Coast.

I find that during the seven years from 1896 to 1902, forty one cases of this disease were treated in the hospital at Duke Town. These cases with two exceptions were those of Europeans resident in the town. Of these thirty eight were males and three were females. Considering that the usual proportion of males to females among the European residents is about twelve to one it would appear that men and women suffer equally from the disease, though of course the numbers given above are too small to dogmatise upon.
As regards occupation, thirty five of the males were traders or their assistants, and three were government servants, while among the females two were missionaries, and one a trader's wife on a visit to the coast. Among the forty one cases it is interesting to note the following details :—

1st attack	=	32 cases
2nd "	=	3 "
3rd "	=	1 case
4th "	=	1 "
8th "	=	1 "
"Several" "	=	1 "
Not stated	=	2 Cases.

There were twenty eight recoveries and thirteen deaths giving a mortality of 31·7% in those attacked by the disease. The annexed tabular statement gives the cause of death so far as it is recorded.

Suppression of Urine = 8 cases.
Persistent or Subsequent Fever = 3 cases.
Heart Failure = 1 case.
Not stated = 1 case.

As regards the fatality of the various attacks, the following table shows that the first attack is responsible for the majority of deaths.

1st attack = 9 deaths.
2nd " = 2 "
Several attacks = 2 "
Not stated = 2 "

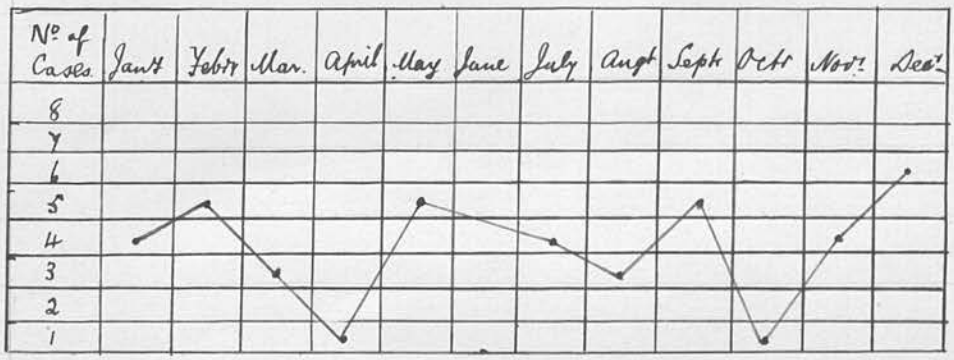
Seasonal Prevalence. It has been supposed that most cases occur during the dry season or during the wet season if there should happen to be long intervals of drought. So far as Duke Town is concerned, the number of admissions for the various months of the year, as given on the next page, does not show any very marked seasonal incidence. There is however an apparent tendency for a year

with comparatively few cases, to be followed by one with a larger number.

№ of admissions for the various months of the years 1896 - 1902.

January	=	4
February	=	5
March	=	3
April	=	1
May	=	5
June	=	0
July	=	4
August	=	3
September	=	5
October	=	1
November	=	4
December	=	6

Or the same results may be represented graphically thus.



This gives during the dry season twenty three cases, and for the wet season eighteen.
In none of the foregoing cases of first attack, was the period of residence on the West Coast less than one year. In some instances as many as five, seven, eight, nine, and fourteen years had been spent in West Africa before the first attack occurred. In the case of those who had already suffered from the disease in other parts of the world, a much shorter period of residence sufficed to precipitate an attack. Looking at the foregoing statistics generally one is impressed by the fact that a large number of traders suffers from the disease. Considering that there is an almost equal number of Government servants and traders, and that the former suffer so little from this affection, it suggests that for some reason the trading community is more liable to this disease.

Symptoms and Course of the Disease.

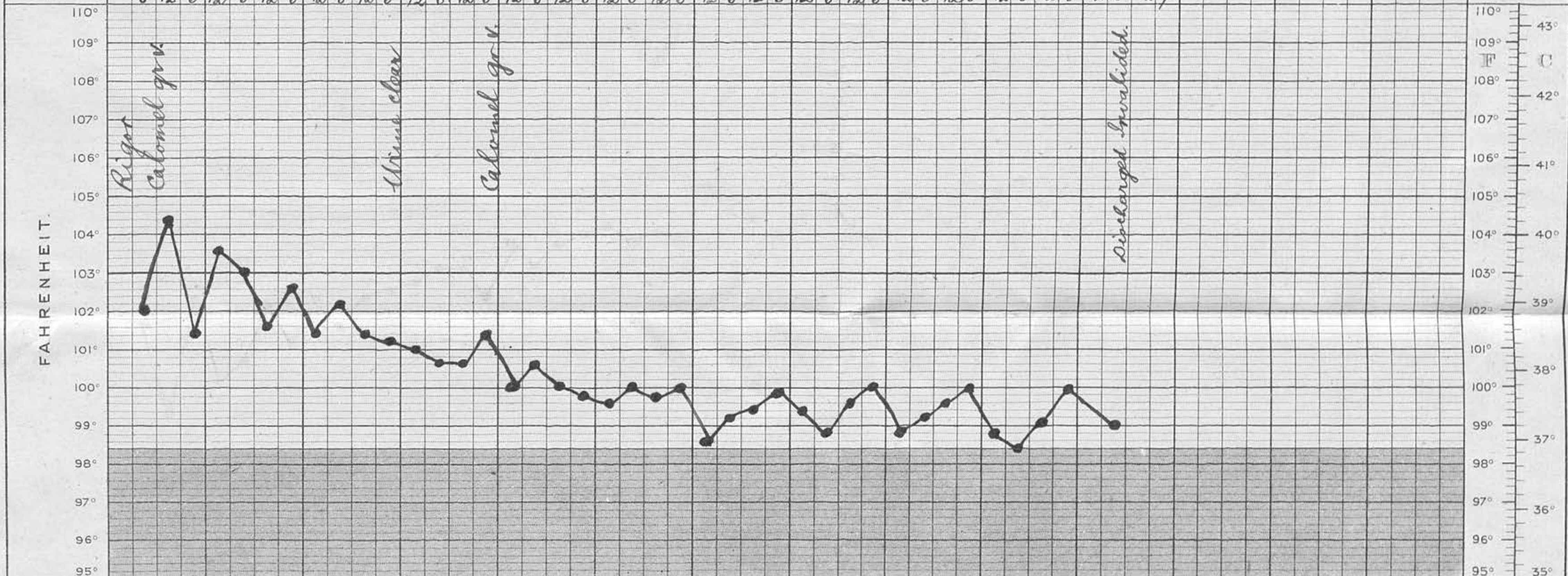
There is usually a period of failing health, but as most Europeans in West Africa are in a more or less impaired condition this is not in any way peculiar. The disease almost invariably sets

in abruptly with a rigor, the temperature rising to 104°, 105°, or 106°F. Immediately after this the patient notices that dark coloured urine is being passed and he is in consequence much alarmed. The urine thus passed may be in very large amount - sometimes 100 oz. per diem - or quite scanty, and the colour varies from a mere "smoky" tinge to an intense black. On standing the urine separates into two layers - an upper layer with a port wine appearance and a lower one of dark-brown flocculent looking material. The latter examined microscopically consists of casts of various kinds with granular debris and perhaps a few red blood corpuscles. There is pain in the abdomen, and over the kidneys with a constant desire to micturate. Shortly after the passage of the dark coloured urine, jaundice of the entire surface of the body, and of the conjunctivae is noticed. This disappears as the urine returns to normal and leaves an intense pallor behind. One of the most distressing symptoms is bilious vomiting, more or less severe, which is frequently present, and which nothing in the way of medicine seems to be available to check. These four - fewer - dark coloured urine - jaundice - and

Chart No. 1.

Medical Officer
Ward
Name of Patient A. R. M. (male) Age 26
Admitted 26th Sep. 1900 Discharged 6th Oct. 1900
Disease Haemoglobinuric Fever (1st Attack).

DATE	Sept 26	27	28	29	30	Oct. 1	2	3	4	5	6
PULSE											
RESPIRATION											
DAY OF DISEASE	1	2	3	4	5	6	7	8	9	10	11
HOUR	a.m. 6, p.m. 12 6	a.m. 12 6, p.m. 12 6	a.m. 12 6, p.m. 12 6	a.m. 12 6, p.m. 12 6	a.m. 12 6, p.m. 12 6	a.m. 12 6, p.m. 12 6	a.m. 12 6, p.m. 12 6	a.m. 12 6, p.m. 12 6	a.m. 12 6, p.m. 12 6	a.m. 12 6, p.m. 12 6	a.m. 12 6, p.m. 12 7



	Sept 26	27	28	29	30	Oct. 1	2	3	4	5	6
SKIN	moist	moist	moist	moist	moist	moist	moist	moist	moist	moist	
URINE	Burgandy Colour		Clear		some lost	some lost	some lost	some lost			
in ounces.	37½	76	79	106	98	71	87	89	89	57	
BOWELS	2	3	1	-	1	1	1	2	1	–	
WEIGHT											
VOMITING No. of times	24	38	25	11	9	–	–	–	–	–	

Temperature Chart by Frank Haydon, No. 2. Published by Down Bros Ltd. 21, St. Thomas's St, London, S.E.

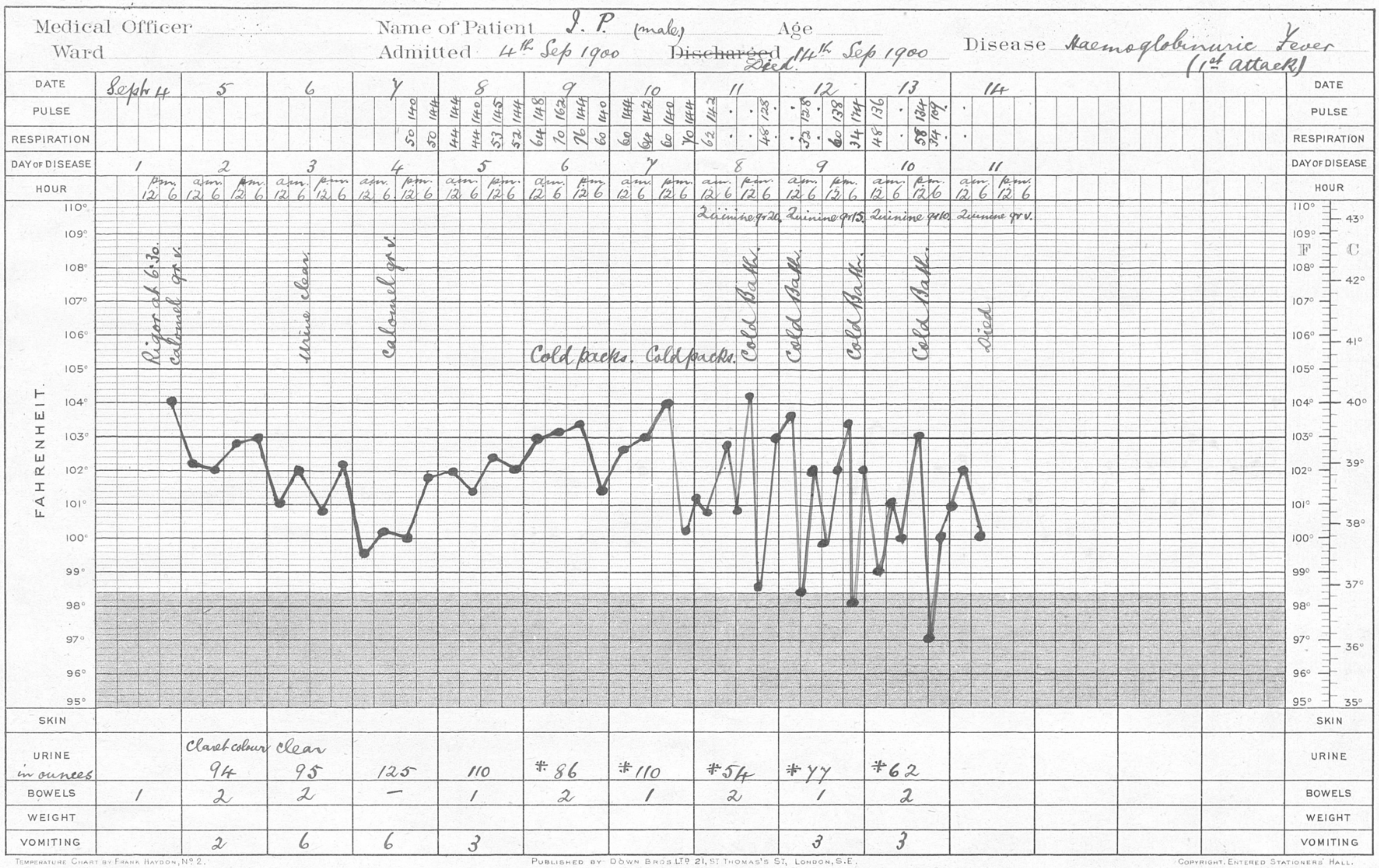
-bilious vomiting, may be said to constitute the cardinal symptoms of the disease, and after persisting for a longer or shorter period one or other of the following lines of development is followed.

I In a typical mild case the temperature slowly returns to normal. The urine clears about the third day and during convalescence an abnormally large quantity is often passed. Vomiting also ceases and the patients recovery is quite uneventful. He usually feels very feeble for a long time, but slowly picks up again a sea voyage being a valuable aid to this end. The following chart shows very well the course of such a mild case.

II. The more severe cases may be divided into two groups. In the first group we have those cases in which everything seems to indicate that the attack will follow a mild course. The urine is abundant and clears as usual about the third day, the temperature falls almost to normal and the bilious vomiting may cease. Soon however the temperature rises again to 103° or 104° F, assumes a remittent character, low muttering delirium comes on, and death follows in a few days.

In the second group come the cases in which from the onset of the disease there is a marked tendency to suppression of urine. Sometimes the urine may not exceed an ounce per diem and its passage is attended with much straining and pain. The patient sinks into a comatose condition, urine and faeces are passed in bed, and death closes the scene.

Charts II and III. give particulars of these severe types of the disease. The averages duration of an ordinary case is about two weeks.



Medical Officer
Ward
Name of Patient J. P. (male)
Admitted 4th Sep 1900
Age
Discharged Died 14th Sep 1900
Disease Haemoglobinuric Fever (1st attack)
DATE
PULSE
RESPIRATION
DAY OF DISEASE
HOUR
FAHRENHEIT
Rigor at 6.30. calomel gr v.
Urine clear
Calomel gr v.
Cold packs. Cold packs.
Cold Bath.
Cold Bath.
Cold Bath.
Cold Bath.
Died
Quinine gr 20.
Quinine gr 15.
Quinine gr 10.
Quinine gr v.
SKIN
URINE in ounces
Claret colour
Clear
94
95
125
110
*86
*110
*54
*77
*62
BOWELS
WEIGHT
VOMITING
Temperature Chart by Frank Haydon, No 2.
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* Some urine passed in bed.

Chart No 2.

Notice the large quantity of urine passed per diem and the marked fall in temperature after the cold bath. The urine is noted as clear on the third day.

Medical Officer
Ward

Name of Patient I. B. (female) Age
Admitted 22 Aug. 1900 ~~Discharged~~ died 4th Sep 1900 Disease Haemoglobinuric Fever (1st attack)

DATE	Aug 22	23	24	25	26	27	28	29	30	31	Sept 1	2	3	4
DAY of DISEASE	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HOUR	pm 6	am 12 6 pm 12 6	am 12 6 pm 12 6	am 12 6 pm 12 6	am 12 6 pm 12 6	am 12 6 pm 12 6	am 12 6 pm 12 6	am 12 6 pm 12 6	am 12 6 pm 12 6	am 12 6 pm 12 6	am 12 6 pm 12 6	am 12 6 pm 12 6	am 12 6 pm 12 6	am 12 6 pm 12 6

FAHRENHEIT. 110° 109° 108° 107° 106° 105° 104° 103° 102° 101° 100° 99° 98° 97° 96° 95°
F 110° 109° 108° 107° 106° 105° 104° 103° 102° 101° 100° 99° 98° 97° 96° 95°
C 43° 42° 41° 40° 39° 38° 37° 36° 35°

Rigor
Calomel gr v.
Calomel gr v.
Calomel gr v.
Died

SKIN														
URINE in ounces	9	Brownish Black 8½	–	clearer 2½	clear 1	1½	1½	3½	"Smoky" 2½ Blood present	1½	6	7½	8½	
BOWELS	1	2	2	10	3	5	6	4	2	2	2	1	2	3
WEIGHT														
VOMITING No of times	5	16	21	3	10	11	14	12	21	19	15	13	12	8

Temperature Chart by Frank Haydon, No 2. Published by Down Bros Ltd 21, St Thomas's St, London, S.E.

Chart No 3.

The temperature curve and the renal secretion are in marked contrast to what is notified on Chart No 2. Notice the very small quantities of urine passed. Pilocarpine was tried in this case without any beneficial effect.

Parasitology and Morbid Anatomy.

The Parasitology of this disease is at present in a state of chaos and many diverse statements have been made by different observers. I have nothing new to add myself except to mention that in two cases examined in the Duke Town hospital by the members of the Malarial Commission, the most careful search failed to show any organisms.

During an attack the Red Blood Corpuscles are rapidly destroyed and in 24 hours their number may fall to 1½ millions. Rapid regeneration occurs, and the blood examination shows nucleated red corpuscles, numerous blood plates, and a marked Leucocytosis not found in ordinary malaria. The Leucocytosis consists in a great increase of the large mononuclear variety of leucocyte while the Lymphocytes are reduced in number. The following table gives particulars of the blood examination in a case of Blackwater Fever which occurred in this Country

R.B.C. per c.m.	Haemoglobin p.c.	Leucocytes per c.m.	Large Mono. Leucocytes	Lymphocytes	Transitional forms	Polymorphs.	Eosinophil.
2·420·000	30	25·591	21·6 %	9·9%	1·0%	64·6%	2·7%

from B.M.J. 8 Aug. 1903.

Postmortem examination generally shows anaemia of the brain and marked congestion of the abdominal viscera. The lungs and heart are usually normal. In all cases the kidneys are markedly affected, usually much enlarged, congested, and with increase of interstitial tissue, Desquamative nephr-itis in all its stages is present, and the tubules are filled with granular pigment, which, with the shed epithelium forms casts. The liver is enlarged, slightly cirrhotic, and yellowish-brown on section. The gall bladder may contain much bile while the spleen is congested and its capsule thickened. Plehn in the Cameroons states that the muscles are stained yellow. The appearances may be complicated by evidence of malarial pigmentation but in two postmortems made by Koch no such pigmentation was present. (Medical Annual 1903. p. 1143)

The Diagnosis is never a matter of difficulty and it is impossible to mistake the disease for any other condition. The Haemoglobinuria is pathognomonic.

Treatment.

Deferring the question of the pathology of the disease to the latter part of this paper we now give a sketch

of the treatment usually carried out in the hospital at Duke Town. In the absence of precise knowledge as to the fundamental cause of Blackwater Fever treatment must necessarily be largely symptomatic Good and efficient nursing is of the utmost importance and takes precedence over all other measures. It is usual to give an initial dose of Calomel and to repeat this as occasion arises. This may be the only medicine given in simple cases. Where the temperature shows remittency as in one of the severe forms of the disease Quinine Sulphate, or other salt of Quinine, in moderate doses is administered either by the mouth, if vomiting is not marked, or by hypodermic injection. In the urinary suppression forms cupping over the loins, poultices, hot fomentations, and pilocarpine are used according to the condition of the patient. It is sometimes necessary to draw off the urine with a catheter, especially when the patient becomes unconscious, though under these conditions the bladder more often empties itself involuntarily. The bilious vomiting which is so exhausting to the patient is very difficult to check and all kinds of external and internal remedies may be tried without in many cases doing very much good. In

the less severe forms some benefit results from a mustard blister over the Epigastrium, and the use of effervescing drinks both alcoholic and non alcoholic. As one patient remarked after recovery from a severe attack of this fever, it was less troublesome to retch nearly all day long than to attempt the swallowing of the various mixtures and drinks prepared for its alleviation.

With a view to flush out the Kidney tubules barley water and other bland fluids are employed, but owing to the constant retching, and the fact that the disease runs a rapid course it is very difficult to meet this indication. Cold packs and cold baths are largely used whenever the fever runs high. As it is usually in the severer cases that such high fever obtains, and as these cases have usually a fatal ending, hydrotherapy only seems to postpone for a brief space the inevitable termination. At the same great benefit results from the use of pack or bath; the patients are always much more composed, half an hour or an hour's sleep may be obtained, while low muttering delir-ium is checked for the time being. The accepted indication for the use of the cold pack was a temperature of 103°F. when the patient had been ill

for some days, and when there seemed to be a tendency to still further febrile increase. A reduction of 3 or 4°F. usually resulted. If the results obtained by the cold pack were not satisfactory the cold bath was used. The dieting of these patients is an extremely difficult matter for the reasons before mentioned. The simpler cases, after the first four or five days can be easily dealt with, but the severer forms tax one's resources to the utmost. Fresh milk could not be obtained and reliance had to be placed upon condensed milk and aerated water, Horlick's malted milk, egg flip, mutton and chicken broths, and other easily assimilable forms of food. As stimulants Brandy in half ounce doses and Champagne in two ounce doses were largely used. No definite rules can be laid down with regard to food and stimulants, but an endeavour was always made to supply the patient with both immediately after a fit of vomiting so that some portion at least might be absorbed before another attack ensued.

Convalescence was slow and as soon as the patient could be safely moved, the rule was to put him on board steamer and send him home to England.

It may be well to mention here that attacks of Blackwater Fever, sometimes fatal, occur in this country in those who have lived for some time in an endemic area. The attack may come on for the first time, or previous attacks may have been experienced in some tropical country. The only case of the kind with which I am personally acquainted occurred in a friend who spent five years in Duke Town, East Africa. In the Tropics his health was good, ordinary malarial attacks troubled him little, and his power of endurance was remarkable. Much of his time was spent on the beach supervising the arrival and dispatch of ships' cargoes. About two weeks after his arrival in this country he had occasion to attend a public meeting. Being late, he hurried to the hall only to find it crowded and no seats available. He stood for a long time beside a large open door, through which a cold draught was blowing, until feeling "chilly" he returned home. He took five grains of Quinine and went to bed. Next morning he felt far from well, was feverish, and on micturating noticed that the urine was very black. This black urine passed in large quantities about every three hours, but

pain was not a prominent feature. Bilious vomiting was also present. In about 48 hours the urine again became normal, the vomiting ceased, and the subsequent progress of the case was quite uneventful. The patient had the good fortune to be attended by a nurse on the staff of the Duke Town Hospital, at home on furlough, and thoroughly conversant with the disease. The treatment differed in no respect from that already described.

Pathology of the Disease.

What is the essential cause of Blackwater Fever? This is by far the most important question in connection with the disease and until a solution is forthcoming any rational treatment of the condition is impossible. Several explanations have from time to time been advanced and each has its own advocates and supporters

The following are some of the chief suggestions.

I. That it is a severe malarial infection.

II. That it is Quinine poisoning

III. That it is a complication of malaria.

IV. That it is a distinct entity.

I. That it is a severe malarial infection.

This theory has not commended itself much to general acceptance. It is quite true that evidence of malignant malarial infection has been found in cases of Blackwater Fever [Brit. Med. Journal 8·8·03] but this may only have been a coincidence, and many cases of severe malaria occur without any Haemoglobinuric symptoms. The distinguishing characteristic of the malarial parasite is its power to transform blood colouring matter into melanin which is stored up in the liver and spleen, and yet in post mortem examinations on cases dying of Blackwater Fever no trace of this pigment has been found.(1) Had this fever been the result of severe malarial infection one would have expected some post mortem evidence of this. Clinically Blackwater Fever cases may be of the mildest possible character and may occur in those who have suffered slightly or not at all from ordinary malarial attacks.

II. That it is Quinine poisoning.

This is the theory advanced by Koch(2) who holds that malaria predisposes to, while Quinine incites, the attack, and whether or not he is correct the effect of his opinion has been very far reaching.

The members of the German trading community in old Calabar, admitted to hospital, could only with difficulty be persuaded to take Quinine for their malarial attacks, the fear of Blackwater Fever being constantly present to their minds.

Koch makes much of the fact that in no case of this fever is it possible to exclude the taking of Quinine. This however is not to be wondered at, because as has so often been pointed out the use of this drug is almost universal in the tropics, where it is considered a specific not only for fever but for almost every other human ailment. Malarial parasites, says Koch, attack and damage the Red Blood Corpuscles, Quinine causes their solution in the plasma with the resulting Blackwater Fever symptoms. All the phenomena of the disease, he says, are explained on this assumption, and the same thing results when the blood of one animal is transfused into another.

This theory is fascinating and much of what has been written against it has really supported it. At the same time the general opinion of tropical practitioners is decidedly adverse to it, and many maintain that Quinine is the only drug we possess that is of any value in the

treatment of this fever.(3) Nor is it invariably the case that Quinine has been taken before the symptoms appear. The late Dr Crosse affirms(4) that he has himself seen and treated both in Africa and in England cases in which no Quinine had been taken, and one of the worst cases I have seen occurred in a lady who studiously avoided Quinine owing to the unpleasant nervous symptoms resulting from its use. Again, one may see many cases of malaria, mild and severe, before one of Blackwater Fever is met with. All cases of malaria occurring among the Europeans in Duke Town were at once removed to hospital and thoroughly treated with Quinine, and I do not know of a single case that developed Haemoglobinuric Fever as a consequence. If Koch were correct one would expect this to be a common, perhaps an invariable, result of all ordinary fevers.

That there are individuals met with who show a peculiar susceptability to the action of Quinine need not be denied. Now and again one meets with a case in which Quinine seems to cause slight haemoglobinuria but this is very different from true Haemoglobinuric Fever. Major Giles [B.M.J. - 16·9·99] speaking of his experience in India states that

everybody must be familiar with cases of malaria in which Haemoglobinuria occurred, but these cases were not exceptionally fatal, whereas the African disease was an absolute terror.
Till further evidence is forthcoming we must regard Koch's statement as an hypothesis of which the practical effect has been somewhat pernicious.

III. That it is a complication of Malaria.

This is the opinion that has prevailed longest and nearly all writers on the subject bring forward evidence in its support, though each writer seems to have his own idea as to how and where the complication comes in.
Moffat in Uganda[5] holds that a chill acting on the parasite at a certain stage in its development in a person predisposed by acute or chronic malarial infection, determines the onset of the condition.
Dr Crosse[6] who himself suffered from many attacks of this fever on the Niger, endeavours to show that in all cases the health of the individual has undergone deterioration. For a long time toxines are being manufactured in the body, something occurs which prevents the due excretion of the toxines and their retention leads to solution of the red corpuscles and so

Haemoglobinuria. He quotes many writers to show that the condition comes on only in those who have suffered from the ordinary forms of fever, and whose physical condition is therefore below normal.

These statements may contain a good deal of truth, and in the light of our present knowledge it is somewhat difficult to criticise them adversely. At the same time they do not seem to contain the whole truth, and even Koch seemed to realise that something more than malaria was required to explain Haemoglobinuric Fever. Among his postulates regarding this disease we have this one " that Malaria and Blackwater Fever show clinical differences when closely studied and compared (7), and hence Koch's own suggestion that Quinine was the essential cause. Some hold that the very fact of Quinine being so useful in the condition is itself a proof of the malarial origin of the complaint. As stated before this drug was seldom used in the treatment of these cases in the Duke Town hospital, and Kearsey mentions [B.M.J. 26·1·01] that in British Central Africa Quinine is not used for the condition. The same writer also mentions that he has successfully treated seven consequtive cases with doses of the Liq. Hydrarg. Perchlor. (B.P.) and Sodium Bicarbonate,

while in other hands this remedy has been eminently satisfactory. Nor can it be that the condition comes on in those only who have neglected the so-called preliminary fevers. In Duke Town the various factories are visited every morning by one of the Government Medical Officers specially engaged for the purpose. No means or convenience for nursing fever patients exists in the factories, and an agent or assistant in any way out of sorts is at once removed to hospital. The same holds true for other Europeans and thus there is practically little or no neglect of ordinary malarial attacks.

The case for and against the malarial origin of this fever was thus summarised by Dr. Manson at the discussion of the subject at the British Medical Association meeting in 1899. (8)

For.

a. It occurred in very malarious districts.
b. The malarial parasite was often found in the blood.
c. It occurred in those who had had many attacks of malaria.
d. It occurred only after prolonged residence and consequent malarial saturation.

Against.

a. Its geographical range was limited as compared with malaria.

b. The malarial parasites were not always found and when found, were not always of the same kind.

c. It was not certain that the fevers preceding the attack were all of them malarial in character.

d. Cases had occurred within a short period of arrival in the endemic area of the disease.

e. The epidemic seasons of Malaria and Blackwater Fever did not always correspond.

f. Blackwater Fever was not amenable to Quinine.

Some of these statements may be perhaps open to criticism but this is a very comprehensive summary and fairly well represents our present knowledge of the connection between the two conditions.

IV. That it is a distinct disease.

This is the theory ably advocated by Dr. Sambon[9] and it is the one which I think the evidence from Duke Town best supports.

I. It is a most striking fact that in Duke Town those who suffer most from this fever are the Hausas and their assistants whose houses are built on the

river's edge. In an earlier part of this paper reference was made to the beach, the native canoes, and the path extending the whole length of the beach behind the factories. The stagnant water in the canoes and in the pools on the path was found to contain Anopheles larvae, and at first glance it would seem as if this fact tended to support the idea that Black-water Fever was malarious. We must remember however that Mosquitoes have the power of flight and even if the breeding grounds lie low, the insects fly in every direction, and do not confine themselves to the neighbourhood of their original habitat. Again the beach and factories are always being visited by the other Europeans, and the traders are frequently visiting the compatriots in their better situated houses. There is a free inter-communication between the various classes of the whites. Many natives are also employed in the government offices, and native children from all quarters come to the various mission schools, so that the possibility of Mosquitoes being confined to any one locality is very remote. Even in houses situated far from the beach Mosquitoes can be captured at all hours of the day and their attentions to the new-comer are just as aggravating at midday as at midnight.

The Malarial Expedition to Sierra Leone[10] noted that few Anopheles could be found on the hill in the centre of the town, though this was only 250 feet high. It is added that this may be owing to the abundance of feeding material within easier reach of the breeding grounds. This is most probable as Sierra Leone is a large well built town occupying an extended plain at the base of the hill, and there is very little traffic in the direction of the hill itself. The conditions at Duke Town are very different.

II. If this fever is purely malarial in origin how is it that those Europeans whose houses are on the higher grounds are practically exempt from it. Ordinary malarial attacks visit government servants, trader and missionary alike, but in Duke Town it is the traders, their assistants and those who have to spend much of their time on the beach, that suffer from the more serious complaint.

III. Dr Fielding Ould in Lagos[11] noted that those who suffered most severely from this affection were the members of the German trading community and the missionaries. He adds that these are the most badly fed and housed of all the whites in that town. This does not apply to Old Calabar as there is little to choose between the houses of the

various divisions of the whites, except the unfavourable position of the factory ones. The same remark applies to food and drink though it may be mentioned that among traders and Government servants much alcohol is consumed, missionaries as a rule being abstainers. The traders in short are as well favoured in every respect as the other Europeans with the single exception of the position of their houses. This seems to suggest that in some way or other Haemoglobinuric Fever is a "place" disease What part the "place" may play in the etiology of the disease is not as yet quite clear, but probably it furnishes the conditions necessary for the development of the specific cause of the complaint.

IV. The fact that cases of this fever are admitted to hospital all the year round and that there is no marked seasonal prevalence also point in the same direction. These conditions may be a certain degree of heat and moisture and as before pointed out this can be obtained at the factory beaches all the year round.

V The evidence from other towns in the Old Calabar district goes to show, that wherever Europeans are located in lowlying swampy towns they suffer from this disease; and where they occupy towns

more favourably situated Blackwater Fever cases are correspondingly more rare. In addition to these con-
- siderations when we remember the clinical history of a case of this fever – its rapid onset with rigor, the black water, vomiting, steady fall in temperature in the favourable cases, and the return of urine to normal, and convalescence in from 10 to 14 days all without the use of Quinine, the non-malarial character of the complaint seems further strengthened. How the specific agent enters the body, and what its nature, it would serve no useful purpose to speculate about. Whatever the real cause Dr. Lambon(12) holds that after entering the body it has a long incubation period. On this supposition he would explain why it is that those who contract the disease have as a rule resided for a longer or a shorter period in the endemic area. This seems to be very probable, and in this way too, we can explain those cases that occur for the first time after leaving an infected part.

That Malaria plays some part in preparing the system for the reception and growth of the essential morbific agent need not be very strenuously denied. It may act chiefly by producing anaemia and general relax-

-ation of the physical tone. Even in those who have the good fortune never to suffer from Malaria during a prolonged residence in West Africa, a certain degree of bodily (and sometimes mental) deterioration is produced, and this is more marked in proportion to the number of malarial attacks. Nothing strikes a new-comer to the Coast so much as the pale jaundiced faces of the Europeans who come on board ship at the various ports. Some persons suffer much more than others, and among my own acquaintances and friends who have suffered from this fever, those had the attack most severely who were most anæmic.

In these and in other matters connected with the disease we have, up to the present however been groping in the dark, and we await with expectation the discovery of the real agent active in its causation and propagation. As the discovery of the parasite, and of a special variety of Mosquito as its host, settled many of the problems regarding Malaria, so we hope a similar discovery may shed a clear light on the still disputed question of the pathology of Blackwater Fever.

It has been asserted by Koch that a thorough Quinine prophylaxis will

probably be found to be the best way of avoiding this fever(13) This at first glance seems a contradiction of his previous statement that Quinine is the essential cause of the disease. It is not really so, for, says Koch, Quinine attacks only the Red Blood Corpuscles damaged by the malarial parasites, whereas if the drug is used prophylactically the development of the parasites is prevented and the Red Corpuscles are preserved intact. Upon these sound corpuscles Quinine has no effect.

It may be found that this drug systematically used, may, from its specific action on the parasite of Malaria, and from its tonic effect on the system, have some power in warding off attacks of this fever, but time for observation is required before any dogmatic assertion can be made. So far the results in Duke Town are not very encouraging. "During the last two years (1902 and 1903)" writes a friend on the staff of the hospital "a great change has come over the health of the Europeans in Old Calabar. This change is coincident with the adoption of the practice of taking Quinine prophylactically. Some take 5 grains daily others take from 15 to 20 grs weekly. It is rarely now that one sees a good old fashioned fever, the usual one is a very mild

affair. As for the hyperpyrexial form (described by Thompstone and Bennet in the Brit. Med. Jour. Jan 26. 1901.) it is almost unknown, only two cases having been recorded in old Calabar during the last two years, both however proving fatal in a few hours."
While this gratifying change has taken place so far as ordinary malarial fever is concerned, no such result has been brought about in the case of the Haemoglobinuric form. The number of admissions to hospital for the same two years showing no improvement over previous years. It will be very interesting to watch the progress of events and should it be found that Quinine has also robbed this most dreaded fever of its terrors, a long step will have been taken towards the safe opening up of West Africa for European commercial enterprise, and for the possibility of bringing to the african native the advantages-and unfortunately many of the disadvantages- of European civilization.

Addenda.

Prognosis in Blackwater Fever.

Dr. Kearsey, Principal Medical Officer, British Central Africa writing on Blackwater Fever in the British Medical Journal Jan. 26. 1901, says that if plenty of urine is secreted the outlook is good as a rule, whereas when there is a diminution of urine the prognosis is bad. This, broadly speaking agrees with our experience in West Tropical Africa, though, as we have already shown, there is a class of case in which the urine may be greatly increased in amount, and a fatal issue result.

Treatment of Blackwater Fever.

The same writer publishes an interesting letter in the British Medical Journal for 5th March 1904 giving his experience of the medicinal treatment of this disease. He points out that having given Quinine a careful trial he failed to recognise any therapeutic benefit resulting from its use, and was led to adopt a modification of Sternberg's treatment for Yellow Fever. He gives Liq. Hydrarg. Perchlor m. xxx along with Sodii Bicarb gr. x

every two hours for the first twenty four hours, and then every three hours till the urine is clear again. He holds that the action is that of an antacid, diuretic and intestinal disinfectant. No ill effects have been observed to follow its use, and eighteen consecutive cases have been treated without a death. In view of such a satisfactory result he considers this method worthy of an extended trial.

References.

(1) Medical Annual 1903. p145 (2) Kleine B.M.J. 14 Sep. 1901
(3) Dowber B.M.J. 1902 Vol I p.1334. (4) Dr Crosse's Paper on "Blackwater Fever" reprinted from the Transactions of the Epidemiological Society. (5) Tropical Med. Journal 15 April 1901.
(6) Crosse Op Cit. p. 24 (7) Brit. Med. Journal 14 Sep 1901.
(8) Discussion on Blackwater Fever at Annual Meeting of B.M.A.ⁿ and reported in B.M. Journal 9th Sep 1899.
(9) Dr Sambons paper in B.M.J. 24 Sep 1898 (10) Report of the Malarial Expedition to Sierra Leone pp. 19 + 23
(11) ditto p. 54. (12) Dr Sambons paper B.M.J. 24 Sep 1898.
(13) Kleine Brit. Med. Jour. 14 Sep. 1901.