190

1911

EAST AFR. PROT.

7140

C O
7140
Rec'd
4 MAR.

.A.G. 55
ackson

Date.

rd February

Last previous Paper.

Gov
30656/10

BACTERIOLOGIST'S REPORT
HALF YEAR ENDED 31ST DECEMBER 1910.

PRINTED FOR PARLIAMENT
(Cd. 6024) FEBRUARY 1912.

Trs with covering letter by the P.J.C.O.

Send duplicate desp: some to the S-S- Bureau L.T. - meteorological Chart + Statistics bkp in mg. to be printed & specially Print the first part of the 2nd Sec: (as marked - sketches to be reproduced) - + send to Mr Keith to bring before the Trop. Dis. Research Fund Ctee at their next meeting at once.

A J.R
6/III

S.R

Mr Keith

See ante 17/4

17/4

Extract from Sub to Meteorological Dept 9 Mar 1911

Ext subsequent Paper
29
83336

7140

191

GOVERNMENT HOUSE,
NAIROBI,
BRITISH EAST AFRICA.

EAST AFRICA PROTECTORATE.

No. 55 of 1911.

February 3rd 1911.

PRINTED FOR PARLIAMENT
OF 4 FEBRUARY 1912.

C O
7140

Sir,

With reference to Sir Percy Girouard's despatch No. 530 of the 1st September 1910 I have the honour to submit herewith the Bacteriologist's report for the half year ending the 31st December 1910 together with a covering letter from the Principal Medical Officer.

I have the honour to be,

Sir,

Your humble, obedient servant,

ACTING GOVERNOR.

THE RIGHT HONOURABLE

LEWIS HARCOURT, P.C., M.P.,

SECRETARY OF STATE FOR THE COLONIES,

DOWNING STREET,

LONDON, S.W.

7413-20

P.M.O's Office.

Nairobi.

1911.

No. 29 /6/1

No. 31/11.

Sir,

I have the honour to transmit the Annual Report by the Bacteriologist for the half year ending December 31st 1911. It is intended as soon as the Review of the work now nearing completion of the Nairobi Laboratory since its foundation is published, to have subsequent reports printed for distribution.

The Report shows that there has been an increase in the routine work over the corresponding period of last year due chiefly to microscopic examinations and water analyses. Of the former, Malaria shows no increase of cases despite an increase of material. A series of examinations for Filariasis has been conducted on prisoners drawn from all parts of the country, with the result that it is probable that the greater portion of the country will be found free from it. One microfilaria was found in a Swahili. The routine examination of cattle and stock slaughtered at the abattoir has been continued, with the result that 60 % of the cattle and sheep are infected with Sarcosporidiosis, the Sarcocyst being generally speaking invisible to the naked eye. A giant form was found in a Grant's Gazelle. Fortunately it is not a condition that has to be considered in its relationship to the consumption of meat.

Of the water analyses, the summarised results of of the whole year are included for sake of convenience

Secretary,

to the Administration,

Nairobi.

The most important work undertaken has been the proposed water supply for Gonbaba; it would really seem as if there was a possibility of a potable and adequate supply being obtained.

The preparation of glycerinated calf lymph has gone on uninterruptedly, 3,916 tubes having been issued. A successful experiment was made with dessicated vaccine prepared according to the method of Marie Phisalix and Achalme, viable vaccine being introduced across the desert between Mt. Kenia and the Abyssinian frontier, an exceedingly hot and waterless journey of some 14 days.

I have the honour to be,

Sir,

Your obedient servant,

Principal Medical Officer.

Nairobi Laboratory

July - December 1912

The routine work of the laboratory has nearly doubled in amount during the last half year. Excluding an increase due to the examinations of slides for Filariasis the increase in the routine work is nearly 100%. There has been nearly double the number of water analyses due chiefly to an attempt to get monthly returns relating to the proposed supply for Mombasa. The samples brought by H.E. the Governor from the Shimba hills and the samples from the same source forwarded since were so good that it appears as if the question of water for a supply for Mombasa were settled. It would have been more satisfactory if samples had been sent monthly since His Excellency first discovered the source, as it is only by such examinations at regular intervals that the dependence or otherwise of the supply on the local rainfall and consequently its uniform character or variations in purity can be determined. There have unfortunately been gaps of months when no samples have been received for analysis and the most that can be said is that there was no appreciable difference between the samples taken in July and those taken by Mr. Small in September.

Malaria.

Compared with the corresponding portion of last year there has been no increase in the number of cases of Malaria diagnosed at the laboratory, and this in spite of the increase

in the number of blood slides examined. It may therefore be said that there has been an actual decrease in the cases of malaria met. This is probably due to the fact that the small rains have been little more than half their normal amount and that the fall was very evenly distributed and quickly absorbed by ground which had had much less than the usual amount of rain during the preceeding big rains. The result of the failure of the big rains and then the comparative failure of the small rains would be that holes and puddles which formed breeding grounds in normal years have never got filled during the whole of the year 1910.

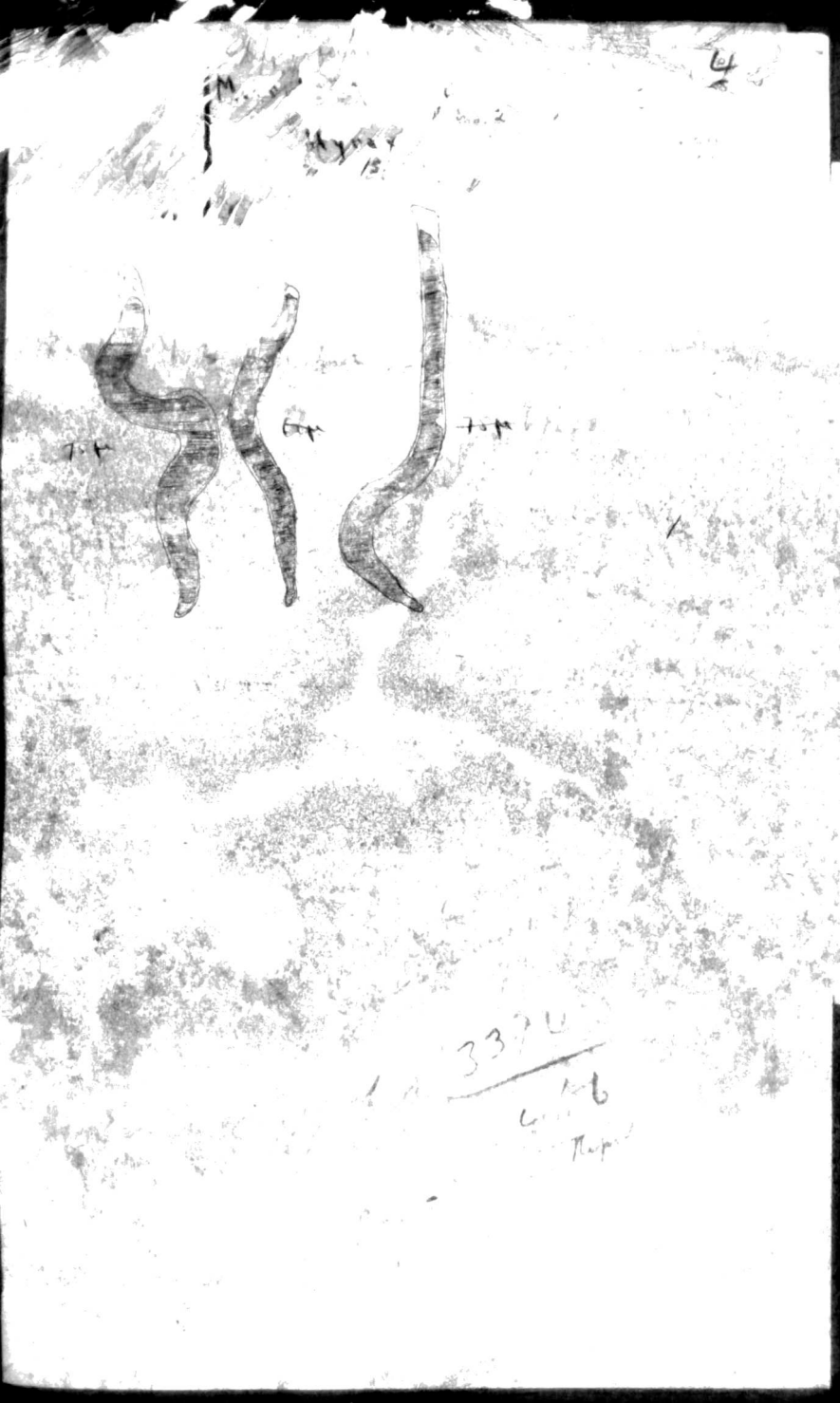
Among the material sent to the laboratory have been 104 blood smears from candidates for government employment, the smears being sent for examination for presence or absence of signs of malaria. In 5 of these cases malarial parasites have been found (3 subtertian infections and 2 quartan infections) and in two instances pigmented large mononuclear leucocytes have been found. The great majority of these 104 subjects have been Indians. It is unlikely that the Indians concerned went up for a medical examination when they were feeling sick so that it is probable that the number found infected is not a fair index of the proportion indeed among the general population but that it is considerably below the true figure.

Filariasis.

In my last report I described the finding among 200 prisoners of 2.5% infected with F. nocturna and 3.5% with F. perstans. During the past six months a larger series has been done and it is possible to distribute the cases to their various tribes.

The blood smears were taken by Mr. Loveley in the gaol between the hours of 8 and 11 p.m. Of the 403 smears taken 6 (1.5%) showed microfilariae. Only one of these showed F. nocturna, the other seven all showing F. perstans. Of these seven cases of F. perstans two were Kikuyu, one a Masai, one a Swahili, one a half-breed from the Masai, one an Uganda and one a Somali. The case of F. nocturna was a Yao.

Considering the number of blood slides from the local native hospital examined during the past years it is extraordinary that microfilariae have been found in so few cases if many of the local natives are infected. Although patients attending this hospital come from every tribe in the Protectorate a majority of the cases must come from the Kikuyu country. Dr. Pritchard tells me that he has found a case of Filariasis in a white woman who could only have been infected at Fort Hall so that it is possible that there may be a focus of infection in that district. It is known that the Kavirondo country (round the lake shore) is highly infected but it appears probable that the infection is absent in the country round Nairobi.


7.4
6.4
7.4

Microfilaria of Hyrax.

In a previous report I described the finding of microfilariae in the blood of a hyrax. During the last six months this parasite has again been found and drawings are now given. The embryo has no sheath and a blunt pointed posterior end. There is no complete break in the striation but in some a V shaped clear spot is present about the middle of the parasite. In length the specimens measured were 80μ to 70μ in length.

Microfilaria of Hyrax.

In a previous report I described the finding of microfilariae in the blood of a hyrax. During the last six months this parasite has again been found and drawings are now given. The embryo has no sheath and a blunt pointed posterior end. There is no complete break in the staining but in some a V shaped clear spot is present about the middle of the ~~xxxxxx~~ parasite. In length the specimens measured were 60μ to 70μ in length.

Some trypanosomes of East Africa.

Three separate trypanosomes have been studied during the past six months as regards their morphology and also ,so far as the supply of animals allowed,as regards their animal reactions. Besides these three,two others have been noticed but it has not been possible to carry out any experiments with them. The original strains experimented with have been derived(1)from a dog naturally infected on Mombasa island(2)from a horse bought in Nairobi byDr. Lowsley and (3) from a monkey used to feed Gl. pallidipes on their arrival at the laboratory. These three are certainly distinct strains as shown both by their morphology and their animal reactions.

Trypanosome of the dog, Mombasa.

A dog belonging to the Provincial Commissioner Mombasa,was found to be suffering from trypanosomiasis by Dr. Small,who most kindly inoculated two rabbits from it and forwarded them to me. The originally infected dog was almost certainly infected by the bite of Gl. pallidipes which abounds on the island. Gl. fusca is found on the mainland close by but in Dr. Small's opinion the infection was contracted on the island itself.

Morphology.

The most remarkable thing about this trypanosome was its polymorphism. The longest forms seen did not exceed 22μ in length,but by everygradation between this long and rather slender form and almost circular forms little larger than a red corpuscle could be seen.

Although intermediate forms could be found,

the majority of the trypanosomes seen could be divided into three groups.-(1)Long slender forms which showed 6μ of free flagellum. In these the posterior end was sharply pointed and the centrosome some little distance from the point.(2)Medium sized forms. These were most varied in size and shape. Most of them were very broad and some were clearly in process of division,there being two nuclei and two centrosomes.Either no free flagellum or only a short portion 1-2μ long could be seen. It was often doubtful whether there was actually a short portion of free flagellum or if the protoplasm of the parasite merely tapered off leaving none of the flagellum free.The posterior end of the parasite was always much more rounded than in the case of the long forms ,the point,when present,being much more blunt. The centrosome was never quite terminal,though often nearer to the extremity than was the centrosome in the long forms.(3)Round and tadpole forms.Less numerous than either of the other forms but still frequently seen were forms which were either typically tadpole shaped or oval or circular.The latter were about the size of a red corpuscle,showed both nucleus and centrosome clearly,usually on opposite sides of the parasite.From the centrosome the flagellum could be traced to the edge of the parasite round which it then curved for some distance finally becoming free of the parasite and projecting for about 6μ beyond the edge.

Locomotion. Locomotion was little marked. The parasites,though active,moved little about the field. It was rare for a parasite centred in the field to move out of sight even when watched for several minutes.

Animal reactions

This trypanosome has been inoculated into rabbit dog monkey(Sykes' cercopitheous) sheep rat and goat. To all except the last it has proved fatal and even the goat has not survived long enough for one to be able to say that it will not succumb.

The dates when trypanosomes were first found and the duration of the disease are as follows.-

		Inoculated from	Tryps. found	Death
Rabbit	No. 236	original dog	7th day	38th day
" "	No. 237	" " " "	7th day	62nd day
Dog	No. 236	Rabbit No.236	Not found	7th day
Dog	No.236	" " No.237	7th day	23rd day
Dog	No.236	Rat No. 253	26th day	32nd day
Dog	No.236	Dog No.236	8th day	21st day
Monkey	No. 240	Rabbit No.236	8th day	31st day
Monkey	No.264	Monkey No.240	12th day	28th day
Monkey	No.266	Dog No. 236	7th day	16th day
Monkey	No.266	Monkey No.266	7th day	7th day
Monkey	No.271	Monkey No.264	8th day	38th day
Monkey	No.276	Monkey No.271	10th day	47th day
Rat	No. 256	Dog No.240	10th day	47th day
Sheep	No. 267	Monkey No.264	12th day	66th day
Goat	No. 267	Monkey No. 271	13th day	alive 47th day

Trypanosome of horse.

The horse from which this strain of trypanosomes was obtained had been infected while out with a shooting party which started from Nairobi; that is to say, the infection could not have been contracted on the coast belt where the dog became infected. It is impossible to say what fly conveyed the disease. Morphology. Like the trypanosome of the Mombasa dog, this trypanosome showed marked polymorphism. The longest forms were 30-32 μ in length and were often very broad. The smallest forms were 8μ-9μ long, and were slender. Every size intermediate between the long and short forms could be seen and some medium sized forms were extraordinarily broad. But no oval or circular forms as seen and described in the dog trypanosome were ever found. In the longer and also in some of the smaller forms a short portion (3μ) of free flagellum could often be seen but no specimens were seen showing as much free flagellum as did some of the trypanosomes from the dog. Nor did there appear to be any rule as to which specimens showed free flagellum and which not. Some of the larger forms showed no free flagellum and some of the smaller showed a small free portion.

The posterior end of the trypanosome was usually rounded. The centrosome was never quite terminal. In the large majority of the parasites the centrosome was close to one edge of the parasite a short distance from the posterior end. Most of the parasites showed chromatic granules often as large as or larger

by inoculation blood [illegible] no. [illegible] in trypanosomes failed, the [illegible] living 101 days and showing no signs of trypanosomiasis. Animals successfully inoculated were monkey sheep and goat. The number of days after inoculation when trypanosomes were found and the duration of the disease were as follows.-

	Inoculated from	Tryps found	Death
Monkey No.266	Original horse	26th	63rd
Monkey No.273	Monkey No.266	6th	25th
Monkey No.276	Monkey No.273	16th	16th
Monkey No.284	Monkey No.276	6th	23rd
Sheep No. 257	Original horse	26th	76th
Goat No.263	Original horse	22nd	31st
Goat No. 285.	Monkey No.273	12th	Alive 36th day

Whereas in animals infected with the dog trypanosome, parasites could usually be found and were plentiful, the horse trypanosome was always rather scanty. This scarcity probably accounts for the apparent prolonged incubation period in some of the animals.-

The following

Trypanosome conveyed by Cl. pallidipes.

A monkey on which Cl. pallidipes were fed on arrival at the laboratory showed such wasting and irregular temperature that a trypanosomiasis was suspected. But search for parasites in the blood always gave results even with the aid of the centrifuge, until the day of the animals death when numerous trypanosomes were found.

Morphology. Unlike the two trypanosomes al-

ready described which showed variations in length between 9μ and 27μ these trypanosomes were very uniform in length being about 14μ long. both broad and narrow forms were present The undulating membrane was barely frayed but all showed a certain amount of free flagellum. In some it was only a portion 1μ-2μ long but in others free flagellum 6μ long could be seen. The nucleus was never terminal. The posterior end of the trypanosome was either rounded or pointed. The protoplasm showed no chromatic granules.

Locomotion. Locomotion was no more marked than in the other two described.

Animal reactions.

Monkey (Syncus' cercopithecus)dog goat and sheep were inoculated with this trypanosome. The goat and sheep never showed infection, and sub-inoculation from the sheep to the monkey failed to produce an infection

The following was the results of inoculation.-

	Inoculated from	Trys. seen	Death
Monkey No.[illegible]	(original) monkey	11th	still alive
Monkey No.250	Monkey No.[illegible]	4th	still alive (months)
Dog No. 255	Monkey No.250	8th	8th
Sheep No.254	No infection		
Goat No.255	No infection		
Monkey No.253	Sheep No.254	No infection.	

Trypanosomes were always exceedingly scanty in the blood of the monkeys. The dog showed a high infection on the day of its death.

The failure of infection in the case of the sheep and the goat

the sheep and goat is particularly interesting. In previous reports I have referred to the seasonal prevalence of the Cl.pallidipes at Kibwezi and to the fact that the Wakamba there move their cattle to the hills in August when this fly is due to reappear, giving as their reason that the fly would kill their cattle. Cl. fusca is present in numbers at Kibwezi all the year round but the natives pay no attention to it. Nor do they pay any attention to the effects of the Cl.pallidipes on their sheep and goats. If the trypanosome used in the above experiments is the only one conveyed by the Kibwezi Cl. pallidipes it is clear that the natives there have learned their wisdom by many years' experience and it is very unlikely that that fly belt has ever been infected with a trypanosome fatal to sheep and goats. It will be of interest to inoculate cattle with this trypanosome and so get experimental proof of the natives' statements.

Post mortem.

In all three trypanosomiases the post mortem changes were very various and no distinction could be drawn after death between the animals which had died of the different strains of trypanosome. The spleen was sometimes enlarged, sometimes not; petechiae on the lungs were invariably present; ulceration of the stomach was frequently but not invariably seen; oedema was never noticed; swelling of the glands was invariable but trypanosomes could seldom be found in the gland juice.

Trypanosome transmission experiments.

Attempts at transmitting various trypanosomes by Gl. fusca have been continued. There was unfortunately some difficulty in getting an animal infected with T. gambiense, the result being that the experiment with this parasite could not be begun till December and still continues. Negative experiments were carried out with Gl. fusca and a trypanosome from a dog at Mombasa and Gl. fusca and a trypanosome conveyed by the Gl. pallidipes at Kibwezi.

Experiment 6.

Can one infect Gl. fusca with the Mombasa dog trypanosome?

Monkey No. 247 was used to feed flies on their arrival at the laboratory until sufficient had been collected for the experiment.

This monkey was bitten 124 times between Aug. 11th and Aug. 22nd. It died on Sept. 24th having shown no signs of trypanosomiasis nor could any signs be found post mortem.

Monkey No. 261 was used to feed the flies surviving from Monkey No. 247.

This monkey was bitten 208 times between Aug. 28th and Sept. 15th (21 days). The animal is still alive and shows no sign of trypanosomiasis.

Monkey No. 264 was ~~xxxxx~~ infected with the dog trypanosome. It was bitten by flies surviving from Monkey No. 261 28 times between Sept. 16th and Sept. 22.

Flies that survived when feeding ceased on the infected monkey were starved for four days to exclude direct transmission and then fed on

Experimental monkey No. 262. This monkey was bitten 176 times between Sept. 26th and Oct. 26th. The animal is still alive and shows no signs of trypanosomiasis.

Conclusion.- In this experiment the animal on which the flies were fed for 21 days is still alive and shows no infection, so that it is possible to exclude natural infection of the flies with a trypanosome transmittable to the monkey.

The trypanosome used ~~to infect the~~ in the experiment was rapidly fatal to monkeys and always present in numbers in the peripheral blood. It is therefore certain that the Gl. fusca used in this experiment did not acquire an infection.

Experiment 7.

Can one infect Gl. fusca with the trypanosome conveyed in nature by the Gl. pallidipes?

Monkey No. 247 was used to feed flies until sufficient were collected for the experiment. It was bitten 367 times between the 1st 24th and Sept. 22nd. It died on Sept. 24th but showed no signs of trypanosomiasis during life nor post mortem.

Monkey No. 261 was bitten 266 times during the 21 days Sept. 28th to Oct. 18th. This animal is still alive and shows no signs of trypanosomiasis.

Monkey No. 151, infected with the Gl. pallidipes trypanosome was bitten by flies surviving

from [illegible] the [illegible]

[illegible] the centre surviving fli[illegible]

[illegible] for [illegible] days and then allowed to bite [illegible] this monkey was of [illegible] bitten 12 times between Oct. 25th and Nov. 23rd. The animal is still alive and shows no signs of trypanosomiasis.

Conclusion.- is in Exp. 6 the fact that the monkey on which the flies were fed for 21 days remains healthy excludes the possibility of the Glossina used in the experiment being naturally infected with a trypanosome transmissable to the monkey.

The trypanosome used in the experiment is fairly easily found in an infected monkey so that it appears that the flies used in the experiment were not able to become infected with this trypanosome.

Experiment 6.

This experiment with G. fusca and T. gambiense is still proceeding.

Sarcosporidiosis of cattle and sheep.

In my last report I drew attention to the the large proportion of cattle killed at the Nairobi Slaughter House found to be affected with Sarcosporidiosis. Examination of material from all oxen slaughtered has been continued during the past six months with the result that 166 out of 244 oxen slaughtered have been found to be infected. It is probable that this percentage of infection (60%) is too low. Many of the smears received, although taken by cutting off the apex of the heart and smearing on a slide, have shown only blood, no elements from the heart wall being visible.

In during the previous six months, all the smears have been forwarded by Mr. Patrick, Sanitary inspector, who has never found in any of the infected hearts signs of infection visible to the naked eye.

I myself took and examined material from a series of sheep killed at the slaughter house and in 37 out of 40 found spores of a Sarcosporidium. As in the case of the ox, there was nothing that could be made out even with a hand lens. Smears of the heart's apex however showed spores indistinguishable from those found in the ox. In examination of a heart found to be infected by aid of the microscope always failed to show anything.

Examination of sections made from infected hearts showed ~~[illegible]~~ thin walled cysts similar to those already described in the ox.

Sarcosporidiosis of Gazella granti.

A hind quarter from a Grant's gazelle was

sent to the laboratory and was found to be [illegible] fully of large cysts from ¼ inch to ¼ inches long. On examination the cysts were found to be densely packed with spores of a sarcocyst. The cysts were white in colour and oval or spindle shaped. Sections were cut and it was found that there was a marked cyst wall apparently consisting of muscle fibres. The centre of the cyst showed no definite structure but all round the periphery the spores were very distinct and stained well.

Examinations were made of a series of hearts of cases on whom post mortem examinations were carried out at the native hospital. So far no case of human sarcosporidiosis has been found.

(Omit to end)

Vaccine.

In my report for the first six months of this year I described a successful field experiment with lymph dried and sealed in a partial vacuum. During the past six months vaccination has been successfully started with lymph thus prepared at Marsabit, a station where every attempt - and many were made - to start vaccination with glycerinated lymph had hitherto proved a failure. Mr. Cody, Assistant surgeon at Marsabit, writes "the percentage of success with the lymph you sent among the people inspected a week or ten days after vaccination was 76. Out of one batch of twelve children I vaccinated with the contents of a tube that had been opened 13 days earlier and then sealed 9 were successful" Such results appear highly satisfactory especially considering the amount of glycerinated lymph vainly wasted previously in efforts to start vaccination at Marsabit. The method of Marie Phisalix and Lehalme should prove of the greatest value in hot countries where transport on ice is impossible, but the preparation is not so easy and convenient as is the preparition of glycerinated lymph.

The amount of glycerinated vaccine issued during the six months has been 3518 tubes as against 24000 for the previous six months. It would appear that the large use made of the vaccine during the former period had been effectual in stopping the threatened epidemic of small pox.

Water analyses.

For the sake of convenience of reference I have included in this report the summarised results of all complete water analyses for the past year. The most important work has been the analysis of samples of the proposed sources of supply for Mombasa, to which I have already referred.

A most interesting analysis was that of a spring at Lake Magadi (analysis 147). Mr. Graham most kindly brought samples of the water and also specimens of the fish which live in the spring. As the water was very alkaline and the large amount of solids consisted largely of Sodium carbonate, it is extraordinary that fish are able to live in this spring.

parts per 10

	No. 104	106	No. 106	No. 107	No. 108
	and			were then	
nia - free	0.003125	0.006	0.0010	0.0020	0.005
albuminoid	0.01625	0.0225	0.006675	0.010	0.0075
rdness - total	20.0	4.0	4.5		
permanent	11.5	3.2	3.5	3.5	3.5
temporary	8.5	0.8	1.0		
lorine	1.8	0.8	4.0	4.0	4.0
trogen as nitrates and nitrites	0.02	0.02	0.02	0.04	0.08
trogen as nitrites	marked trace	nil	nil	marked trace	marked trace
ygen consumed in 5 s. at room temperature.	0.105	0.05	0.05	0.060	0.060
lids - total	14.0	20.0	25.0	30.0	26.0
volatile	4.0	9.2	10.0	10.0	8.0
non volatile	10.0	11.0	15.0	20.0	18.0
ignition	nil	slight blackening	slight blackening	slight blackening	slight blackening

.104 Fort Hall. Mogari Italian mission. 10-1-10

. 106 Fort Hall. Kahuma mission. 3-2-10

. 108 Nairobi nes supply. 3-2-10

. 107 Nairobi. Indian Mills sodawater. 3-2-10

. 108 Nairobi. Nazareth's soda water. 3-2-10

	No. 109	No. 110	No. 111	No. 112	No. 113
Iron	0.01	[illegible]	[illegible]	[illegible]	[illegible]
Manganese	0.05	0.017	[illegible]	[illegible]	[illegible]
Hardness - total	5.0	4.0	[illegible]	[illegible]	[illegible]
permanent	4.0	[illegible]	[illegible]	[illegible]	[illegible]
Grains to	1.0	[illegible]	[illegible]	[illegible]	[illegible]
Color	0.0	[illegible]	[illegible]	[illegible]	[illegible]
Nitrogen as nitrates	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nitrogen as nitrites	0.007	0.0	4.10	[illegible]	[illegible]
Nitrogen as nitrites.	Distinct trace	Nil	[illegible] trace	[illegible] trace	Nil
Ammonia	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chlorine	[illegible]	1.10	[illegible]	[illegible]	[illegible]
Solids - total	40.0	8.	108.	110.	14.0
Volatile	10.	4.0	10.	[illegible]	2.0
Non volatile	20.0	4.0	17.	10.0	12.0
Condition	[illegible]	[illegible]	[illegible]	[illegible]	Nil

No. 109 Nairobi River.

No. 110 Mombasa. Ice factory rain tank. 17-2-10

No. 111 Mombasa. Soda water from [illegible] 23-2-10

No. 112 Mombasa. Soda water from [illegible] 23-2-10

No. 113 Nairobi. U. K. Soda water. 16-4-10

	No. 114	No. 115	No. 116	No. 117	No. 118
monia - free	0.0025	0.01	0.0145	0.00075	0.0125
albuminoid	0.0275	0.02	[illegible]	0.0225	0.025
dness - total				4.0	
permanent	8.5	2.0	6.0	[illegible]	10.7
temporary				10.0	
chlorine	2.0	1.0	4.0	4.0	7.5
tro gen as nitrates and nitrites	0.0	0.04	[illegible]	[illegible]	1.0
tro gen as nitrite	nil	distinct trace	nil	nil	nil
ygen consumed	10.3				
... at 80 to 27°	0.050	0.152	[illegible]	[illegible]	0.150
ature					
olids - total	50.0	[illegible]	10.0	50.0	45.0
volatile	[illegible]	5.0	2.0	10.0	17.0
non volatile	19.0	[illegible]	8.4	20.0	28.0
ntention					much
		Very slight	nil	bad smell	blackening & odour.

o. 114 [illegible] Cotton Filter. 24-4-10.

o. 115 [illegible] Railway Manufactory. 2-4-10

o. 116 Bairoi. Intake All's zone water. 2-6-10

o. 117 [illegible] 2-6-10

o. 118 [illegible] water. 2-6-10

parts per 100,000

	No. 119	No. 120	No. 121	No. 122	No. 123
Ammonia - free	0.0026	0.0318	0.0376	[illegible]	0.0413
Ammonia - albuminoid	[illegible]	0.0775	0.04	[illegible]	0.022
Chlorine - total	[illegible]	[illegible]	4.0	4.0	12.0
Chlorine - permanent	3.0	4.0	2.0	3.0	12.0
Chlorine - temporary	[illegible]	[illegible]	2.0	1.0	0.0
Chlorine	4.0	3.0	2.0	2.0	12.
Nitrogen as nitrates					
and nitrites	0.06	.04	[illegible]	[illegible]	0.0
Nitrogen as nitrites	nil	[illegible]	[illegible]	[illegible]	[illegible]
Oxygen consumed in 3 hours		[illegible]	[illegible]	[illegible]	
No. 1 at room temperature	0.062	0.12.0	[illegible]	0.0476	0.0
Solids - total	20.0	30.0	30.0	30.0	
volatile	10.0	10.0	[illegible]	10.0	
non volatile	10.0	20.0	20.	20.0	
Reaction	Nil	Charcoal	Charcoal		

No. 119 Kairo 1. Nathpath's well water. 16-6-10

No. 120 Kairo 1. Kalinaa Tissa's well water. 12-7-10.

No. 121 Tyari. Irrigation trench. Filtered water. 26-7-10

No. 122 Tyari. Irrigation trench. Unfiltered water. 26-7-10

No. 123 Lagu. Chamba well water. 1-8-10

		parts per 1[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]nia - free	0.08	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]rine - total		[illegible]	[illegible]	1.0	2.8
permanent	8.0	8.0			
temporary	1.6				
[illegible]lorine	60.0	40.0	1.0	[illegible]	[illegible]
[illegible]trogen as nitrates					
[illegible] and nitrites	12.0	18.8	Barest trace	trace	0.04
[illegible]rogen as nitrites	nil	[illegible]	[illegible]	nil	[illegible]
[illegible]yen consumed in 3 [illegible]s. at room temperature.	[illegible]	0.227	0.09	.10	0.125
[illegible]lids - total	200.0	142.0	8.0		
volatile	[illegible]	30.0	7.0		
non volatile	165.7	110.0	1.0		
[illegible]nition	nil	nil	black ash		

[illegible]. 124 [illegible] . well water from Masjid Mecca. 1-8-10

[illegible]. 125 [illegible]. Lake. Asan Ali's soda water. 1-8-19.

[illegible]. 12627 [illegible] . Chins hills. Vreri river at source. 30.7.10

[illegible]. 12628 [illegible]. Chins hills. [illegible] river. 31-7-10.

[illegible]. 12[illegible] [illegible]. Chins hills. [illegible] forest station. 31-7-10

	No. 1				
		parts per 1			
	No. 131	No. 132	No. 133	[illegible]	[illegible]
Ammonia - free	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
albuminoid	[illegible]	0.00[illegible]	0.0[illegible]	0.01[illegible]	[illegible]
Hardness - total	[illegible]	nil	nil	nil	[illegible]
permanent	5.6				0.3
temporary					[illegible]
Chlorine	4.6	1.07/7	1.7	1.7	[illegible]
Nitrogen as nitrates and nitrites	0.04	Rarest trace	Rarest trace	Rarest trace	Rarest trace
Nitrogen as nitrites	nil	nil	nil	nil	nil
Oxygen consumed in 4 hrs. at room temperature	0.03	0.0[illegible]	[illegible]0327	0.0[illegible]27	0.04[illegible]
Solids - total	13.0	6.[illegible]	6.[illegible]	7.[illegible]	6.[illegible]
volatile	3.[illegible]	5.[illegible]	[illegible]	3.[illegible]	4.[illegible]
non volatile	7.	1.[illegible]	3.[illegible]	4.	2.[illegible]
On ignition	nil	blackening	[illegible]	[illegible]	Very slight blackening

No. 131 Nairobi. Lotin[illegible] Hill's so[illegible] water. 1[illegible]-10

No. 132 Mombasa. Shimba Hills. Mreri river. 13-8-10

No. 133 Mombasa. Shimba hills. Mreri river. 13-8-10

No. 134 Mombasa . Shimba hills. Mreri river. 13-8-10

No. 135 Mombasa . Shimba hills. Mreri river. 10-8-10

parts per 1[illegible]

	No. 136	No. 137	No. 138	No. 14[illegible]
[illegible] - free	0.005136	0.00[illegible]	0.00[illegible]	0.00[illegible]
albuminoid	0.0140	0.00675	0.00[illegible]10	0.010
[illegible]rdness - total	4.0	0.0	0.0	10.0
[illegible] permanent	2.0	0.0	0.0	2.0
[illegible] temporary	2.0	0.0	0.0	4.0
[illegible]lorine	4.6	2.4	4.0	1.2
[illegible]roxide as nitrates	[illegible]			
[illegible] and nitrites	Marked trace	Marked trace	Marked trace	nil
[illegible]tra[illegible] nitrites	nil	nil	nil	faint trace
[illegible]ygen consumed in 3 hrs. at 80° temperature	0.10[illegible]	0.0[illegible]	0.047	0.0148
[illegible]lids - total	10.[illegible]	6.[illegible]	6.0	20.0
volatile	4.0	1.0	4.0	8.0
non volatile	6.0	4.0	4.0	12.0
[illegible] ignition	blackening	slight blackening	slight blackening	slight blackening

*Magnesia present.

[illegible]. 136. Hoshbass, Chimba hills, Nabanga stream, 10-[illegible]-10.

[illegible]. 137 Hoshbass. Chimba Hills, [illegible] stream. 10-[illegible]-10

[illegible]. 138 Hoshbass. Chimba hills. [illegible] stream. 21-[illegible]-10

[illegible]. 14[illegible] [illegible] hills. 4-10-10.

parts per 100000

	No. 140	No. 141	No. 142	No. 143	No. 144
nia - free	0.002	0.018		0.00020	0.005
albuminoid	0.016	0.04		0.02120	.016
ness - total		1.5		5.5	8.0
permanent	2.5	3.7		5.5	8.5
temporary		1.8		0.0	0.5
rine	2.2	11.4		28.0	2.0
en as nitrates					
nd nitrites	0.04	trace		present trace	0.6
gen as nitrites	trace	marked trace		marked	marked
en combined in 4 . at room temperature	0.2.	0.424		0.162	0.268
s - total	8.0	5.0		125.0	60.0
volatile	2.0	2.0		10.0	18.0
on volatile	3.0	3.0		65.0	37.0
hitch	slight blackening	slight blackening		nil	slight blackening
s 0.2037			4.6	21.6	8.0
s 0.0				13.6	7.0

140 Kisumu. Grand railway soda water. 10.10.10

141 Kisumu. Grand railway ice. 10.10.10.

142 Kai hills. For magnesium 25.10.10

143 White indei. River. 25.10.10.

144 Kikwezi River. 25.10.10.

parts per 1[illegible]

	No. 146	No. 148	No. 147	No. 140	No. 146
[illegible]	[illegible]	[illegible]	[illegible]	717	[illegible]
Alkaloid	[illegible]	[illegible]	[illegible]		[illegible]
[illegible] - total	[illegible]	[illegible]	[illegible]		[illegible]
permanent	[illegible]	[illegible]	[illegible]		[illegible]
temporary	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]line	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] nitrites					
[illegible] nitrites	bare trace	trace	trace		trace
[illegible] as nitrites	nil	trace	marked		marked
[illegible] consumed in [illegible]					
[illegible] at room temper-					
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
[illegible] - total	[illegible]	[illegible]	[illegible]		[illegible]
volatile	[illegible]	[illegible]	[illegible]		[illegible]
non volatile	[illegible]	[illegible]	[illegible]		[illegible]
[illegible]ition	blackening	blackening	nil		nil
	much	much		much	much

[illegible] [illegible] in [illegible] [illegible] [illegible] river. 7.11.17

[illegible] [illegible] river 12.11.17

[illegible] [illegible] 1. [illegible] spring. 26.11.17

[illegible] [illegible] 1. Upper well. 26.11.17

[illegible] [illegible] 1. big well. 26.11.17

	Parts per [illegible]				
	10.1[illegible]	10.1[illegible]	10.1[illegible]	10.1[illegible]	10.1[illegible]
[illegible] - free	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
albuminoid	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] - total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
permanent	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
temporary	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]en as nitrates					
[illegible]nd nitrites	trace	trace	[illegible]	trace	[illegible]
[illegible]rogen as nitrites	[illegible]	trace	trace	trace	nil
[illegible]n consumed in [illegible] at room temperature	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]ds - total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
volatile	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
volatile	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]nition	charring	very slight blackening	very slight blackening	much charring	much charring

[illegible]80 Turoma river. [illegible]6.11.1[illegible]

[illegible]81 Malindi. [illegible].11.1[illegible]

[illegible]82 Malindi. [illegible].11.1[illegible]

[illegible]83 Malindi. [illegible].11.1[illegible]

[illegible]84 Vitui . River at station. [illegible].11.1[illegible]

Summary of examinations

Bloods	
Negative	602
differential leucocyte counts	268
increase of large mononuclear leucocytes and pigment	27
Malaria	
benign tertian	17
quartan	4
subtertian	28
Filaria	
nocturna	1
perstans	67
Trypanosoma gambiense	2
Urines	
chemical	12
microscopical	16
for gonococcus	
positive	4
negative	10
Widal ~~[illegible]~~ reactions	
negative	17
positive	6
Sputa for tubercle	
negative	10
positive	8
pneumococci	8
Faeces	
negative	2
amoeba histolytica	2
ova of Ascaris	1
ova of Trichocephalus trichiurus	1

Bacillus leprae	1
Rats for plague - negative	12
Pelion sheep	8
Waters	
chemical analyses	36
bacteriological	1
Chemical analyses	6
Sections	
pneumococcal infections	4
septic infarcts	1
cervicitis	2
Horse - blood-	
trypanosomiasis and	
piroplasmosis	3
Guinea fowls	
negative	12
leucocytozoon	1
leucocytozoon and	
halteridium	3
halteridium	6
Monkey	
negative	4
Plasmodium kochi	16
Piroplasma pitheci	1
Hyrax	
negative	3
microfilaria	1
Sarcosporidium	
Ox - negative	68
positive	153
sheep - negative	56
positive	37
gazella granti	1

Negative smears from game	
antelope	1.
hare	1.
courser bird	1.
ground squirrel	1.
Various	18
Total	1456

Stuart H Ross

Bacteriologist