Annual medical report / East Africa Protectorate.

COLONY AND PROTECTORATE OF KENYA.

ANNUAL MEDICAL REPORT

FOR THE

YEAR ENDING 31ST DECEMBER, 1922,

INCLUDING THE

Annual Report

OF THE

BACTERIOLOGICAL LABORATORY

FOR THE YEAR 1922.

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FOR THE YEAR 1922.

MEDICAL DEPARTMENT,

HEAD OFFICES,

NAIROBI,

17*th April*, 1923.

SIR,

I have the honour to submit, for the information of His Excellency the Acting Governor and for transmission to the Right Honourable the Secretary of State, the Medical Report on the health and sanitary condition of the Colony and Protectorate of Kenya for the year 1922, together with the returns, etc., appended thereto.

I have the honour to be,

SIR,

Your obedient servant,

JOHN L. GILKS,

Principal Medical Officer,

Colony and Protectorate of Kenya.

The Honourable,

The Acting Colonial Secretary,

Nairobi.

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I.—ADMINISTRATION.

SECTION 1.—DEPARTMENTAL.

1.—ESTABLISHMENT.

The Medical Department did not escape the wave of retrenchment which affected Government activities generally in 1922. It was decided that the medical expenditure must be reduced by approximately £50,000 and estimates had to be prepared on that basis. In order to effect the economy required it was necessary not only to reduce the staff considerably but also to close down entirely a number of existing institutions. The method adopted in framing the estimates on the new lines was to leave untouched the existing large centres in Native Reserves as far as possible, closing down the more accessible dispensaries which were in charge of Sub-Assistant Surgeons and to effect economies, wherever possible, in the direction of combining duties and reducing expenditure in connection with menial staff, medical stores, etc.

The new conditions came into being as soon as sanction was received from home in September, and the necessary steps were taken to reduce staff and close down out-stations.

The reductions in the sanctioned medical staff comprised the following :—

Senior Medical Officer	1
Dental Surgeon	1
Medical Officers	4
Medical Officers of Health	4
Nursing Sisters	6
Sanitary Inspector and Overseers	8
Assistant Surgeons	5
Sub-Assistant Surgeons	29
Compounders	10

Corresponding reductions were made in the clerical staff.

In the estimates as printed the reduction of Medical Officers appears as 5, but on consideration of the proposals the vote for Medical work in Native Reserves was increased by £1,000 in order to include an extra Medical Officer.

The reduction in the staff of Medical Officers and Medical Officers of Health entailed the withdrawal of Medical Officers from Lamu and Kismayu, the posting of District Surgeons at Eldoret and Nakuru, the re-arrangement of work and hospitals at Nairobi, to which further reference will be made in the section "Hospitals, Dispensaries and Institutions," and the reduction of relief staff and staff available for posting a necessity or emergency dictated.

The sub-stations closed down as a result of the financial position were :—

(1) Naivasha.
(2) Eldama-Ravine.
(3) Londiani.
(4) Kabarnet.
(5) Rumuruti.
(6) Embu.
(7) Kericho.
(8) Makindu.
(9) Voi.
(10) Kyambu.
(11) Nyeri.

Of the above Voi, Makindu and Naivasha are on the Railway line and sick can be transported by train to the nearest centres. Kyambu is only ten miles

from Nairobi and the road communication is all that can be desired. Two only, viz., Kabarnet and Embu, concerned essentially native areas, while Kyambu and Nyeri can be described as serving both Europeans and Natives. Voi and Makindu existed mainly for the benefit of the Uganda Railway.

Changes in policy were involved in the new conditions as, in order to bring down the estimates to the required figure, it was necessary to withdraw the subsidy to Missions, to abolish dental facilities for officials and to hand over the European Hospital, Eldoret, to the local community. As regards the former, comment has been made in the two preceding annual reports and the effect of the second can best be judged after experience.

No reduction of the bacteriological staff has been effected, as it was realised that an efficient laboratory is the basis for all scientific medical work, while from the purely financial side a reduction in staff would entail largely increased expenditure of such items as vaccine lymph and plague vaccine but it is necessary under the changed conditions that some of the official visiting in Nairobi be undertaken by the Bacteriologists.

It is to be remembered that the staff of the Medical Department has been reduced by the necessities of the situation to the lowest possible limits, that were it not for the whole hearted co-operation on the part of all sections of the personnel, it would be impossible to carry on the existing activities, that extension is impossible, and that the margin of safety has been reduced all round to the barest minimum especially with regard to the sanitation and public health requirements of the country.

The sanctioned establishment and the establishment actually entertained at the commencement of the year 1922 and the establishment authorised to be retained at the end of the year are given below :—

TABLE A.

ESTABLISHMENTS SANCTIONED JANUARY, 1922, ENTERTAINED 1922 AND AUTHORISED TO BE RETAINED IN DECEMBER, 1922.

	Sanctioned establishment on January 1st, 1922.	Establishment actually entertained on January 1st, 1922.	Establishment authorised to be retained on December 31st, 1922.
ADMINISTRATIVE DIVISION :—			
Principal Medical Officer	1	1	1
Deputy Principal Medical Officer	1	1	1
Chief Sanitation Officer	1	1	1
Medical Storekeeper	1	1	1
Assistant Medical Storekeeper	1	—	—
Office Superintendent	1	1	1
European Accountant	1	1	1
European Stenographer	—	—	1
European Clerks	2	2	2
1st Grade Clerk	—	1	1
2nd Grade Clerks	2	2	2
3rd Grade Clerks	6	6	11
4th Grade Clerks	22	20	8
Issuers of Medical Stores	2	2	2
Messengers and Packers	18	18	17
MEDICAL DIVISION :—			
Resident Surgical Officer	1	1	1
Senior Medical Officers	5	5	4
Dental Surgeon	1	1	—
Dental Mechanics	2	—	—
Medical Officers	19	18	14
District Surgeons	4	3	4
European Dispensers	4	3	2
Matron	1	1	1

TABLE A—*continued.*

ESTABLISHMENTS SANCTIONED JANUARY, 1922, ENTERTAINED 1922 AND AUTHORISED TO BE RETAINED IN DECEMBER, 1922—*continued.*

	Sanctioned establishment on January 1st, 1922.	Establishment actually entertained on January 1st, 1922.	Establishment authorised to be retained on December 31st, 1922.
MEDICAL DIVISION :—*continued.*			
Nursing Sisters	25	24	19
Male Nurses	1	—	—
Superintendent Lunatic Asylum	1	1	1
European Warders Lunatic Asylum	2	2	2
Matron Lunatic Asylum	1	1	1
Assistant Matron Lunatic Asylum	1	1	1
Assistant Surgeons	10	8	5
Sub-Assistant Surgeons	50	37	21
Compounders	18	13	8
Motor Drivers	14	11	8
Native Hospital Attendants		As necessary	
Native Asylum Attendants		As necessary	
SANITATION DIVISION :—			
Sanitation Officers	2	—	—
Senior Medical Officers of Health	3	—	—
Medical Officers of Health	8	8	4
Senior Sanitary Inspectors	3	1	2
Sanitary Inspectors, 1st Grade	6	5	6
Sanitary Inspectors, 2nd Grade	14	7	2
Sanitary Overseers	6	—	1
Superintendent, Infectious Diseases Hospital	1	1	1
Nurses	2	2	2
European Clerk	1	—	—
Mechanics and Greasers for Clayton Disinfectors	4	3	3
Native Attendants for Infectious Diseases Hospitals, Leper Lazarettos, etc.		As necessary	
LABORATORY DIVISION :—			
Senior Bacteriologist	1	1	1
Assistant Bacteriologists	2	2	2
European Laboratory Assistants	1	1	1
Asiatic Laboratory Assistants	3	3	2
Native Laboratory Attendants		As necessary	

2.—LIBRARIES.

A medical library is maintained at the Laboratory and a lesser one at the Headquarter Medical Offices, both of which are available for reference by Medical Officers. Books are issued on loan to all Medical Officers who make application. The libraries are added to by the purchase of the latest medical publications from time to time whilst a varied number of scientific periodicals are regularly supplied.

During the year a catalogue was compiled and issued to all Medical Officers.

SECTION II.—EXTRA DEPARTMENTAL.

3.—REGISTRATION OF MEDICAL PRACTITIONERS AND DENTISTS.

The Ordinance governing registration came into force on the 24th September, 1910. Since that date and up to the end of the year the following have been placed on the Register:—

Registered Medical Practitioners	124
Licensed „ „	6
Dentists	9

Seventy-four of the medical practitioners were registered for Government service and sixty-one as private practitioners.

During the year four names were placed on the Register.

The Board nominated for the purpose of the Ordinance consisted of :—

Dr. C. L. Chevalier,
„ A. R. Paterson,
„ F. L. Henderson,
„ H. H. V. Welch,
„ R. W. Burkitt,

with the Principal Medical Officer as President and Registrar.

No meetings were held during the year.

4.—THE DRUGS AND POISONS ORDINANCE, 1909.

This Ordinance controls the licensing of chemists and druggists as well as the sale of poisons throughout the country.

Twenty-six names have been placed on the Register since the introduction of the Ordinance to the end of 1922. Of these three were by examination.

The Board appointed under the Ordinance consisted of the following :—

Dr. C. L. Chevalier,
„ A. R. Paterson,
„ F. L. Henderson,
Mr. V. H. Kirkham,
„ A. A. White,
„ L. A. Howse,

with the Principal Medical Officer as Chairman and Registrar.

One meeting was held during the year.

5.—THE PUBLIC HEALTH ORDINANCE, 1913.

The Board established under this Ordinance deals with proposals for the sub-division into building sites of land in the neighbourhood of townships.

Ten meetings were held during the year.

The Annual Report of the proceedings of the Board will be found in Appendix "A."

6.—THE PUBLIC HEALTH ORDINANCE, 1921.

Under this Ordinance there is established a Board—the Central Board of Health—with the Principal Medical Officer as Chairman. The function of the Board is to advise the Governor on any matter affecting the public health.

Eight meetings were held during the year and a number of resolutions were forwarded for the consideration of Government. Several of the resolutions dealt with questions of great importance, more particularly in connection with the alienation of land and the regulation of closer settlement. The principles underlying these resolutions, which are given in full in the Annual Report of the proceedings of the Board reproduced in Appendix "B," merit the most careful consideration.

II.—PUBLIC HEALTH.

The Kenya Colony and Protectorate has an area of some 245,000 square miles and is situated between latitude 5° N. and 5° S. and bounded on the east by the Indian Ocean and Italian Somaliland, on the north by Abyssinia, on the west by the Victoria Nyanza and the Uganda Protectorate and on the south by the Tanganyika Territory. The country presents the greatest variations in climate and altitude. The coast is tropical and the climate damp and hot, though temperature readings are not excessively high and seldom rise above 90° in the shade. The northern territory is hot and dry, and is chiefly waterless desert country of a low altitude. The Victoria Nyanza is at an altitude of 3,500 feet and the country immediately surrounding it is hot and tropical, but rapidly rises and sub-tropical and almost temperate conditions then prevail. Between the coast strip and the more elevated interior is a well marked desert zone which, in the old days before the building of the Uganda Railway, must have formed a very effectual barrier between the comparative civilisation of the coast and the primitive savagery of the interior. A considerable area of the country comprising the provinces of Ukamba, Kikuyu, Naivashi and part of Kavirondo is situated at an altitude of over 4,000 feet and presents several mountains, of which the highest is Mount Kenya (17,040 feet) after which the Colony and Protectorate have recently been named. The climate of the upland areas show considerable variations, and though cool nights are the rule, the flat plains or sheltered valleys may be uncomfortably warm in the middle of the day. On the north-west border of the Colony the land slopes up to the mass of Mount Elgon (14,010 feet).

The inhabitants of the country may be divided into classes—(1) the native Africans of Bantu or Nilotic origin, (2) the tribes of Hamitic origin—Somalis, Gallas and Masai, and (3) members of trading or invading races—Europeans, Arabs and Indians. Of the foregoing it may be stated roughly that the distribution of the first class is in the large native reserves, the second in the northern areas with the exception of the Masai who have their own reserve along the Tanganyika border, and the third along the coast strip and in the various townships with a comparatively large part of the European population as farmers in the Highlands. The presence of numerous townships, of which Nairobi and Mombasa are the largest, indicates that there is an urban population, and this is of considerable magnitude and attracts natives from the various tribes who tend to become more and more detribalised and to become permanent town dwellers. A second division of the community, therefore, arises, viz., an urban and a rural population.

The non-native census taken on April 1st, 1921, revealed the following :—

Europeans	9,651
Indians	22,822
Goans	2,431
Arabs	10,102
Others	627

It is probable that owing to trade depression the totals of the present time are smaller than at that date, though no definite data are available.

Registration of births and deaths is not enforced among the non-European population and the absence of this makes the preparation of vital statistics an impossibility. It is evident that a system of births and deaths registration is a necessity, at any rate, in the larger towns, though even if such were instituted immediately reliable figures would not be obtained until the population had become used to the innovation.

The number of European births, deaths and marriages during 1922 were as follows :—

Births	261
Deaths	89
Marriages	132

Of the three large towns, Mombasa, Nairobi and Kisumu, to which Medical Officers of Health are appointed, the census figures of 1921 and estimated figures of population for 1922 are given below :—

(*a*) MOMBASA.

	1921.				1922.			
	Males.	Females.	Children.	Total.	Males.	Females.	Children.	Total.
Europeans	383	175	95	653	499	108	145	752
Arabs	2,152	1,610	1,938	5,700	2,206	1,408	1,512	5,126
Indians	2,896	1,806	2,900	7,202	3,081	1,372	2,548	7,001
Goans	489	83	124	696	552	74	101	727
Natives	7,428	6,828	3,719	17,983	11,676	10,253	5,240	27,169
	13,368	10,200	8,776	32,234	18,014	13,215	9,546	40,775

Total Population, 1921 32,234
" " 1922 40,775

It is doubtful if the figures given are even approximate. The census of 1921 was the fiast to be taken in Mombasa, and it is said that the number of natives recorded was considerably below the number actually living in the township at the time. The population given for 1922 is not a true estimated population for the reason that the means to calculate such are non-existent. It is based on Tax returns, etc. The very fact that the 1922 population shows an increase of more than 8,000 on the 1921 population is itself sufficient to throw considerable doubt on the truth of either figure.

Comparatively few buildings have been erected in Mombasa during the year 1922, and had the population increased by one quarter during the year, very considerable overcrowding would have been noticed.

Births.—The number of European births during the year in Mombasa was 17, as compared with 11 during the year 1921. The number of births among Asiatics and Natives cannot be given as such births are not registered. The Medical Officer of Health from personal observation suggests that the birth-rate among African natives of the town is low, certainly considerably lower than that of the Indian community.

The relative number of women to children is interesting :—

1921.		1922.	
Native.	Indian.	Native.	Indian.
1—0·54	1—1·9	1—0·51	1—1·1

Deaths.—680 deaths were notified as compared with 686 in 1921. The crude death-rate calculated on a population of 40,775 is, therefore, 16·7 per thousand.

(*b*) NAIROBI.

	1921.				1922.			
	Males.	Females.	Children.	Total.	Males.	Females.	Children.	Total.
Europeans	1,438	976	605	2,929	1,249	892	726	2,867
Goans	848	115	137	1,100	852	142	199	1,193
Indians	4,681	1,205	2,120	8,006	3,519	1,264	2,211	6,994
Arabs	59	14	15	88	59	14	15	88
Anglo-Indians, Seychelles, etc. ...	118	62	75	255	118	62	75	255
	7,054	2,372	2,952	12,378	5,797	2,374	3,226	11,397
Africans (estimated population) ...		...	...	12,088	...	...	...	12,200

Total Population 1921 24,466
,, ,, 1922 23,597

The estimated population of Nairobi for 1922 is only a very approximate figure, as the means to calculate such are practically non-existent. As there are a number of empty European and Asiatic houses in the town, it is probably true that there has been a decrease in the population of these two races. It is doubtful if the African figures are even approximate and it would appear that the figures should be higher.

Births.—128 European births were registered during the year, 67 males and 61 females, as compared with 142 births in 1921, 85 in 1920, and 88 in 1919.

As many of these births occurred in nursing homes, and the parents were not usually resident in Nairobi, a birth-rate calculated on these figures would be misleading.

There is no information with regard to native or Indian births.

The total number of deaths from all causes reported during the year was 504, as compared with 570 in 1921, giving a crude death-rate of 21·0 per 1,000 of the population living.

European deaths numbered 35 which is equivalent to a crude death-rate of 12·4 per thousand. A recorded death-rate would probably give a lower figure. In England and Wales in 1921 the death-rate was 12·1.

Asiatic deaths numbered 130, which is equivalent to a crude death-rate of 15·6.

African deaths numbered 339, giving a death-rate of 27·9.

(*c*) KISUMU.

	1921.				1922.			
	Males.	Females.	Children.	Total.	Males.	Females.	Children.	Total.
Europeans	162	66	25	753	80	39	32	151
Arabs	62	7	22	91	20	5	5	30
Indians	897	261	468	1,626	448	157	189	794
Goans	112	30	27	169	83	20	35	138
Anglo-Indians, Seychelles, etc. ...	9	6	11	26	3	3	8	14
	1,242	370	553	2,165	634	224	269	1,127
Africans	...	...	...	3,143	...	...	...	4,154

Total Population 1921 5,308
„ „ 1922 5,281

During the year 115 deaths were reported from all causes as follows :–

Europeans.	Asiatics.	Africans.
2	20	93

This gives a crude death-rate of 21·7 per thousand. As, however, a very large number of the African and Asiatic deaths are those of persons who have been brought into the township for hospital treatment, the recorded death-rate would certainly be much lower.

GENERAL NATIVE POPULATION.

Such statistics as are available regarding population in the Natives Reserves are based on the figures procured in connection with tax collection and are approximate only.

The estimated total native population is about 2,500,000. The table appended is of interest as giving some idea of the population and its density in the various districts. It will be noticed that in three districts the density of population is over two hundred to the square mile, while in the Masai country, where the people are purely pastoral, a density of only three to the square mile is encountered.

TABLE B.

POPULATION.

Province.	District.	Native.	Non-Native.	Area square miles Native Reserve.	Native Population per square mile.
Coast	Vanga	40,699	402	No figures	No figures
	Kilifi...	57,770	572	do.	do.
	Malindi	27,003	1,149	do.	do.
	Lamu	19,504	2,561	do.	do.
	Tana River	14,215	103	do.	do.
Ukamba ...	Voi	34,145	156	do.	do.
	Ulu	184,683	937	2,102	88
	Kitui	107,695	120	5,771	19
Kikuyu	Nyeri	175,544	532	641	274
	Fort-Hall	187,627	675	578	326
	Kyambu	104,317	1,385	382	273
	Meru	113,284	87	3,222	35
	Embu	83,894	35	1,324	63
Nyanza ...	N. Kavirondo ...	295,846	230	2,524	117
	S Kavirondo ...	237,409	244	2,800	84
	C. Kavirondo ...	275,140	261	1,843	149
	Lumbwa	59,761	348	878	68
	Nandi	35,519	No figures	441	81
Suk-Kamasia ...	Ravine	17,568	do.	342	51
	Kabarnet	26,390	do.	1,560	17
	Elgeyo	14,905	do.	No figures	No figures
	Maraquet	16,739	do.	do.	do.
	Kacheliba	21,989	do.	3,275	7
Masai Reserve	Narok	44,450	338	14,600	3
	Mara				
	Ngong				
	Laitokitok				
Jubaland ...	Kismayu	99,658	1,689	No figures	No figures
	Gobwen				
	Afmadu				
	Alexandra				

An interesting investigation has been carried out in the Central Kavirondo district with the object of obtaining figures bearing on the vital statistics of the native population in the reserve, chiefly in the direction of the infant mortality and the fecundity rates. The results are embodied in Table "C" appended.

The method followed in conducting the investigation was to examine all the inhabitants and interrogate all the women of those villages to which opportunity enabled a visit to be paid, and though the numbers are not very large and allowance has to be made for errors in the estimation of ages and in the facts as given by the women themselves, yet, on the whole, it is probable that the results are fairly accurate and give a not incorrect picture of conditions as they exist. It is, of course, possible that were every small village

over a large area to be investigated, the results obtained might vary from those hitherto arrived at, and it does not by any means follow that figures relating to Kavirondo would hold good for another tribe, *e.g.*, the Kikuyu. Comparison of the table with the figures obtained in what was formerly German East Africa and set forth by Külz shows considerable differences, notably with regard to the proportion of barren women and the infant mortality rate.

Certain points are apparent on examination of the figures and these are:—

(*a*) The small proportion of barren women.

(*b*) The very high infant mortality rate, over 400 per 1,000.

Külz (L.) Biology and Pathology of the Children of the Aborigines in German Protectorates. Reviewed in Tropical Diseases Bulletin, vol. 17, No. 3, April 1921, pp. 207-212.

(*c*) The high fecundity rate as compared with England, where the figure was 4·2 in 1894.

(*d*) The preponderance of male over female births 104·8-100, which corresponds to the figure obtaining at present in England.

It might be argued from the small proportion of barren women that venereal disease, especially gonorrhœa, is not common, but little information is available as to the correctness or otherwise of this deduction.

The huge infantile mortality rate is probably to no little degree influenced by the faulty methods of infant feeding which obtain among the Kavirondo. It is an error to suppose that the native baby, at any rate in Kenya Colony, is entirely breast fed; at the age of a few weeks supplementary artificial feeding is resorted to in the shape of weak gruel made from flour of the various food grains or of yams and bananas which are chewed up by the mother and then given to the child. The Medical Officer who conducted the investigations is of opinion that the beer drinks which take place at the gathering of the crops have a distinct influence on the infant mortality in that the children are left at home while almost the whole adult population takes itself off and devotes itself to feasting and drunkenness. Another factor which may have a bearing on the infant mortality is the custom of keeping the newly-born infant for some days in the close and stuffy hut with the possibly increased liability to lung complaints. The cause of a large proportion of infant deaths is given by the mothers as being due to chest trouble. Malaria and diarrhœa must also exact an enormous toll, while the influence of yaws cannot but be considerable.

Of great interest also are the infant and adult morbidity tables which were prepared at the same time as the other investigations were being carried out, and which are reproduced (Tables "D" and "E"). It will be noticed that the high splenic index obtained on the examination of children is not paralleled among adults. The yaws rate is high both among children and adults, and it is possible that this should be still higher, as the Medical Officer who compiled the figures is of opinion that he confused yaws with syphilis at the beginning of his investigation, with the result that the syphilis figure is too high. Scabies is another notable cause of morbidity. The item "deformities of feet" refers mainly to the effects of the invasion of jiggers and does not include such abnormalities as flat foot.

TABLE C.

ANALYSIS OF AN INVESTIGATION WITH REGARD TO THE FERTILITY OF THE WOMEN AND THE MORTALITY AMONG THE CHILDREN OF THE CENTRAL KAVIRONDO DISTRICT OF THE NYANZA PROVINCE, 1922.

	LOCATION.															Totals.
	Alego.	Asembo	N. Gem.	S. Gem.	N. Ugenya	S. Ugenya	Uyoma.	Kano.	Nyakatch.	Nyangori.	Samia.	Sakwa.	Kadimu	Kajulu.	Sagam.	
Total number of women examined (married)	280	248	210	230	60	310	150	80	242	200	310	50	103	56	62	2591
Mean age of women examined (married)	24·14	25·41	26·21	26·38	25·45	26·96	25·24	23·50	27·52	24·71	25·21	24·54	25·47	25·70	29·87	25·76
Number of barren women (married five years and without children)	1	3	1	4	nil	1	nil	nil	nil	1	4	1	1	nil	nil	17
Number of live births...	649	693	669	779	191	1099	414	205	869	481	880	122	317	201	274	7843
Number of male live births	323	374	335	393	109	549	218	93	431	251	490	62	152	98	136	4014
Number of female live births	326	319	334	386	82	550	196	112	438	230	390	60	165	103	138	3829
Number of still births	13	6	nil	2	1	13	nil	nil	4	nil	1	1	2	3	6	52
Number of male still births	9	4	nil	2	nil	9	nil	nil	3	nil	nil	nil	1	1	3	32
Number of female still births	4	2	nil	nil	1	4	nil	nil	1	nil	1	1	1	2	3	20
Number of abortions	131	116	68	67	1	21	30	nil	16	nil	17	21	10	1	23	522
Number of male (?) abortions	73	60	30	34	1	12	21	nil	9	nil	10	14	5	1	10	280
Number of female (?) abortions	58	56	38	33	nil	9	9	nil	7	nil	7	7	5	nil	13	242
Average number of children at mean age of women examined ...	2·3	2·8	3·2	3·4	3·2	3·6	2·8	2·6	3·6	2·4	2·8	2·4	3·1	3·6	4·4	3·0
Estimated number of children during child bearing period (15-40)	6·4	7·0	7·3	7·7	7·2	7·4	6·9	7·1	6.9	6·0	7·1	6·1	7·9	8·2	7·4	6·8
Proportion of live births to still births and abortions	100·22	100·18	100·10	100·9	100·1	100·3	100·7	100·0	100·2	100·0	100·2	100·18	100·4	100·2	100·11	100·7
Total deaths in first year of life	311	330	250	377	68	368	176	84	370	162	309	62	163	98	113	3241
Male deaths in first year of life	153	180	135	194	36	169	86	34	171	81	171	33	79	47	51	1620
Female deaths in first year of life	158	150	115	183	32	199	90	50	199	81	138	29	84	51	62	1621
Total deaths in after years of life to 16 years	80	69	113	113	26	177	56	25	125	97	201	21	18	50	60	1231
Male deaths in after years of life to 16 years	47	39	57	61	17	77	33	17	70	45	118	11	9	29	34	664
Female deaths in after years of life to 16 years	33	30	56	52	9	100	23	8	55	52	83	10	9	21	26	567
Total deaths within a few days of birth	80	131	75	80	14	105	47	20	94	24	15	21	42	15	23	786
Male deaths within few days of birth	35	68	48	45	8	48	20	9	37	9	4	15	21	8	5	380
Female deaths within few days of birth	45	63	27	35	6	57	27	11	57	15	11	6	21	7	18	406
Total deaths about weaning age $\frac{9}{12}$ to $\frac{18}{12}$ years	138	49	81	65	18	135	59	30	118	50	101	4	31	52	41	972
Male deaths about weaning age $\frac{9}{12}$ to $\frac{18}{12}$ years	68	28	40	38	7	59	32	12	57	24	61	nil	22	24	21	493
Female deaths about weaning age $\frac{9}{12}$ to $\frac{18}{12}$ years	70	21	41	27	11	76	27	18	61	26	40	4	9	28	20	479
Total deaths	391	399	363	490	94	545	232	109	495	259	510	83	181	148	173	4472
Male deaths	200	219	192	255	53	246	119	51	241	126	289	44	88	76	85	2284
Female deaths	191	180	171	235	41	299	113	58	254	133	221	39	93	72	88	2188
Total resulting living progeny	258	294	306	289	97	554	182	96	374	222	370	39	136	53	101	3371
Male resulting living progeny	123	155	143	138	56	303	99	42	190	125	201	18	64	22	51	1730
Female resulting living progeny	135	139	163	151	41	251	83	54	184	97	169	21	72	31	50	1641

TABLE D.

CENTRAL KAVIRONDO DISTRICT, 1922.

Morbidity Table. Children (16 Years and Under).

Location.	Alego.		Asembo.		No. Gem.		S. Gem.		N. Ugenya.		S. Ugenya.		Uyoma.		Kano.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Total Number examined	99	133	273	197	130	126	118	138	63	57	217	167	76	55	129	127
Enlarged spleens	12	12	38	25	13	10	19	19	7	7	46	38	4	8	13	18
Ulcers	5	2	2	1	...	2	8	4	2	3	6	7	4	...	...	...
Deformities of feet	...	...	...	...	...	...	...	1	1	...	...	1	...	...	...	...
Yaws	...	6	10	10	19	10	5	7	1	1	1	5	1	1	...	1
Diseases of the eye	...	2	2	3	...	1	1	...	1	3	5	3	...	...	2	1
Umbilical hernia	1	1	2	3	2	5	2	3	1	1	4	4	...	3	1	...
Scabies	5	4	18	6	4	9	6	7	5	8	7	5	2	3	2	1
Smallpox scars	...	...	1	...	...	...	...	...	1	...	...	...	...	...	5	2
Leprosy	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...

Location.	Nyakatch.		Nyangori.		Samia.		Sakwa.		Kadimu.		Kajulu.		Sagam.		Total.		Percentage.
	M.	F.	M.	F	M.	F.	M.	F.	M.	F.	M.	F.	.	F.	M.	F.	
Total number examined ...	196	188	51	19	152	138	9	39	71	71	50	63	59	69	1,693	1,587	...
Enlarged spleens	18	18	5	...	18	24	2	3	34	28	6	8	15	12	250	230	14·6
Ulcers	5	2	2	...	6	2	1	2	4	...	2	1	...	3	47	29	2·3
Deformities of feet... ...	1	...	...	...	1	1	...	...	...	...	...	...	...	...	3	3	0·2
Yaws	11	21	...	...	14	7	...	1	1	...	...	2	1	2	64	74	4·2
Diseases of the eye ...	...	4	...	...	4	4	..	1	...	1	1	2	...	1	16	26	1·3
Umbilical hernia	3	3	...	...	1	2	...	1	3	7	6	1	1	1	27	35	1·9
Scabies	15	1	10	3	4	9	4	17	2	4	8	2	4	2	96	81	5·4
Smallpox scars	...	...	...	...	2	1	...	...	...	...	...	...	..	...	9	3	0·4
Leprosy	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	0·0

TABLE E.

CENTRAL KAVIRONDO DISTRICT, 1922.

Morbidity Table. Adults (over 16 Years).

Location.	Alego.		Asembo.		No. Gem.		S. Gem.		N. Ugenya.		S. Ugenya.		Uyoma.		Kano.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Total number examined	192	266	261	256	137	210	226	218	94	57	320	256	192	128	90	64
Enlarged spleens	5	2	2	1	2	1	...	8	...	...	4	4	6	2	2	...
Ulcers	5	4	4	3	2	2	4	1	3	2	8	2	2	3	...	1
Deformities of feet	8	10	4	9	3	9	11	12	7	2	11	11	4	6	2	1
Yaws	13	12	13	11	10	13	5	5	3	2	7	7	6	2	...	1
Diseases of the eye	10	3	6	2	2	4	12	8	1	2	11	12	5	2	1	3
Umbilical hernia	...	1	...	1	...	...	...	1	...	...	1	2	...	...	...	.
Scabies	...	...	...	...	1	1	1	...	...	1	3	...	...	...	...	...
Smallpox scars	5	1	1	2	1	5	5	3	6	2	17	5	...	...	5	1
Syphilis	5	5	9	6	4	3	...	5	1	...	3	1	...	3	...	1
Leprosy	1	...	..	1	...	...	...	..	...	...	...	...	...	...	...	...
Other causes	2	2	3	1	2	1	4	2	1	...	4	...	1	4	...	...

Location.	Nyakatch.		Nyangori.		Samia.		Sakwa.		Kadimu.		Kajulu.		Sagam.		Total.		Percentage.
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
Total number examined ...	265	210	72	184	304	310	1	36	32	102	15	51	74	64	2,375	2,412	...
Enlarged spleens	2	1	...	...	...	2	...	...	8	14	..	2	...	...	31	37	1·4
Ulcers	3	4	...	1	1	...	...	2	1	...	1	...	2	2	36	27	1·3
Deformities of feet ...	10	16	1	3	12	6	...	2	...	...	1	...	1	1	75	88	3·4
Yaws	8	19	...	...	6	8	...	1	...	...	...	...	1	1	72	82	3·2
Diseases of the eye ...	7	13	...	3	10	15	...	...	4	..	...	3	1	3	70	73	3·0
Umbilical hernia	...	...	1	...	...	...	...	...	...	...	...	...	...	...	2	5	0·1
Scabies	2	...	...	...	..	3	...	1	1	...	...	...	...	...	8	6	0·3
Smallpox scars	2	1	3	...	36	35	...	...	5	4	...	...	5	5	91	62	3·2
Syphilis	1	4	...	...	...	...	...	2	...	...	...	1	...	1	23	32	1·1
Leprosy	3	...	..	...	...	...	...	...	...	...	...	...	...	...	4	1	0·1
Other causes	3	6	1	...	...	1	...	4	13	8	...	1	...	...	34	30	1·3

EUROPEAN OFFICIALS.

During 1922 both the total and average numbers of officials resident were slightly less than in the preceding years. The sick time figures show an appreciable drop. There were five deaths as against four in each of the two preceding years.

The comparative table of in-patients and out-patients is :—

	In-patients.	Out-patients.
1922	635	567
1921	603	676
1920	611	618

The causes of death were :—

Pneumonia,
Bright's disease,
Enteric,
Carcinoma of uterus.

Sixteen officials were invalided during the year owing to the following causes :—Anæmia, 2 cases ; concussion, 1 case ; chronic occipital headache, 1 case ; general debility, 3 cases ; neurasthenia, 2 cases ; tachycardia, 1 case ; eye affection, 1 case ; chronic gastritis, 1 case ; insomnia, 1 case ; dysentery, 1 case ; rheumatism, 1 case ; hepatitis, 1 case.

TABLE SHOWING THE SICK, INVALIDING AND DEATH RATES AMONGST EUROPEAN OFFICIALS IN THE COLONY AND PROTECTORATE OF KENYA.

	1920.	1921.	1922.
Total number of officials resident	1,259	1,353	1,337
Average number resident	746	1,011	940
Total number on sick list	574	592	635
Total number of days on sick list	6,373	8,704	5,640
Average daily number on sick list	17·41	23·84	15·45
Percentage of sick to average number resident ...	2·33	2·35	1·64
Average number of days on sick list to each patient	11·12	14·70	8·88
Average sick time to each resident	5·39	6·43	6·00
Total number invalided	28	16	16
Percentage of invaliding to total residents	2·36	1·18	1·19
Total deaths	4	4	5
Percentage of deaths to total residents	·34	·29	·37
Percentage of deaths to average number resident ...	·53	·39	·53
Number of cases of sickness contracted away from residence	—	—	—

NON-EUROPEAN OFFICIALS.

A slight decrease occurred during 1922 in the total and average numbers of non-European officials resident in the country, and it is satisfactory to note that the large drop which was recorded last year in sick time again occurred ; the figure is lower by over 4,000.

Deaths were six in number as against 10 and were due to the following causes :—

Blackwater	3 cases.
Pneumonia	2 cases.
Cerebro-spinal-meningitis	1 case.

Invalidings totalled 42 as against 53 and were caused by :—Eye affection, 8 cases ; general debility, 6 cases ; epilepsy, 2 cases ; senility, 1 case ; insomnia, 1 case ; asthma, 1 case ; anæmia, 1 case ; chronic rheumatism, 1 case ; neurasthenia, 2 cases ; dyspepsia, 1 case ; deformed foot, 1 case ; chronic ulcer, 1 case ; diabetes, 2 cases ; tuberculosis, 3 cases ; albuminuria, 1 case ; chronic bronchitis, 2 cases ; locomotor ataxy, 2 cases ; paralysis, 2 cases ; typhoid, 1 case ; hæmorrhoids, 1 case ; wound, 1 case ; deafness, 1 case.

TABLE SHOWING THE SICK, INVALIDING AND DEATH RATES AMONGST NON-EUROPEAN OFFICIALS IN THE COLONY AND PROTECTORATE OF KENYA.

	1920.	1921.	1922.
Total number of officials resident	2,392	2,429	2,325
Average number resident	1,762	1,987	1,879
Total number on sick list	4,439	3,951	3,337
Total number of days on sick list	30,053	22,865	18,207
Average daily number on sick list	82·11	62·64	49·88
Percentage of sick to average number resident ...	4·66	3·15	2·65
Average number of days on sick list to each patient	6·77	5·78	5·45
Average sick time to each resident	13·29	9·41	9·68
Total number invalided	60	53	42
Percentage of invaliding to total residents	2·65	2·18	1·81
Total deaths	12	10	6
Percentage of deaths to total residents	·53	·41	·25
Percentage of deaths to average number resident ...	·68	·50	·32
Number of cases of sickness contracted away from residence	—	—	—

III.—MAJOR ENDEMIC AND EPIDEMIC DISEASES.

YAWS (Framboesia Tropica).

Definition.—A name which is given to the disease of man which results from infection with a specific organism known as the Spironema pertenue, Castellani, 1905.

Description.—The disease is characterised by a primary lesion (or yaw) which is usually extragenital, by a secondary granulomatous eruption (yaws) and not infrequently by tertiary manifestations of a varied nature. Among the more common of the tertiary manifestations are gummatous-like nodules, deep superficial or fungating ulcerations, and chronic periostitis of various bones, while one of the most characteristic is the peculiar, destructive ulceration of the nasopharynx known usually as gangosa.

Mode of Infection.—There is reason to believe that infection is most frequently acquired either by direct contact with an infected person, *e.g.*, as between mother and child, or indirectly as the result of the contamination of some abrasion by flies which have recently been in contact with an infected person. Conveyance of the infection by blood-sucking flies of the genus Stomoxys, by ticks of the genus Ornithodorus, by insects such as lice or bed-bugs, or by contact with utensils, clothes or huts which may recently have been used by an infected person, possibly occurs.

The conveyance of the infection during sexual intercourse is conceivable and in a certain number of instances doubtless occurs, but there is, however, no reason for regarding such occurrences as other than incidental or for placing the disease within the category of true venereal infections.

No instance of ante-natal infection has so far been recorded in this country. The point is, however, one on which further observation and investigation is required, as among one tribe at least there is a strongly held belief that infection not infrequently results in repeated abortions, and in support of this a certain amount of statistical evidence has been collected.

Nomenclature.—"Yaws" would appear to be a word of West Indian origin and is the name by which the disease is most commonly known to practitioners in the British Colonies. The Swahili name for the secondary manifestations is "Tego,"* while the name which they apply to certain of the tertiary manifestations is "Mti." The name applied to the secondary manifestations by the Kikuyu is "Matokia," while that used by the Luo speaking Kavirondo is "Nyatch."

History of the Disease in Kenya.—In the Annual Medical Report of the East Africa Protectorate for the year 1902, which is the earliest available among the records of the Department, Dr. MacDonald, the Principal Medical Officer at that time, describes under the name of "Mti" certain conditions which we now recognise as tertiary manifestations of yaws. Dr. MacDonald makes no mention either of yaws or of syphilis in his report, but he states that the condition which he is describing is not leprosy, though it might easily be confounded with that disease. Dr. MacDonald's observations were made in Mombasa.

A record of the disease contemporary with the above is to be found in the Quarterly Medical Report of the Uganda Protectorate of 30th September, 1902, where it is noted that 101 cases of yaws received treatment during the quarter.

The East African Reports for 1903 and 1904 are not available and in the Report for 1905 the disease is not mentioned.

In the Report for 1906 it is recorded that the Medical Officer at Kisumu is of the opinion that yaws is "fairly common among the Kavirondo," but no mention is made of any cases having received treatment.

In the Report for 1907 it is recorded that 215 cases of yaws were treated in the Nyanza Province. No mention is made of the disease as occurring elsewhere in the Protectorate, but a general remark is made to the effect that "syphilis is spreading."

In the Report for 1908, 142 cases of yaws are noted as having been treated, and the Medical Officer at Fort-Hall, a station in the Kikuyu Province, states that "yaws is very prevalent amongst the Wakikuyu."

In the Report for 1909, 121 cases are shown as having been treated, and the Medical Officer, Fort-Hall, refers to the matter as follows:—"It would "appear from information received from various Mission stations in the "Province that syphilis is fairly common, especially in the Fort-Hall district; "at the same time it must be remembered that yaws is also prevalent, and no "doubt many cases of yaws have been recognised as syphilis manifestations." The Medical Officer, Kisumu, also refers to the matter in his Report and notes as follows:—"Syphilis is reported to be spreading . . . probably exaggerated

* Madan's Swahili Dictionary gives "Tego—a powerful charm capable of causing disease and death." The word is also sometimes used in respect of Syphilitic lesions. The more correct name for Syphilis would, however, appear to be "Cuba," though this word also is frequently used in respect of yaws.

"by confusing yaws with this disease." The Medical Officer, Mombasa, reports that "Many cases of yaws are to be seen at the United Methodist "Mission at Mazeras, fourteen miles from Mombasa."

In the Report for 1910, 164 cases are noted as having been treated and the disease is reported by the Medical Officer at Lamu to be of frequent occurrence "especially among the children" in Tanaland.

In 1911, 1912, and 1913, 124, 53, and 175 cases of yaws were treated respectively but no special mention of the disease is to be found in the Reports for three years.

In 1914, 112 cases were treated, and two cases are recorded as having occurred in Europeans, one at Nyeri and one at Fort-Hall.

In 1915 and 1916, 189 and 221 cases were treated respectively.

In 1917, 334 cases were treated, and the "almost universal prevalence of yaws in the Kenya Province" is recorded.

In 1918 and 1919, 325 and 639 cases were treated respectively.

In the Report for 1920, prominence is given to the prevalence of yaws in the Kikuyu Reserves and in South Kavirondo, and the necessity for tackling the disease in a vigorous fashion is emphasized. 657 cases were treated in that year.

In 1921, provision was made for the purchase of considerable stocks of Galyl and Novarsenobillon, and treatment on a larger scale was commenced. In South Kavirondo, where a Medical Unit had been established for the first time some few months before the beginning of the year, over 3,400 cases received treatment. At Fort-Hall in the Kenya Province a yaws camp was opened in connection with the Hospital and over 3,000 cases were dealt with in that district. Towards the end of the year a medical station was established at Chuka, some 60 miles from Fort-Hall, in the centre of another heavily infected district of the Kikuyu Province, and a certain number of cases were treated there before the year closed. The total number of cases treated in the Colony during 1921 was 7,401. Under the heading "Hospitals and Dispensaries, Prevailing Diseases," some account of the ravages of yaws is given in the Annual Report for that year.

In 1922, the year for which the present Report is written, it was found that the disease was prevalent not only in the South Kavirondo district of the Nyanza Province but that there was a considerable prevalence in the Central Kavirondo district as well. In addition it was found that cases also existed in the North Kavirondo district, while it was further established that the disease was exceedingly prevalent on the coast and in the neighbourhood of Mombasa where over 2,000 cases received treatment before the end of the year as against 89 in 1921. The total number of cases treated in 1922 was over 24,000.

From the foregoing records it would, therefore, appear :—

(*a*) that yaws was present in this part of Africa at points so far apart as Uganda and the neighbourhood of Mombasa as long ago as 1902;

(*b*) that yaws was present among the Nilotic Kavirondo on the shores of the Victoria Nyanza in 1906 and among the Wakikuyu of the Highlands in 1908.

(*c*) that the disease has never been absent from the country during the intervening years.

Detailed records of the number of cases treated at each station in the country are only available after 1910. An examination of the records from then onwards shows that every year a few cases of the disease were treated at almost every station. From this fact, however, a universal prevalence of the disease need not be deduced, as up till recently the cases treated at most

stations were drawn only from the inhabitants of the stations themselves or from their immediate neighbourhoods, that is from people who were more or less in contact with travellers from other parts of the Colony. The infection in all the cases which came to notice was not necessarily acquired in the immediate vicinity. Nevertheless, it must not be forgotten that there remain large areas in the country which have not yet undergone anything in the nature of a medical or sanitary survey, and it is not impossible that some at least of these areas are at present, or have been in the past, seriously affected.

Native Evidence as to the History of the Disease.—In every district in which yaws is now prevalent, the story told by the natives is that the disease has existed among them as long as they and their fathers and their grandfathers can remember. In most cases no alteration in the degree of incidence is recognised as having taken place, except perhaps in the Central Kavirondo district of the Nyanza Province, where the disease is stated to have been much more prevalent some twenty years ago than is now the case.

Present Incidence of the Disease.—The disease is known to be prevalent at the present time in the following areas :—

On the coast from Shimoni to Malindi and for an unknown distance inland.

In the Tana Valley.

In the South Kavirondo district of the Nyanza Province (chiefly confined to the low-lying locations inhabited by the Nilotic Kavirondo).

In the Central Kavirondo district of the Nyanza Province (17 locations are inhabited by Nilotic Kavirondo and two by Bantu tribes ; of the former all are infected, of the latter, one, Samia, is heavily infected and one, Nyangori, is apparently not infected at all).

In the Fort-Hall, Embu, Meru and South Nyeri districts of the Kenya Province.

The disease is known to exist in the North Kavirondo district of the Nyanza Province. Cases are also reported from time to time from most of the other stations in the Colony and Protectorate. Whether the disease is prevalent in any of the districts in which these stations are established is a matter which remains to be investigated. There is some reason to believe that the Masai also are infected.

Changes in the Incidence of the Disease.—The figures given in Table "F" (page 31) show that there has been during the past two years a very large increase in the number of cases receiving treatment. This is most probably to be accounted for by the fact that within the past few years there has been made available for the first time a remedy, the exhibition of which is followed within a very few days by the complete disappearance of all the more distressing manifestations of the disease. That its incidence was tending to increase about the time that this treatment became available is, of course, possible, but there is no evidence in support of that conclusion. The Official Reports which have been quoted above appear to lead to the conclusion that for twenty years past at least the incidence has been very considerable, while native evidence in Central Kavirondo is to the effect that in that district at least a decrease is now taking place.

Most Medical Officers are of opinion that in those districts where a large number of cases have been treated there has resulted at least a slight decrease in the incidence of the disease during the past year.

Percentage of the Population Infected.—An endeavour is at present being made to acquire more accurate information on this point. A few figures are, however, available.

The Fort-Hall district, in which 6,616 cases were treated during 1922, supports a population which is estimated at 187,627. That is to say at least 3 % of the population were at one time or another during that year suffering from active yaws. It will not be a matter for surprise should it be found that an even greater number remains to be treated. In the Central Kavirondo district it was found that of 7,933 persons (adults and children) examined as to their physical condition, 278 or 3·5 % were suffering from the disease. It is not improbable that there are at present in the Colony and Protectorate at least 60,000 persons who require treatment for yaws.

Influence of Race, Climate and Altitude.—In the South Kavirondo district, the locations of which can be divided into two groups, one inhabited by the Kisii, a Bantu tribe, and one inhabited by the Jaluo, a Nilotic tribe, yaws is almost entirely confined to the latter group. It happens, however, that the Luo locations are those which are situated near the shores of the Victoria Nyanza in a warmer and drier climate and at an altitude lower by at least a thousand feet.

In Central Kavirondo, sixteen low lying locations, of which fifteen are inhabited by Nilotic Kavirondo and one by Bantu Kavirondo, are all infected, while the remaining location of this district—Nyangori—which is inhabited by a Bantu tribe and situated at a higher altitude, is apparently free from the disease.

On the other hand, in the Kikuyu Province which is situated in the Highlands and inhabited by none but Bantu peoples, the disease is as prevalent as in any other part of the country. It is noted, however, by the Medical Officer, Fort-Hall, that in the Kikuyu Province the disease is much more prevalent in the lower lying locations of that Province than in the higher. It is true that the difference between the altitude of these locations is not to be compared with the difference between the lower of these locations and the coast, still the difference in climate is very considerable. It would, therefore, appear that temperature and climate may have a bearing on the incidence of the disease, while race and altitude are not in themselves factors of importance. The disease is common both at sea level and at an altitude of 5,000 feet, while neither the Bantu nor the Nilotic stocks escape its ravages.

Influence of Social and Sanitary Conditions.—The social condition of most African natives in Kenya is, with the exception of that of the inhabitants of Mombasa, exceedingly low, and comparison between different tribes cannot readily be made. Similarly, the standard of sanitation is elementary. The incidence of a disease which is almost certainly the result of infection conveyed by contact either direct or indirect (flies and fomites) can hardly but be largely influenced by these conditions. It is a noteworthy fact that, though infected natives must proceed from time to time to plantations and to other works where large numbers of labourers are employed, outbreaks of the disease would not appear to follow.

Instances of the occurrence of the disease both among Asiatics and among Europeans are on record, but are exceedingly few in number.

Prevention.—Assuming that the only reservoir of the infecting organism is man and that bulk infection takes place, as a rule, only under conditions where close contact either with infected persons, fomites or flies is unavoidable, three methods by which prevention might be secured suggest themselves. These methods are as follows :—

(1) By immunising the population.

(2) By raising the general standard of sanitation.

(3) By organising a direct attack on the casual organism.

The first of these methods is not, however, feasible, no method of immunising the individual having so far been devised.

The second method, if carried sufficiently far, would probably in the long run result in the complete eradication of the disease. Dependent, however, as any radical improvement in sanitation must be, not only on the economic condition of the people but on their general outlook on life, it is not reasonable to rely on this method to secure the eradication of the disease at any time in the near future. Minor sanitary methods, such as segregation of the sick and disinfection of housing and fomites, would doubtless be useful and will ultimately require to be employed; for the moment they are not feasible.

Fortunately, the third method—direct attack on the casual organism—can be put into operation. Effect is given to it each time a patient is treated, and it would appear not impossible largely to reduce the incidence of the disease within a comparatively short period of years by so extending the facilities for treatment as to ensure that all natives at present infected may be dealt with as soon as possible, and that all future cases which may occur may receive treatment as soon as they can be diagnosed.

Fortunately, also, an efficient method of treatment which almost certainly renders the patient either non-infective or very much less infective within a very few days is available. It only remains to use the method in an effective manner. Hitherto Medical Officers have had their time fully occupied in dealing with such persons as have come to the various hospitals and dispensaries for treatment. These people have come in, however, from all parts of the districts concerned, and though they have come in in large numbers, many sick, each one of whom represents a focus of infection, have remained scattered over these districts. During 1923 an attempt will be made so to organise a treatment campaign as to ensure, if possible, that all existing cases in parts at least of each district receive treatment as nearly as possible at the same time.

Measures will also be taken to secure the treatment of any fresh cases that may occur as soon as they can be diagnosed.

Finance.—It is not yet known how many injections of Novarsenobillon, the drug which has hitherto been most largely used in the treatment of yaws, may be required to effect a permanent cure. As a general rule, however, it would appear that one or two injections of 0·6 gramme are sufficient to clear up all cutaneous manifestations and to render the patient non-infective for at least many months, if not for years. During 1922 over £4,350 was expended on the purchase of Novarsenobillon. Had treatment continued to depend on the exhibition of that drug, the scheme which has been outlined above would almost necessarily have remained a financial impossibility. Fortunately, within the past few months another drug which appears to be equally, if not more efficacious, and is at the same time infinitely cheaper, has become available. The drug in question is Sodium Potassium Bismuth Tartrate, and the cost works out at about $\frac{1}{10}$th of a penny per dose as against three shillings in the case of Novarsenobillon. The problem of financing a treatment campaign on an extensive scale would appear, therefore, largely to have disappeared. Difficulty there may be with regard to the provision of staff but the difficulty should not be insuperable. Should such be necessary, it should be by no means impossible to procure African dressers sufficiently intelligent to administer intramuscular injections under the supervision of European Medical Officers.

For the introduction of the use of Sodium Potassium Bismuth Tartrate in the treatment of yaws the colony is indebted firstly to Dr. Andrew Balfour, who drew our attention to the fact that success was attending its use in the Tanganyika Territory, and secondly to Dr. Shircore, of the Tanganyika Medical Service, who very kindly provided us with all the information with regard to its use and preparation which was at his disposal Lastly, we are indebted to the Director of the Chemical Research Laboratories, Nairobi, who thereafter devoted much attention to the question of its production and who has prepared for our use large quantities of a salt which appears to be satisfactory in every way.

The dose used is 0·2 gramme given intramuscularly in 2 c.c. of sterile water.

TABLE F.

TABLE SHOWING THE NUMBER OF CASES OF YAWS AND SYPHILIS TREATED AT VARIOUS HOSPITALS AND DISPENSARIES IN KENYA DURING THE YEARS 1907 to 1922.

Year.	Number of Cases of Yaws treated.	Number of Cases of Syphilis (?) treated.
1907	215	1,861
1908	142	1,540
1909	120	1,556
1910	164	1,413
1911	124	1,233
1912	53	1,174
1913	175	1,158
1914	112	1,043
1915	189	913
1916	221	834
1917	344	782
1918	325	699
1919	639	1,053
1920	657	1,614
1921	7,401	1,914
1922	21,733[x]	2,896

[x] This figure does not include some 2,500 cases treated on safari in various districts.

II.—SYPHILIS.

The number of cases of syphilis which have come under notice during 1922 shows a very considerable increase over the total for the previous year; this may be the result either of a spread of the disease or of an increased faith in methods of intravenous treatment with arsenic compounds. It will be noted that the figures given in Table "F" show that during the whole period the numbers of cases of syphilis which have come under observation have remained at approximately the same level, while the yaws totals have increased enormously since 1918. The probable condition of affairs is that in the earlier years a proportion of yaws cases were diagnosed as syphilis.

It has frequently been stated, though the figures of attendances did not bear this out that syphilis is increasing rapidly among the natives. It is probably true that a certain increase is taking place, though this would appear to occur mainly among the town dwellers, and the following table tends to show that syphilis among natives in the Colony and Protectorate is largely confined to urban areas :—

Towns. 1922.			Reserves. 1922.		
Mombasa	...	246	Fort-Hall	...	0
Nairobi	...	291	Kisii ...	...	7
Nakuru	...	70	Chuka...	...	15

The diagnosis of syphilis in Kenya among a population where yaws is almost universally present rests very largely on signs appertaining to the first and second stages of the disease; the tertiary external lesions are indistinguishable from tertiary yaws and the Wassermann reaction is no help. Parasyphilitic lesions are not common among natives, and it is possible that paraframboesial manifestations exist. There is a close resemblance between the secondary lesions in syphilis and yaws when these are sparse and situated in the axillæ, perineum and internatal folds and the diagnosis in such cases is a matter of considerable difficulty and is frequently only to be determined by the absence from the district of undoubted cases of primary syphilis.

A point which is apparent on examination of natives suffering from undoubted syphilis is the comparative mildness of the symptoms which accompany the primary and second stages of the disease and the comparative rareness of those secondary features which are common among Europeans, both at home and in this country. It is not usual to find ulceration of the throat, and sore throat is seldom complained of among natives, pyrexia is not frequently noted and no stress is laid on headache and pains in the limbs. A marked difference in severity appears to exist in the disease as it affects natives and as it affects Europeans when contracted from natives. In the latter case the progress of the affection is rapid, and secondary signs and symptoms are very severe.

The difficulty with regard to the giving of adequate treatment for syphilis still obtains. Patients cannot be persuaded to continue treatment after the unpleasant symptoms of the disease have disappeared, and it will require a considerable amount of education before the native can be got to realise that prolonged treatment is necessary.

The line of treatment adopted during the year has been the administration of novarsenobillon and mercury, and it is intended during 1923 to make a trial of bismuth salts.

III.—LEPROSY.

The number of new cases which have come under observation shows a considerable increase over the total for 1921, which itself was greater than those for preceding years as is shown below :—

1922	...	...	...	81
1921	...	...	...	42
1920	...	...	...	25
1919	...	...	...	18
1918	...	...	...	19
1917	...	...	...	25

The increase in the totals must not be taken to indicate necessarily an increase in the amount of leprosy in the country. The probability is that there has been no actual increase at all but that the great faith which natives have in novarsenobillon has induced sufferers, who would not formerly have attended, to present themselves, hoping that the new method of treatment would have as marvellous effect with leprosy as with yaws.

The morbidity tables which appear earlier in the report show that in the examination of 8,067 persons six cases of leprosy were detected, i.e., 0·74 per thousand, and this may be taken as being correct, though it may be possible that the natives themselves practice a certain amount of segregation for this disease. It is certain that in North Kavirondo segregation does take place, but there is no information on this point with regard to Central Kavirondo. It would not appear that leprosy is a common disease in any part of the country, though it is evident that it occurs everywhere.

The two leper settlements at Lamu and Malindi are still maintained and at the close of the year 8 and 41 inmates were accommodated therein. Search has been made during the year for a site near Mombasa suitable for a leper camp and sufficiently near to be easily accessible to a Medical Officer, but so far no suitable position has been discovered.

The various forms of treatment enumerated in last year's report have been continued at Kakamega and in addition Harper's method of intravenous injection of chaulmoogra oil has been adopted in a proportion of the cases. The results have not proved very satisfactory, though the patients themselves maintain that they are much better. At Fort-Hall, where the intravenous chaulmoogra oil treatment only has been carried out, the results, at any rate in the

nodulas variety of the disease, have been much better and the report is that though no cases can be said to be cured, yet considerable improvement in the direction of shrinking of nodules and return of sensation has occurred. The Senior Medical Officer, Fort-Hall, is of opinion that if cases presented themselves early and could be persuaded to remain sufficiently long, cures could be effected by the intravenous chaulmoogra oil treatment. In leprosy, as is in other diseases requiring long continued treatment, the difficulty is that the patients become weary and go back to their homes.

IV.—TUBERCULOSIS.

310 cases are recorded as having been treated at Government Native Hospitals and Dispensaries, with 70 deaths as against 280 and 68 respectively in 1921.

In Mombasa 64 deaths were notified as having occurred from this disease, that is to say, 9·4% of the deaths from all causes in Mombasa were attributed to tuberculosis. This is equivalent to a death rate of 1·6 per thousand of the population of that town.

In Nairobi 21 deaths were notified.

Reference to table VIII in this report will show that though cases have been treated at nearly every station in the country, the majority of these cases occurred either at Kismayu, Mombasa or Nairobi.

Whether the patients who came to notice at the various out-stations contracted the disease in their reserves or in the towns is not known. That there is a considerable incidence among natives working in the towns would, however, appear to be the case. Further investigation with regard to this is obviously called for and as the disease is a notifiable one under the Public Health Ordinance, an endeavour will be made to secure the notification and the history of as many cases as possible during 1923.

In Nairobi and Mombasa cases of phthisis are accommodated at the Infectious Diseases Hospitals and in that in the latter town, a ward containing a range of ten rooms was erected during the year for the accommodation of phthisical patients. The building is of a somewhat temporary nature but is well finished, easily cleaned and admirably adapted for the purpose.

V.—PLAGUE.

I.—INCIDENCE OF THE DISEASE.

NYANZA PROVINCE.

South Kavirondo.—An isolated case occurred in February at the Seventh-Day Adventist Mission at Kamagambo.

In June and July small outbreaks and some isolated cases occurred in the locations of Kitutu and South Mugirango. It is probable that the total number of deaths did not exceed fifty. The incidence was, therefore, very similar to that of previous years.

Central Kavirondo.—As Central Kavirondo is a district in which rat-destruction was carried out on a large scale throughout the year, such details with regard to the incidence of the disease as are available are given below in full. It is to be noted that the Medical Officer from whose reports this information is extracted was constantly on tour throughout the district during the year; the information, therefore, presents a more accurate picture of what actually took place than is usually to be obtained with regard to a Native Reserve.

15th April.—"Rats have been observed dying in Alego Location in considerable numbers, and 5 cases of human plague have occurred amongst the natives, all proving fatal. Two cases occurred in adjoining bomas and the other three cases in a boma several miles distant. The necessary precautions have been taken. It should be noted that rat-destruction has not been carried out in this location as thoroughly as in some other locations, an average of 10·4 rats per hut being killed in nine months."

30th April.—"A number of cases in Alego and an odd case or two in Sakwa and Asembo. I estimate between 20 and 30 deaths due to plague have occurred in this location during the last few weeks."

15th May.—"I regret to report that plague is again prevalent more or less throughout the Reserve. Deaths have occurred in the different locations as follows from this disease:—Uyoma 7, Asembo 12, S. Gem 6, N. Gem 6, Samia 16, Sakwa 5, Alego 10 = 62 deaths during the fortnight. Also in Seme and N. Ugenya. Numbers not yet reported."

30th May.—"Plague is still occurring in the Reserve, but is, I think, abating to some extent. It is, as in past years, extremely difficult to estimate the exact number of cases that have occurred, the natives being inclined to attribute all deaths which are occurring at present to plague."

15th June.—"Odd cases of plague are still occurring in Alego Location, but no further cases have been reported from other parts of the district."

30th June.—"A few cases of plague are still occurring in the district."

15th July.—"No further cases of plague have been reported during the fortnight."

15th November.—"Seven deaths from plague reported from Samia having occurred during period October 20th to November 1st."

30th November.—"Six deaths at Monyala Headman Mohanga in Samia during past fortnight."

28th December.—"Three deaths from plague occurred in the location of Headman Mkudi, Samia Location."

The Medical Officer, from whose reports the above notes are extracted, had been in charge of the district since July, 1921, and he is of opinion that the incidence of the disease was very much less in 1922 than in the preceding year but he reserves his opinion as to whether this is to be attributed to the rat-destruction campaign or not.

North Kavirondo.—In this district also a general rat campaign was carried out on a large scale throughout the year. The number of deaths from the disease is reported by the Medical Officer to have been as follows:—Wanga 7, Bunyore 1, Marach 4, Malama 20, Mukulu 10, Ohayo 15, Waholo 4, Total 61.

The population of North Kavirondo is estimated at 295,846. The number of deaths in 1921 was estimated at 1,028, while the figure for 1920 was between 1,500 and 2,000.

The following extract from a report of the Medical Officer with regard to certain of the above cases is of interest:—

"I proceeded to Wanga on 23rd August and on enquiry was informed that there had been five cases with four deaths. Further investigation revealed the fact that one of these deaths could not have been plague, as a chronic illness in no way resembling plague was described."

"Two of the cases were a headman and his wife living in an isolated hut close to Chief Mumia's boma. The third fatal case was in a boma five miles off the main road....."

"The hut in which the first two deaths had occurred was first examined. Twenty men were placed at my disposal by Chief Mumia. The hut was first surrounded from a radius of about ten yards. All grass and bush was thoroughly searched and cut inwards towards the hut.

"Some of the party then surrounded the hut, while others went on the roof to remove the grass. The remainder of the party took up positions inside the hut."

"Three live and five dead rats were found in this hut.

"Next day the boma in which the third fatal case had occurred was visited. In a hut a child was seen suffering from bubonic plague.

"The infected hut was first dealt with, the decomposed bodies of seven rats were found. No live rats were found. Five other huts yielded a total of 182 live rats as follows:—50, 27, 32, 43 and 30.

"All the inhabitants of the infected boma and bomas in the immediate neighbourhood were inoculated, a total of 73 persons.

"An extensive rat campaign was instituted, 17,599 rats being destroyed. Wanga was left on the 28th August, Marach being reached the same day. Two deaths from what appeared to be plague, in bomas about two miles apart, were stated to have taken place two to four weeks prior to our arrival. The infected bomas were thoroughly searched but no evidence of plague-infected rats was found. A vigorous rat campaign yielded 18,492 rats. No inoculations were carried out here. On the morning of the 2nd September Marach was left and Ohayo reached via Wanga. Chief Mumia was seen, *en route*, and reported that there had not been any fresh cases in the interval.

"On arrival at Ohayo, Chief Okwara reported numerous deaths from plague. Closer investigation proved that probably only four of these cases had been plague. These four cases had occurred in widely separated bomas; no two cases had occurred in the same area.

"The alleged infected bomas were dealt with in a similar manner to those which had been found infected at Wanga; but no plague-infected rats were found.

"A general rat campaign throughout the location yielded 23,658 rats.

"All the locations visited during this safari had been inoculated about eighteen months previously. The total number of rats destroyed in these three locations during the safari was 59,749."

The observations contained in the above Report raise many questions of great interest and suggest numerous lines of research. Why was plague only sporadic considering the overcrowded condition of the rat population of the huts in the Boma in Wanga? Was there a low flea index? What species of flea were prevalent there? Were any of the live rats incubating the disease or recovering from it? If no rat-destruction had been carried out, would further human cases have occurred? An executive Medical Officer dealing with plague in the field, organising rat-destruction, deroofing huts, inoculating the people, and travelling from place to place, has, as a rule, but little enough time to make even as detailed observation as the above; he has none at all to collect the ecloparasites from 182 rats or to make large numbers of spleen smears. There is an unrivalled opportunity for research in the Kavirondo districts at present, and information of much practical value to the executive sanitary officer might be obtained. It is greatly to be hoped that within the next year or so the Department may be in a position to take full advantage of

this. Till staff is available opportunities of investigation must perforce go by, unless the field for enquiry should be sufficiently inviting to attract workers from elsewhere.

Kisumu District.—This district consists largely of Indian and European farms. No case occurred in 1922 as against two small outbreaks in 1921.

Kisumu Township.—No case of plague occurred within the township area during 1922. One case occurred in a native fireman on the s.s. "Clement Hill" in October. The ship was fumigated thereafter but somewhat curiously no rats were found. As plague existed at the time at Kampala in Uganda and this fireman had spent some time ashore there, it is presumed that he acquired the infection in that port. The plague record of Kisumu Township for the past four years is as follows :—

1919	...	...	...	41 cases.
1920	...	...	...	41 cases.
1921	...	...	...	4 cases.
1922	...	...	...	nil.

UKAMBA PROVINCE.

Kyambu District.—See under heading "Kikuyu Province."

Nairobi.—No case of the disease occurred within the Municipal area during the year.

Nairobi District.—No cases occurred.

KIKUYU PROVINCE (formerly KENYA PROVINCE).

KYAMBU DISTRICT.—(1) *Native Reserve.* During 1922 cases only occurred in a very sporadic fashion in this area. The notes of the European Sanitary inspector who dealt with such outbreaks as occurred are as follows :—

January 5th, 6th and 7th, near Dagoretti :—

Two cases of plague.
Dethatched 5 huts and found 25 dead rats.
Laid Barium Carbonate poison baits in 242 huts (15 baits per hut).
Inoculated 617 natives.

June 13th, 14th and 15th, Philipu's location near Dagoretti :—

Two cases of plague.
Dethatched 8 huts and found 7 dead rats.
Laid large number of Barium Carbonate baits.
Inoculated 1,394 natives.

July 18th, 19th, 20th and 21st, rat plague reported near Kabete :—

Huts dethatched 2.
Dead rats found 4.
Huts baited with Barium Carbonate 386.
Natives inoculated 2,412.

December 26th, deaths from plague reported near Kambui Mission :—

Huts baited 160.
Dead rats found *after baiting* 213.
Natives inoculated 723.

(2) *European Farming Area.* No cases of rat or human plague were reported as having occurred.

Fort-Hall District.—In March, rat plague occurred at Makuyu in the centre of the European farming area. No human cases occurred. A European Sanitary Inspector spent ten days in the area and a vigorous rat campaign was carried out on all the neighbouring farms.

In the Native Reserve in the Locations known as Karanjás and Ngarús several small outbreaks occurred. Thirty-one cases in all were seen by the Senior Medical Officer. The total number that occurred is not known but it would not appear to have been large. A certain amount of rat-destruction was carried out, but owing to lack of staff no organised campaign was possible. Over 2,000 natives were inoculated.

NAIVASHA PROVINCE.

Nakuru Township.—On 18th July an Indian carpenter died of plague in the Nakuru Bazaar. Investigation did not reveal any antecedent rat mortality. As the carpenter in question had come from Nairobi within seven days previously, he may have acquired the infection in that town, though, as far as was known, neither rat or human plague existed there at the time. The origin of the infection remained obscure. No further cases occurred in Nakuru.

Nakuru District.—In the first week of September a small outbreak of bubonic plague which ultimately resulted in six deaths occurred on a farm about five miles from Nakuru.

The farm affected marched with the farm on which two deaths from the same disease had occurred in October, 1921, almost exactly a year before.

The outbreak was not easily dealt with. All the buildings on the farm on which the cases occurred and on the neighbouring farms were wattle and daub structures with grass roofs, while stored in these buildings were considerable quantities of wheat, flax and tow. A small Clayton machine was put into use and an endeavour made by covering these materials with tarpaulins to fumigate them *in situ*; later they were turned out in the sun and again fumigated. Very large quantities of barium carbonate baits were laid throughout the area, and trapping and hunting were also resorted to. It is to be hoped that the infection has been eradicated, but it is impossible to be sure. There was no evidence that the occurrence of the disease this year was the result of a fresh importation of the infection, and the outbreak would appear to represent a somewhat remarkable instance of "carrying over."

SEYIDIE PROVINCE.

Mombasa.—No cases occurred. Two vessels on which cases of plague had occurred during the voyage entered Kilindini Harbour during the year. The vessels were the s.s. "Marechal Gallieni" on the 20th March, and the s.s. "Dumbea" on the 1st March. The sick had in both instances been landed at a previous port.

In the case of the first vessel there were no passengers nor cargo for Mombasa. In the case of the second there were a few passengers and 14 tons of cargo. The former were allowed to land under surveillance, the latter was offloaded into a lighter under the supervision of a European Sanitary Inspector and moored in the stream. The cargo in the lighters was later on subjected to a careful examination. Four packages only were found which were in any way suspicious of having harboured rats and these were opened and examined; three were passed but the fourth—a case of preserved meat—had evidently been entered by rats, and in view of the impossibility of disinfection, it was dumped in the sea.

2.—NOTE ON THE RODENTS OF KENYA.

In the Annual Report for 1921, in describing the "black" house rats of Kenya, Cattus rattus kijabius, it was stated that in some specimens the fur of the belly is "of a much lighter, greyish or lemon colour." The above would appear to be incorrect, as specimens showing the above characteristic which were sent to the British Museum for determination have now been identified as Rattus rattus frugivorus. As far as is known, the habits of these two sub-species, kijabius and frugivorus, are in this country identical, both are domestic in their habits and neither have so far been found living apart from human habitations. The relative distribution of these two sub-species has not yet been determined.

It has been noted during the year that neither species is to be found at Narok' a station in an isolated situation in the Masai Reserve.

A list of the genera and species of the small mammals collected in 1921 in the North Kavirondo district and referred to in the report for that year will be found in Appendix "C" at the end of this report.

3.—FLEAS.

(1) The collection of the ectoparasites of rats and other small rodents made in 1921 by Mr. van Someron in North Kavirondo was worked out during the year. The determinations were made partly at the Entomological Laboratory of the Agricultural Department by the Chief Entomologist, Mr. T. J. Anderson, and partly in England. It is hoped that the results may subsequently be published elsewhere.

(2) During the year a further collection of fleas was made from rats supplied by the Medical Officer of Health, Nairobi. An average of three rats were examined daily. Full details will be found in the Bacteriologist's Report for the current year but the following summary is not without interest:—

Identification of fleas from 1,146 rats (Rattus rattus kijabius) caught in Nairobi between December 7th, 1921, and December 6th, 1922:—

Number of rats examined	1,146
Number of rats without fleas	441
Total number of fleas	3,105
Average number of fleas per rat... ...	2·7

Of these 3,105 fleas, 1,862 were Xenopsylla cheopis and 974 were Xenopsylla brasiliensis, while 269 belonged to various other genera.

For the above determinations the Department is again indebted to the Chief Entomologist of the Agricultural Department, Mr. T. J. Anderson.

4. ANTI-PLAGUE MEASURES.

(*a*) GENERAL PROPAGANDA.

A sixteen-page pamphlet* on the subject of Rats and Plague was published during the year and widely distributed among settlers, missionaries, Government officials and others. Copies were also issued to those members of the Asiatic and African communities who might be likely to read English. The subject-matter of the pamphlet was also largely reproduced in the daily press and in a weekly agricultural journal. Later a translation in Kiswahili was published in the official publication of the Native Affairs Department "Habari," which has a wide circulation among natives in many parts of the country.

* "Rats in relation to disease with particular reference to Plague and its prevention and Eradication by the Prevention and Destruction of Rats." Health Pamphlet No. 1, Government Press, Nairobi, 1922.

(*b*) METHODS ADOPTED IN TOWNSHIPS.

Kisumu.—Trapping and hunting were carried on throughout the year and 7,562 rats were accounted for in this manner. In addition barium carbonate baits were laid weekly in the neighbourhood of the port.

All vessels of the Uganda Marine were claytonised quarterly with the holds empty, while lighters were claytonised monthly. All dhows other than those trading between ports on the Kavirondo Gulf, the condition of which was known, were claytonised on arrival after each voyage but with the cargo *in situ*. A large Clayton mounted on a barge is available for the above work.

All hides, cotton seed and grain were claytonised in closed trucks before proceeding down rail.

Nairobi.—Routine trapping and poisoning of rats were continued throughout the year. The total number trapped was 12,745 as against 27,529 in the previous year. The decrease in the number trapped may possibly be accounted for by the fact that poison baits (barium carbonate) were laid on a much more extensive scale in 1922 than in 1921. The figures for the two years are as follows:

1922.

Number of baits laid 665,263.
Number of dead rats found 3,352.
(i.e. one rat found dead per 198 baits set.)

1921.

Number of baits laid 39,566.
Number of dead rats found 243.
(i.e. one rat found dead per 162 baits set.)

It may safely be presumed that the number of rats poisoned was considerably in excess of the number found dead. A measure of great importance from the point of view of plague prevention was the demolition of 218 wattle and daub grass-roofed huts. It is hoped that during 1923 sufficient alternative and more sanitary housing will have become available to allow of the removal of all such grass-roofed huts as still remain within the Municipal area.

Mombasa.—The number of rats trapped during the year was 6,385 as against 5,465 in 1921.

Of the total number trapped:

2,678 were Rattus norvegicus.
3,707 „ Rattus rattus.
1,797 „ Males.
4,588 „ Females.

It had been intended to make a trial in Mombasa during 1922 of the Rodier system of reducing the rat population but it was felt that this should be preceded firstly by some attempt to estimate the present degree of infestation and secondly by a preliminary and intensive campaign on the usual lines. Press of work in other directions did not permit of the initiation of these projects, however, at any time during the year. The question of elaborating a method for the reduction of rats in a port such as Mombasa, either by routine measures spread over the year or by what might be termed catastrophic measures which could be called into play immediately the occasion might arise, is a matter of great importance and considerable difficulty; it is not of the nature of a side issue, and to evolve a satisfactory method will require a certain amount of research and preliminary experiment. It is hoped that it will be possible to devote the necessary time to this matter during 1923.

(c) METHODS ADOPTED IN NATIVE RESERVES.

(1) *Poisoning.*—This method has been largely used throughout the year, more particularly in the Kyambu and Fort-Hall districts where the Kikuyu population has strong prejudices against the dethatching of huts and where it has so far not been possible to have a general rat campaign carried out by the people themselves. When cases are notified the village or boma is visited either by a European Medical Officer or Sanitary Inspector, and after the huts in which cases have actually occurred have been deroofed and dealt with, mealie meal baits containing 3 grains of barium carbonate each are laid in all huts in the neighbourhood. The areas dealt with are usually about one or two square miles in extent and contain from one to two hundred huts. 15 baits are laid in each hut and left there. In no instance where the above procedure has been thoroughly carried out has there been any extension of the outbreak.

(2) MEASURES CARRIED OUT BY THE NATIVE POPULATIONS.

RAT DESTRUCTION CAMPAIGN IN CENTRAL AND NORTH KAVIRONDO DISTRICTS.

The rat destruction campaign which was inaugurated in the above districts in 1921, of which a detailed account was given in the Annual Medical Report for that year, was continued throughout 1922.

The method of conducting the campaign was in no wise different from that adopted in 1921. The people were instructed through their chiefs to kill as many domestic rats as possible and at the end of each month to send the tails of all rats destroyed to the chief of the location for transmission to the District Commissioner or Medical Officer for enumeration.

Tables showing the number of rats destroyed each month in each location are attached. In all cases the figures given are those of the number of tails actually sent in and counted under the direct supervision of an European officer. No rewards were given for rat destruction, and though in certain locations there was at times a certain amount of slackness, no great difficulty was experienced in obtaining the amount of destruction shown in these tables. For the present the figures given are chiefly of interest as indicating that under the circumstances which pertain in these districts, it has been possible to maintain a rat destruction campaign on a relatively large scale over a considerable period. That the campaign was maintained without payment or reward and without the engagement of special staff is a fact which is not without interest, which would perhaps be the more fully appreciated if it be noted that, had even so small a reward as two cents of a shilling been given for each rat caught, the year's catch would have involved Government in an expenditure of over £3,500, while if 3d. a rat (the reward offered in some other countries) had been given the amount expended would have been over £44,000.

EFFECTS OF THE RAT CAMPAIGN IN THE INCIDENCE OF PLAGUE.

In last year's report it was stated that "in the absence of detailed records of past outbreaks of plague in these districts, and particularly in the absence of information with regard to their seasonal incidence, it is not yet possible to

draw any conclusions as to the results of the campaign, and it is unlikely that it will be possible to do so until it has been in operation for some years." That statement still holds good, and though one might be tempted to correlate the small incidence of plague in 1922 as compared with the very considerable incidence in 1921 with the amount of rat-destruction which has been carried out, there is not, as yet, any justification for so doing. That such outbreaks as occurred were comparatively few in number and that none of them assumed any considerable proportions may, of course, have been due to the campaign. Of that however, there is as yet no proof. The important point which emerges is *that, in spite of the campaign, certain small outbreaks of human plague did occur, i.e., it has been proved that, in spite of the amount of rat-destruction which took place, the infection still persists either in the domestic rodents or elsewhere.*

In view of the above fact, it is possibly desirable to review the work which has been done and to consider now whether the campaign is being waged in such a fashion as may ultimately result in the achievement of the ends we have in view and, if it is not being so waged, whether the plan of campaign cannot be improved.

THE ENDS IN VIEW.

These are three in number.

(1) It is hoped so to train the people as communities in the destruction of rats that they will be in a position, under proper direction, to prevent any outbreaks of plague that may occur from attaining serious proportions.

(2) It is hoped to teach the individual that the prevention of the disease in his own hut or boma lies in his own hands and to convince him that it is worth his while always to be taking the steps necessary for such prevention.

(3) It is hoped that by intensive killing over a period of years either (*a*) all infected rats may be killed off, or (*b*) the rat population may be kept so low that all infected rats have an opportunity of dying off without propagating the infection and that, following on either or both of the above results, the infection may disappear from these districts. The achievement of this end is, of course, dependent on the infection being confined in these areas to domestic rodents alone.

The first of the above ends has probably been achieved in at least a few locations. The second has possibly been achieved in the case of a few individuals. More cannot be said, nor is it likely that much more will be possible till the natives of Africa come to put a higher value in their own potentialities than they do to-day. The third end in view—the elimination of the infection from the districts—has not so far been accomplished, and it is in consideration of this fact that it is particularly desirable to review the work which has been done and to ascertain, if possible, the effect which the campaign is having on the rat population and whether a more intensive campaign is necessary and, if necessary, possible.

THE EFFECT OF THE CAMPAIGN IN THE RAT POPULATION.

With the object of ascertaining the effect of the campaign on the rat population, a comparative analysis of the returns of destruction in 1921 and 1922 has been made and is given in the attached table (Table "I").

In considering this table, a few facts with regard to these districts must be borne in mind.

	Area.	*Population.*	*Number of Huts.*
North Kavirondo ...	2,669 sq. miles	295,846	98,965
Central Kavirondo ...	1,483 ,,	275,140	109,528
Total ...	4,152 sq. miles	570,986	208,493

The huts are in all cases wattle and daub structures thatched with grass.

Grain in considerable quantities is stored near every hut. The average rat population per hut in another part of the country where conditions are not unsimilar was, in 1921, found to be 15 rats per hut for 180 huts examined.

The problem of carrying out rat-destruction on a large scale over an area of 4,152 square miles is obviously one of considerable difficulty. The question arises: "Is the rat population being kept at a lower figure than was formerly the case?" A direct experiment is difficult to devise as the rat population of the district probably varies considerably, not only from time to time, but from area to area. At the first glance the results recorded in tables "G" and "H" seem reassuring, while the analysis given in table "I" show that, on the whole, destruction for the twelve months of 1922 has been less proportionately than for the last six months of 1921. This falling off might however, be due either entirely to one or other of the following causes or to some or all of them:—

(1) To there having been a falling off in the vigour with which the campaign was prosecuted.

(2) To the rats having become more wary or to an alteration having taken place either in their habits or their habitat.

(3) To there having been a reduction in the rat population consequent on the destruction carried out in the last six months of 1921.

It is possible that the first of these causes has operated to some extent if for no other reason than because the novelty had worn off. On the other hand, organisation has improved and the people have developed the technique of rat-catching, while the use of a native trap of their own devising and of remarkable efficiency has become fairly general throughout a number of the locations.

That the second cause has operated there is no evidence.

Against the third factor having yet come into play, there is a considerable amount of evidence. The rat population to-day may be considerably less than was formerly the case, but it would not appear that any falling off in the number of rats destroyed can possibly be accounted for by there being fewer rats available.

The largest number of rats killed per hut per six months in any location of either district for the period July to December, 1921, was 23·5, the figure reached in the South Ugenya location of Central Kavirondo, as against the average figure of 9·9 rats per hut over all the locations in the district over the same period. For the 12 months, January to December, 1922, the highest figure per hut was 35·5 again in South Ugenya, while the average over all locations was 17·1.

By six monthly periods the figures for South Ugenya are as follows:—

LOCATION OF SOUTH UGENYA.

Period.	Number of Rats killed.	Number of Rats per hut per six months.	
July to Dec., 1921 ...	44,927	23·5	= 35·5 per year.
Jan. to July, 1922 ...	43,405	22·6	
July to Dec., 1922 ...	24,553	12·8	

There are no notable differences between the location of South Ugenya and the rest of the district, and no reason is apparent why more rats should have been killed there than elsewhere, save that the chief of that location is a native of unusual intelligence and energy. Had the inhabitants of all the locations of both districts been as active as those of South Ugenya and killed rats to the extent of 35·5 per hut per year, the total rat-killing for the year should have been 7,387,017. But it was less than half that number, being only 3,575,202. It would, therefore, appear that 3,811,815 rats which might have been killed were left alive. 3,811,815 rats for the whole of the two districts equals 18 rats per hut, or more than the estimated normal rat population at any one time. Doubtless many of these 3,811,815 rats must have met a natural death during the year, but many also must have survived and produced offspring. Whatever, therefore, may have happened in South Ugenya, and it is possible that there the falling off in the third six monthly period was due to lack of rats to kill, it would appear that this cannot have been the case in the districts generally and that, so far as reducing the level of the rat population is concerned, the campaign has probably been without effect.

It would, therefore, seem that we are not yet killing enough rats appreciably to affect their numbers, which would appear to continue to be effectually limited chiefly by the available shelter and food supply. All that we are doing is to run through the generations a little quicker. In so doing, we may be accomplishing two things :—

(1) We may be eliminating the infested rats, or
(2) We may be eliminating an immune generation of rats.

If the first be accomplished the second is of little importance ; if the first be not accomplished we might be in a worse position than before the campaign started, were it not for the fact that the people are now in a better position to carry out at short notice an exceedingly intensive local campaign whenever they may be required to do so.

(d).—INOCULATION WITH HAFFKINE'S PROPHYLACTIC.

Prophylactic inoculation was carried out during the year as occasions required and 18,737 persons received injections. The use of this method was limited, however, to the protection of the inhabitants of infected huts and bomas and such of the inhabitants of the neighbourhood as might desire to avail themselves of the prophylactic.

The procedure is a popular one and in no instance was any difficulty experienced in securing the inoculation of all persons who were likely to be exposed to infection.

District inoculation on a large scale as was practiced in 1920 and 1921 was in no case attempted. It is the considered opinion of the Department that to carry out extensive prophylactic inoculation where radical and less expensive measures can readily be taken by the people themselves is an unjustifiable expenditure of public funds and not unlikely by inducing a sense of security not universally justified, to prevent the adoption and efficient execution of more radical but more troublesome measures and so to put off the day when the infection may perhaps be finally eradicated.

TABLE G.

RAT DESTRUCTION RETURN: NORTH KAVIRONDO AND NANDI RESERVES, 1922.

Location.	Chief.	Huts.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Total.	
			Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.
Wanga	Mumia ...	7,749	10,459	1·3	1,900	0·2	11,487	1·4	5,860	0·7	7,609	0·9	4,290	0·5	5,060	0·6	15,362	1·9	22,840	2·9	4,128	0·5	9,261	1·1	5,284	·6	103,540	13·4
Marama	Mulama ...	8,694	11,093	1·2	10,051	1·1	39,103	4·5	13,833	1·6	34,715	3·9	16,917	1·9	29,927	2·6	12,449	2·0	10,953	1·2	10,601	1·2	9,129	1·0	26,158	3·0	224,929	25·9
E. Kakamega ...	Osore ...	2,830	4,138	1·4	4,559	1·6	5,384	1·9	5,130	1·8	2,120	0·7	2,527	0·8	17,686	6·2	10,006	3·5	8,052	2·8	5,613	1·9	1,517	0·5	4,214	1·4	70,946	25·0
Watsotso ...	Wambani...	1,711	450	0·2	512	0·2	3,452	2·0	822	0·4	3,608	2·1	1,755	1·0	4,724	2·7	3,378	1·9	994	0·5	1,784	1·0	151	0·0	6,810	3·9	28,440	16·6
W. Kakamega ...	Mulimo ...	5,432	5,145	0·8	16,224	2·8	12,860	2·3	5,865	1·0	2,774	0·5	6,664	1·2	29,123	5·2	7,012	1·2	7,152	1·3	4,805	0·8	8,280	1·5	10,525	1·9	116,429	21·4
Mukulu	Ropando ...	1,643	1,570	0·9	1,377	0·8	2,545	1·5	...	...	3,264	1·9	877	0·5	5,327	3·2	1,821	1·1	...	...	650	0·3	...	...	...	...	17,431	10·6
Kakalelwa ...	N'dombi ...	1,782	...	...	700	0·3	2,563	1·4	...	...	1,958	1·0	4,127	2·3	3,976	2·2	3,874	2·1	2,984	1·6	2,200	1·2	1,130	0·6	1,450	·8	24,962	14·0
Kabarnet	Mwanza ...	3,037	3,747	1·2	2,600	0·8	23,582	7·7	...	...	8,589	2·8	...	...	6,951	2·2	3,826	1·2	2,428	0·7	4,621	1·5	3,227	1·0	4,540	1·4	64,111	21·1
N. Kitosh ...	Marunga ...	8,505	9,900	1·0	...	...	19,179	2·2	...	...	12,801	1·5	10,081	1·1	13,890	1·6	5,379	0·6	13,192	1·5	26,564	3·1	...	...	10,225	1·2	121,211	14·2
S. Kitosh ...	Sudi ...	7,017	22,982	3·2	3,044	0·4	21,013	2·9	10,007	1·4	13,269	1·8	14,916	2·1	23,153	3·2	11,827	1·6	36,206	5·1	14,026	1·9	4,070	0·5	15,043	2·1	189,556	27·0
Wamia	Kadakada..	6,261	3,803	0·6	920	0·1	12,687	2·0	1,470	0·2	19,713	3·1	9,143	1·4	4,860	0·7	1,758	0·2	12,272	1·9	6,599	1·0	...	...	...	...	73,225	11·7
Marwach ...	Oduya ...	4,599	7,195	1·3	10,194	2·2	16,115	3·5	8,899	1·9	10,249	2·2	4,050	0·8	4,717	1·0	1,332	0·2	18,514	4·0	9,774	2·1	...	...	...	...	91,039	19·8
Ohayo	Okwara ...	4,447	23,675	5·3	7,336	1·6	10,574	2·1	5,510	1·2	23,063	5·1	6,320	1·4	4,480	1·0	5,075	1·1	27,676	6·2	12,396	2·7	3,000	0·6	...	...	129,105	29·0
Waholo	Were ...	2,470	4,062	1·6	3,450	1·3	4,321	1·7	3,783	1·5	5,014	2·0	3,621	1·4	5,158	2·0	5,468	2·2	1,657	0·6	2,730	1·1	2,290	0·9	2,100	·8	43,654	17·6
Tiriki	Amiani ...	4,986	2,810	0·5	7,139	1·4	6,257	1·2	1,795	0·3	7,121	1·4	1,481	0·2	30,322	6·0	10,165	2·0	...	...	5,380	1·0	5,690	1·1	4,977	·9	83,137	16·7
S. Maragoli ...	M'nubi ...	6,853	16,428	2·3	12,055	1·7	19,807	2·8	7,300	1·0	9,445	1·3	14,370	2·0	35,894	5·2	14,498	2·1	22,461	3·4	14,230	2·0	20,965	3·0	...	...	187,453	27·4
Kisa	Kuta ...	1,725	2,218	1·2	8,091	4·6	2,500	1·4	2,886	1·6	2,393	1·3	1,390	0·8	10,892	6·3	2,940	1·7	1,580	0·9	9,030	5·2	4,294	2·4	2,560	1·4	50,774	29·4
N. Maragoli ...	Shivachi ...	9,232	8,845	0·9	3,464	0·3	14,572	1·5	4,699	0·5	39,376	4·2	15,926	1·7	68,128	7·3	25,587	2·7	24,121	2·6	19,490	2·1	18,417	1·9	28,351	3·0	270,976	29·4
Bunyore... ...	Songoro ...	9,484	10,063	1·0	15,290	1·6	14,041	1·4	9,321	0·9	11,916	1·2	58,185	5·1	25,875	2·7	27,185	2·8	5,717	0·6	17,053	1·7	15,429	1·6	17,623	1·8	227,698	24·0
Totals... ...	... ...	98,457	148,583	...	168,906	...	242,042	...	87,180	...	218,997	...	176,640	...	330,143	...	168,942	...	218,799	...	171,674	...	106,850	...	139,860		2,118,616	21·5

TABLE H.

RAT DESTRUCTION RETURN: CENTRAL KAVIRONDO DISTRICT, 1922.

Location.	Chief.	Huts.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Total.	
			Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.	Number of Rats.	Number per Hut.
Alego	Ngonga ...	13,169	21,800	1·7	15,200	1·2	1,010	0·1	14,637	1·1	20,494	1·6	3,000	0·2	16,250	1·2	30,790	2·3	23,060	1·8	15,521	1·2	19,970	1·5	8,060	0·6	189,792	14·5
Asembo	Odindo ...	5,465	17,800	3·2	10,857	2·0	1,660	0·3	3,000	0·5	4,410	0·8	7,165	1·3	8,300	1·5	4,760	0·9	5,379	1·0	5,660	1·0	4,350	0·8	8,610	1·5	81,951	15·0
N. Gem	Ogada ...	10,162	11,800	1·2	58,325	5·7	14,639	1·5	22,523	2·2	16,210	1·6	50,591	5·0	10,802	1·1	12,310	1·2	10,060	1·0	630	...	10,694	1·0	9,308	0·9	227,892	22·4
S. Gem	Ndeda ...	6,164	10,325	1·7	9,900	1·3	25,900	4·2	7,620	1·2	5,390	0·9	3,600	0·6	11,950	1·9	7,300	1·2	9,140	1·5	6,960	1·1	6,690	1·1	10,000	1·6	114,775	18·6
Kadimu	Okello ...	2,259	8,204	3·6	1,772	0·8	3,376	1·5	...	...	2,310	1·0	3,010	1·3	2,970	1·3	4,223	1·9	2,530	1·1	...	...	...	...	1,980	0·8	30,375	13·4
Kajulu	Awuor ...	2,638	1,927	0·7	1,954	0·7	...	...	...	...	...	...	826	0·3	530	0·2	1,967	0·7	2,878	1·1	...	...	3,000	1·1	3,510	1·3	16,592	6·3
Kano	Amimo ...	14,880	6,510	0·4	8,340	0·6	3,370	0·2	...	...	...	...	...	...	780	0·1	...	...	7,140	0·5	...	...	1,970	0·1	2,300	0·1	30,410	2·0
Kisumu	Johanna ...	5,578	3,170	0·6	4,891	0·9	5,620	1·0	4,570	0·8	2,880	0·5	5,570	1·0	3,830	0·7	3,972	0·7	6,517	1·2	16,666	2·9	12,610	2·2	11,425	2·0	81,721	14·7
Nyakatch ...	Kere ...	7,741	...	...	10,148	1·3	2,770	0·4	485	0·1	950	0·1	3,040	0·4	1,537	0·2	1,960	0·3	7,563	1.0	3,090	0·4	...	...	7,600	0·9	39,143	5·0
Sagam	Orawa ...	1,873	...	...	15,238	8·1	3,340	1·8	2,540	1·4	1,930	1·0	2,150	1·1	1,820	1·0	1,970	1.1	3,112	1·7	2,410	1·3	2,590	1·3	2,770	1·4	39,870	21·3
Sakwa	Alulu ...	4,635	28,178	6·1	970	0.2	1,442	0·3	...	...	...	...	11,519	2·5	1,480	0·3	680	0·1	5,035	1·1	2,520	0·5	2,800	0·6	6,071	1·3	60,695	13·0
Samia	Kadima ...	8,992	10,641	1·2	14,653	1·6	11,000	1·2	20,490	2·3	33,581	3·7	5,000	0·6	26,615	3·0	11,690	1·3	25,407	2·8	34,140	3·8	20,200	2·2	26,120	2·9	239,537	26·6
Seme	Oguk ...	10,148	1,033	0·1	8,980	0·9	3,418	0·3	...	...	...	...	3,580	0·4	5,530	0·5	3,150	0·3	3,800	0·4	...	...	15,910	1·5	8,290	0·8	53,691	5·3
N. Ugenya ...	Muganda ...	7,460	17,444	2·3	7,470	1·0	15,738	2·1	12,000	1·6	19,526	2·6	...	...	6,450	0·9	8,305	1·1	16,343	2·2	13,760	1·8	10,440	1·4	9,730	1·3	137,206	18·4
S. Ugenya ...	Mugenya ...	1,913	9,457	4·9	4,336	2·3	16,090	8·4	5,887	3·1	5,135	2·7	2,500	1·3	5,060	2·6	3,740	2·0	3,640	1·9	4,543	2·3	3,480	1·8	4,090	2·1	67,958	35·5
Uyoma	Moyi ...	4,181	4,654	1·1	1,660	0·4	1,200	0·3	1,721	0·4	1,060	0·3	3,062	0·7	2,263	0·5	1,488	0·4	3,916	0·9	3,120	0·7	...	...	5,060	1·2	29,204	7·0
Nyangori ...	Sonono ...	2,270	1,124	0·5	1,260	0·6	1,834	0·8	...	...	440	0·2	616	0·3	...	...	1,010	0·4	5,090	2·2	1,870	0·8	...	...	2,530	1·1	15,774	6·9
			154,067	...	175,954	...	112,407	...	95,473	...	114,316	...	105,229	...	106,167	...	99,315	...	140,610	...	110,890	...	114,704	...	127,454	...	1,456,586	13·3
Totals settled areas			3,982	...	5,307	...	17	...	...	...	...	...	...	...	137	...	67	...	73	...	...	...	...	...	...	...	9,583	...
Totals		109,528	158,049	...	181,261	...	112,424	..	95,473	...	114,316	...	105,229	...	106,304	...	99,382	...	140,683	...	110,890	...	114,704	...	127,454	...	1,466,169	...

TABLE I.

NORTH AND CENTRAL KAVIRONDO DISTRICTS.

Comparative Analysis of Rat Destruction Returns for 1921 and 1922.

	Year.	Total Number of Rats destroyed.	Average Number of Rats destroyed per hut for all locations.		Number of Times the Standard Figure of 5 rats per hut per month was attained or exceeded.			Largest average Figure per hut for any location for any one month.	Number of locations in which the figure of 10 rats per hut per 6 months or 20 rats per hut per year was attained or exceeded.	Largest Average Number of Rats per hut; (*a*) per 6 months, or (*b*) per year for any one location.
			Per 6 months.	Per Year.	Once in a location.	Twice in a location.	Three Times in a location.			
Central Kavirondo District.	(1) 1921. Six months only	983,387	9	18	6 times	Twice	...	8·2 rats	7	(*a*) 23·5 (or 47 per year).
	(2) 1922. Twelve months	1,456,586	...	13·3	5 times	Once	...	8·4 rats	4	(*b*) 35·5
	(3) Total for 18 months	2,439,973	...	...	11 times	3 times	...	8·4 rats	...	...
North Kavirondo District.	(4) 1921. Nine months only... ...	1,181,133	10·9	21·9	12 times	Twice	...	8·9 rats	10	(*a*) 18·3 (or 36·6 per year).
	Six months only	1,085,704	...	...	...	...	...	...	...	...
	(5) 1922. Twelve months	2,118,616	...	21·5	11 times	Once	Once	7·3 rats	10	(*b*) 29·4
	Total for 21 months	3,299,749	...	...	23 times	3 times	Once	8·9 rats	...	...
Total for 1922, both districts (lines 2 and 5) ...		3,575,202	...	17·1	16 times	Twice	Once	8·4 rats	14	35·5 (per year).

Number of Huts in North Kavirondo, 98,965.

Number of Huts in Central Kavirondo, 109,528.

The estimated population of North Kavirondo is 295,846.

The estimated population of Central Kavirondo is 275,140.

The average number of rats destroyed per head of the estimated population during the year 1922 was

Note a "Location" is a territorial division of a "District." Each Location is under the control of a Chief, and may contain anything from 1,600 to 14,000 huts. On an average each contains about 5,000 huts.

VI.—SMALL-POX.

No case of small-pox came to the notice of the Department as having occurred in the country during the year, and in spite of the fact that this disease has occurred to a greater or less degree in Zanzibar and the Tanganyika Territory between which countries and Mombasa there exists a continuous flow of passenger-traffic, no case was introduced.

VACCINATION.

57,246 vaccinations were performed during the year as against 58,909 in 1921.

Routine vaccination is carried out as follows:—

(*a*) In the case of all contract labour recruited and written on in the Nyanza Province and, as far as possible, in the case of all contract labour recruited or written on elsewhere.

(*b*) In the case of all admissions to the first class prisons and, as far as possible, to the second and third class prisons.

(*c*) In the case of all police and King's African Rifles recruits.

From time to time occasion is also taken to secure the vaccination of all the unvaccinated inhabitants, both official and unofficial, of the smaller Government stations.

There is some reason, therefore, to hope that a considerable proportion of the more itinerant sections of the population has been vaccinated.

Of the three larger towns, Kisumu may be said to be well protected both as to adults and children. In Nairobi and Mombasa it is probable that a considerable proportion of the adult male population has been vaccinated within recent years, though the females and children are largely unprotected.

During the past year, however, a certain amount of vaccination has been carried out among the women and children of Mombasa by the Nursing Sister attached to the Health Office in that town. It is hoped during 1923 to make the registration of births compulsory both in Nairobi and Mombasa and by that means gradually to secure the vaccination of the bulk of the population.

In Nairobi the establishment of a child welfare centre and dispensary in the new native location and the ultimate removal thereto of the majority of the native population will greatly facilitate the progress of vaccination in that town.

Of the populations in the Native Reserves, none can be said to be protected against small-pox even to a moderate extent, and a thorough vaccination of these populations and their subsequent maintenance in a well-vaccinated condition is one of the most important matters still to be undertaken by the Department.

For a number of reasons the above fact does not now, however, give rise to anxiety to the same extent as was the case a few years ago. During the past two years the performance of the operation has been confined either to Medical Officers, Assistant or Sub-Assistant Surgeons or to native vaccinators working under their immediate supervision, while great attention has been given to technique and most satisfactory lymph has been produced at the Laboratory. Septic arms or unduly severe reactions have, therefore, been of rare occurrence, and as a consequence the operation is not now held in dread as was once the case.

It is of interest to note that at Narok in the Masai Reserve, where all vaccination is carried out personally by the Medical Officer in charge, considerable numbers of Masai came voluntarily to the station for the specific purpose of being vaccinated.

Another fact which has a material bearing on the situation, which may be expected to make wholesale vaccination more possible in the future, is that owing to the phenomenal success which has followed the exhibition of Novarsenobillon in the treatment of yaws in all parts of the country and what many natives consider the equally phenomenal success of inoculation in the prevention of plague, European methods of treatment and prophylaxis have recently acquired a very greatly increased prestige among these communities.

It is not unlikely, therefore, that during the next few years it will be possible—should sufficient staff be available—gradually to protect at least the more accessible of the native populations and that effective action in an emergency is now for the first time a possibility.

Many details of interest and importance in connection with the preparation of lymph and the results of vaccination in Kenya will be found in the Bacteriologist's report for the current year.

VII.—CEREBRO-SPINAL FEVER.

28 cases with 19 deaths came to notice during the year, as compared with 71 cases and 41 deaths in 1921. The majority of the cases were treated either at Kisumu or Nairobi. The incident was distributed throughout the year and nothing in the nature of a definite outbreak occurred.

VIII.—ANTHRAX.

Anthrax is met with in all parts of the country with the exception of the coast, and it is noteworthy that, in spite of the large numbers of hides which are exported from Mombasa, cases do not come under notice from that area.

In November an outbreak of some size associated with an increased mortality in cattle occurred in the Embu district, and 34 cases were detected.

The fact that among many of the tribes a hopelessly diseased beast is immediately slaughtered for food fully explains the incidence of anthrax.

It has been remarked in previous reports that anthrax in this country is a mild disease, as compared with that met with in England, and there has been no reason to vary this statement.

IX.—INFLUENZA.

Outbreaks of influenza occurred from time to time all over the country, more particularly in the early part of the year. Mombasa, Nairobi and the Uasin Gishu Railway area appeared to be more severely affected possibly than other districts.

The disease was generally of a mild type, though it probably had a considerable influence on the number of cases of pneumonia which occurred among the labour employed on the construction of the Uasin Gishu Railway.

X.—PNEUMONIA.

Pneumonia continues to form a large proportion of the cases of acute disease admitted to the native hospitals.

The figures for the past three years are :—

	Cases.	Deaths.
1922	986	241
1921	1,233	254
1920	1,230	286

No information is as yet available as to the groups of pneumococci which occur locally, and no trial has been made of the method of anti-pneumococcal vaccination as practised in the mines in South Africa. A proposal was put forward that labour employed on the Uasin Gishu Railway construction should be protected by anti-pneumococcal vaccination but in view of the large numbers of short term labourers which were being employed at the time, the suggestion was not pressed. Had the condition which obtained at first of employing only long term contract labour been maintained, Government would probably have adopted the suggestion.

XI.—THE ENTERIC GROUP.

Thirty-eight cases with 4 deaths were treated in Government Hospitals as against 42 cases with 6 deaths in 1921. Of the above cases 24 occurred among Europeans. Seventeen of these cases were treated at the European Hospital, Nairobi, the incidence was spread over the year, and it was not possible to attribute the infection in these cases to any one specific insanitary condition.

In addition to the above, a number of cases occurred during an outbreak of dysentery among native labourers employed at Lake Magadi. On investigation obvious sanitary defects were found. These were rectified by the Company concerned immediately on being brought to notice.

XII.—TYPHUS.

Three cases of what were clinically the typhus-like disease of the country came under notice during the year ; of these one only was treated in Hospital. All cases recovered. The reactions with Bacillus X 19 were negative. Guinea pigs were inoculated with blood from one case and taken to Ireland in the hope that opportunity might occur of testing the reaction of these against blood from an undoubted case of typhus. The opportunity unfortunately did not present itself.

XIII.—DYSENTERY.

During the year 534 cases of dysentery were treated as in-patients at the various hospitals and dispensaries and 72 deaths occurred. The records show that no outbreak of any magnitude came under notice in the Native Reserves and the disease during the year appeared to be chiefly confined to the settled areas.

A considerable outbreak, over 200 cases, associated with enteric, occurred among the employees of the Magadi Soda Company at Magadi Lake and was caused undoubtedly by certain sanitary deficiencies which were at once rectified on being pointed out to the Company's Manager and Medical Officer. The incidence of the disease rapidly decreased on sanitary improvements being effected and subsequently disappeared but recurred in a smaller outbreak later in the year when the general sanitation was satisfactory. The recurrence appeared to have a commensal origin and it is, therefore, possible that, until

the native habit of feeding from a common cooking pot is changed, such outbreaks are liable to occur, even though the sanitary condition may be otherwise satisfactory.

The only other outbreak of any size which came under notice during the year was one in connection with the labour employed on the Kilindini Harbour Works. The first case occurred in July and thereafter until the end of the year roughly 25 cases per month came under notice, totalling on December 31st, 124 in all with 11 deaths. The outbreak ceased shortly afterwards. It was difficult to state what was the origin of the infection. The first few cases occurred in labourers who had been in the camp for some weeks and in December a fresh infection seems to have been introduced by the arrival of new labour suffering from dysentery. The type of the disease was, on the whole, mild but was prone to run a long course and several cases died between four to six weeks after the beginning of the attack.

In Nairobi 93 cases were admitted to hospital, with 18 deaths and 36 cases with one death occurred at the Nairobi gaol.

The outbreaks at Magadi and Kilindini were entirely of bacillary origin, as were the cases at the Nairobi gaol.

The returns from the Laboratory show that out of a total number of 496 specimens of fæces examined for all causes amœbæ were found in 34 only and out of 109 cases cultured the Flexner bacillus was isolated once only and the Shiga bacillus also once only.

XIV.—UNDULANT FEVER.

For the first time the presence of undulant fever has been definitely proved in the country, though it has long been suspected that such existed. In view of the fact that the disease occurs both in Uganda and the Soudan, it is perhaps not surprising that it should be found in this country as well. In all, four cases, all natives, were detected and the diagnoses were confirmed in the Laboratory. Two cases, the first diagnosed and confirmed, were askaris of the 3rd King's African Rifles who were stationed at Moyale in the Northern Frontier District and who both died, though the Medical Officer was of opinion that the mental effect of the departure of the rest of the battalion had a great deal to do with the fatal termination and but for this both might have recovered. One case was detected by the Sub-Assistant Surgeon at Kitui. The patient was an Mkamba resident in Kitui, who was in the habit of travelling about the country; he was admitted to hospital at the beginning of December and remained at the end of the year. The remaining case occurred at Fort-Hall and the patient was a Kavirondo who had been working in that district. The duration of the disease was six weeks in the last case and recovery ensued.

It is probable that the disease has existed for a long time in the country, and this is suggested by the wide-spread distribution of the cases which have been detected.

XV.—MALARIA.

This disease is found practically throughout the country. On the coast, in the neighbourhood of the Victoria Nyanza and in the warmer and more sheltered parts of the Highlands it undoubtedly gives rise to a large amount of sickness and debility both among natives and Europeans.

The rainfull during 1922 was considerable and prolonged and showed a marked contrast to the comparative drought of 1921 and the light rain of 1920. As a result of the heavy and prolonged rains, malaria showed itself in an increased amount in areas in which it usually occurs, while there appeared to be

considerable spread in localities which had previously not been affected to any extent. In come cases in the neighbourhood of Thika and Kyambu there was a serious dislocation of the work on farms owing to prevalence of malaria among the labour employed.

The total number of cases returned as malaria is 20,581 and this, though a large increase over the numbers of 1921, does not represent an increase in the admission ratio of malaria to other diseases and indicates that a greater value attaches to the figures. The type of malaria most frequently met with on the coast is the benign tertian, while sub-tertian is the commonest in the Highlands and the reports from the Northern Frontier Districts indicate that the quartan parasite is predominant in that area.

In the North Kavirondo Native Reserves a large amount of work was carried out by officers of the Administration in draining many of the large swamps which occur in the valleys in that district. Primarily this work was instituted with the object of preventing mosquito breeding, but so valuable has the reclaimed land proved to be for agricultural purposes that the work is likely to be continued if only on this account.

This course of action is one which has great potentialities and its application particularly in parts of some of the more malarious of the Highlands, such as the valleys in the Fort-Hall and Kyambu districts might be attended with most beneficial results.

In Kisumu Township a very large amount of reclamation work was carried out during the year by the Health Office staff. The clearing of papyrus from the lake shore in front of the town was completed, while most of the swamps in the vicinity of the town were efficiently drained. As a result of both of the above measures much valuable land was brought under cultivation and, it is hoped, will be maintained in a comparatively well-drained condition for that purpose without further expense to the public. For much assistance in the above work the Department is indebted to the Administrative Officers of the Township and the surrounding district.

A list of the mosquitoes bred out from the larvæ obtained during the course of the work at Kisumu will be found in Appendix "D" at the end of this report.

The following figures showing the deaths notified as due to malaria for the past six years in Kisumu is not without interest, in view of the work which has been carried out there :—

Year.	Deaths notified as due to Malaria.
1917	30
1918	18
1919	16
1920	13
1921	12
1922	2

In the Township of Mombasa, which has a population of about 40,000, 96 deaths were returned as having been due to malaria. As the great majority of these cases, however, were not seen by a medical practicioner, no great value can be attached to them. More useful information is to be obtained from the figures supplied by the Medical Officers attached to the European and Native Hospitals, which are as follows :—

248 cases in Europeans came to notice, of these 87 were treated in Hospital and 2 died.

1,713 cases in Natives came to notice, of which 628 were treated in Hospital and 1 died.

The death-rate for 1,961 cases in Mombasa seen by an offier of the medical staff is, therefore, 0·15 %. Undoubtedly, however, the figure was higher than this, as but few of these cases were diagnosed microscopically. Nevertheless, the fact that only three deaths occurred among 1,961 persons with symptoms pointing to malaria suggests that at least a considerable number of the remaining 93 deaths which were reported were not the result of this disease.

On the Island of Mombasa there is only one anopheline breeding ground of importance—a large swamp in the neighbourhood of Kilindini. Were this area to be adequately drained, there is reason to expect that indigenous cases of the disease would cease to occur on the Island. It is proposed if the necessary financial provision can be made, to carry out the drainage of this swamp during 1923.

It is greatly to be regretted that the lack of an Entomologist still prevents anti-malarial work being carried out in a scientific manner and under expert advice.

XVI.—BLACKWATER FEVER.

14 cases occurring in Europeans, of whom 3 died, and 25 cases among natives and Asiatics with 7 deaths, were treated by Government Medical Officers, as against totals for all races of 28 and 5, 13 and 4, and 47 and 21 in the years 1921, 1920 and 1919 respectively. The incidence was most noticeable on the Coast, and though it is impossible to say that all the patients who became ill in Mombasa or Kilindini had suffered from the malaria contacted in the Island, the yearly occurrence of the disease in residents and particularly in persons resident near the only large anopheline breeding ground in the Island renders it not improbable that were this swamp to be dealt with, a marked improvement in the health of the inhabitants would result.

XVII.—TRYPANOSOMIASIS.

25 cases were treated at Government Hospitals and of these 2 died.

A number of the above cases received the treatment recommended by Marshall and Valsallo, but it is too early yet to arrive at a conclusion as to the results.

No special investigations were carried out during the year and no large works in the way of clearing were instituted. The known infected areas were, however, as far as possible kept under observation, and from the neighbourhood of the Meriu River in South Kavirondo the inhabitants of a number of infected bomas were removed to a tsetse-free area, while arrangements were made to keep the neighbourhood of the ford through the river clear of bush. There is no evidence that any material alteration has taken place with regard to the incidence of the disease during the year.

XVIII.—RELAPSING FEVER.

In all, 42 cases of relapsing fever were reported from the following stations :—

Fort-Hall	18
Embu	3
Chuka	6
Nairobi	9
Kitui	4
Machakos	1

with one doubtful European case at the European Hospital, Nairobi.

The cases which came under observation at Nairobi were police askaris who had been quartered in the Fort-Hall district, and the infection appeared to have been contracted either at Thika, where the huts were found to be infested with Ornithodorus moubata, or at a minor post between Thika and Fort-Hall, where infestation was also present. It is not altogether impossible that infection might have been acquired in Fort-Hall itself where several cases occurred among tribal retainers housed in tick infested lines, though the actual police huts at that place were free. It will be noted from the foregoing and from the table of localities, that a number of the places from which cases of spirillum fever have been reported form a chain along the Thika-Meru road. No cases came under observation from Meru itself during 1922, though such were reported in previous years. Investigation of conditions along the line, from which cases of spirillum fever were reported, revealed the presence of infestation by Ornithodorus moubata in the various rest camps along the road. All infested camps, askaris huts and tribal retainers' lines were burnt and rebuilt where necessary. The Machakos and Kitui areas from each of which cases were reported are comparatively close to the region traversed by the Thika-Meru road and are both Ornithodorus areas.

XIX.—LEISHMANIASIS.

No cases of Kala Azar were reported during the year, though the Medical Officer in charge of the Northern Frontier District states that while travelling he saw one suspicious case but the circumstances were such that no investigation could be made. The Medical Officer, Northern Jubaland, reports that dermal leishmaniasis is common and that he has identified the Leishman-Denovan bodies in scrapings.

XX.—HELMINTHIASIS.

During the past two years careful investigations have been carried out with regard to the degree of helminthic infection occurring at the following places :—

(*a*) Kakamega in the Nyanza Province.

(*b*) Chuka in the Kikuyu Province.

(*c*) Kismayu in the Jubaland Province.

That is to say, small specimen populations have been examined in the Lake area, in the Highlands and on the Coast.

From 60 to 80 % of the persons constituting these populations were found to be infected with one or more kinds of helminth. The proportion infected with ancylostomes was greater on the Coast than in the Highlands or in the Lake area and except for those so infected few persons appeared to show obvious symptoms of disease, and even those who harboured ancylostomes were only in a few cases seriously ill.

With regard to certain areas on the Coast which have not yet been carefully investigated, there is still some suspicion that ancylostomiasis may be responsible for a considerable amount of ill-health but that the infection is responsible for any large degree of morbidity elsewhere would appear to be doubtful.

IV.—NATIVE LABOUR.

(A) CONTRACT LABOUR.

(1) *Recruiting and Housing and Inspection of Recruits.*—The chief labour recruiting field of the Colony is in the Kavirondo districts of the Nyanza Province. The centre of the business is Kisumu. Most of the recruiters own small camps at various points in the district and larger camps in Kisumu. The former are inspected by District Commissioners and District Medical Officers as opportunity serves, but as they are frequently out of commission for varying periods, their condition is not always very satisfactory. The larger camps in Kisumu, on the other hand, being practically always in use and being immediately under the eye of the Medical Officer of Health of that town, are kept in very good condition. A great deal of attention has been devoted to these camps during the past two years, they are now well laid out, the buildings are either of sun dried brick or corrugated iron and latrines have been provided; they are constantly inspected and are kept in a sanitary condition. Under the Master and Servants' Ordinances 1910-18, all labour recruited by a labour agent must be inspected as to its physical condition by a Government Medical Officer before a contract may be registered. This examination is carried out by the Medical Officer, Kisumu, and the recruits are vaccinated at the same time. The following table shows the number of recruits who were examined, passed fit or rejected for various kinds of work at the Kisumu Health Office during the twelve months—January to December, 1922. Considerable numbers of recruits were also vaccinated and passed or rejected at other stations but the returns are not yet to hand:—

TABLE J.

LABOUR EXAMINED AND VACCINATED AT KISUMU DURING 1922.

Month.	Railway and Pier Construction.		Magadi Soda Company.		Fuel Cutting.		General Labour.		Total.
	Passed.	Rejected.	Passed.	Rejected.	Passed.	Rejected.	Passed.	Rejected.	
January	1,188	427	118	11	49	23	521	162	2,514
February	1,148	360	105	21	49	12	513	98	2,320
March	1,274	301	134	36	123	28	1,151	309	3,394
April	753	215	70	26	31	12	687	302	2,131
May	449	186	137	86	20	17	543	259	1,756
June	55	19	14	8	6	—	203	111	410
July	142	43	60	28	21	4	256	98	658
August	190	72	62	31	42	17	459	149	1,047
September ...	228	86	48	1	64	8	508	139	1,047
October	102	56	71	8	13	16	542	131	947
November ...	121	31	56	9	18	12	410	82	665
December ...	146	35	31	9	96	23	591	118	1,049
Totals ..	5,796	1,831	906	264	532	172	6,384	1,958	17,083

(2) *Inspection of the Sanitary conditions under which Native Labour is employed.*—(a) *On farms and plantations,* (b) *on larger works, e.g., the Kilindini Pier construction, the Magadi Soda Works, flax factories, etc., and medical arrangements in connection therewith.*

All farms, plantations and works receive attention from the Labour Inspectors of the Department of Native Affairs and a marked improvement is taking place both with regard to the housing and feeding of labour. It has not so far been possible for the Medical Department to give as much attention as is required to conditions on farms and plantations but the conditions under which the labour force is employed on the Kilindini pier construction have received constant attention and have been on the whole satisfactory, while the works at Lake Magadi were visited on three occasions during the year.

A number of flax factories were also visited during the year, and though the conditions did not always appear satisfactory, no evidence was forthcoming that they were deleterious to the health of the workers. These factories will, however, require to be kept under observation.

The question of securing adequate medical attendance and sufficient hospital accommodation for labour in farming areas and on large plantations is one to which a satisfactory solution has not yet been found. With the development of a more stable condition of industry and of trade generally, the provision of more suitable arrangements than exist at present should not be impossible.

(B)—LABOUR EMPLOYED IN TOWNSHIPS: CASUAL LABOUR.

Though the bulk of the labour employed in towns is engaged by the month and but few, with the exception of dock labourers at Kilindini, are employed by the day, the majority of the unskilled natives working in these towns come within the category of "casual labour." The solution of the problems presented in connection with the provision of housing for these people and the improvement of the sanitary condition of the premises in which they work, occupy no small part of the time of the Medical Officers of Health and the European Sanitary Inspectors at Nairobi and Mombasa. That these problems are at present receiving a great deal of attention will be gathered from a perusal of the extracts from the reports of these officers which are given in the Sanitation Section of this Report. The need for adequate housing for this class of labour is particularly pressing in Nairobi and is still by far the most urgent matter at present before the Municipality. It is most earnestly to be hoped that before the end of 1923 some scheme for providing decent and sanitary accommodation for this section of the community on a large scale will, to some extent at least, have been carried into effect.

(C)—LABOUR EMPLOYED ON RAILWAY CONSTRUCTION.

UASIN GISHU RAILWAY CONSTRUCTION.

The Medical arrangements in connection with the Uasin Gishu Railway Construction and the health of the labour employed thereon has been a source of considerable anxiety during the year.

The original draft contract laid it down that the Medical side of the work was to be carried out by Government but the agreement as signed rendered the contractors the executive authority for providing medical attendance, etc., with the Medical Department as advisers. It is true that the terms are mandatory as regards the acceptance by the contractors of instructions given by the medical Department but there can be no doubt that the first is the preferable arrangement. The result of the whole medical staff being servants of the contractors and not of the Government was that they had no powers at all under the Masters and Servants Ordinance and that any suggestions which they wished to put forward had to be submitted through the Contractor's Agent to the Chief Engineer, Construction and Survey of Railways, for his approval, while any suggestions of the Medical Department had to be submitted to the Chief Engineer, who, if he approved, passed orders to the Agent and so on.

The sum apportioned for medical and sanitation purposes in the original estimate for the construction of the Railway was £17,059 out of a total of £1,923,598 or 0·83 per cent. and the staff allowed was :—

Medical Officer	1
Hospital Assistant (Indian)	2
Indian Compounders	2
Assistant Surgeons (Asiatic)	2
Clerk (Asiatic)	1
Menials	20

and this for an expected labour strength of at least 10,000 spread over as much as 70 miles of country.

The route followed by the line runs in a circuitous fashion from Nakuru, 6,070 feet, through broken hilly and thickly wooded country reaching to an altitude of over 9,000 feet and then dropping to the Uasin Gishu Plateau, Eldoret 6,868 feet and Turbo 5,925 feet. At the higher altitudes the nights are extremely cold and the rainfall heavy while during the greater part of the year very heavy cold showers occur. The route more or less closely follows existing roads, with the exception of the section from mile 26 to mile 42 where it branches away through very rough forest country where the work of construction is very heavy and the only means of approach is by mule or horse. A road of approach was later constructed to gain access to mile 37½, where a small township for European employees was constructed. In the wet weather the roads become impassable.

The method of construction followed is by means of sub-contracts for varying lengths of earthworks to as many sub-contractors as are available with the result, already indicated, that work proceeds over a distance of as much as 70 miles at one time.

Prior to the commencement of work the Contractor's Agents were communicated with on more than one occasion and asked as to the medical arrangements to be made, but no information was forthcoming.

Application was made by the contractors at the latter end of 1921 for the seconding of the most recently joined medical officer to act as Medical Officer in charge but it was not considered that an officer of a few weeks' experience would be suitable and inquiries were made as to whether more senior officers would consent to be seconded, but none were forthcoming. Finally a local medical man was engaged.

Work was begun in the early part of the year, though the Medical Department was not informed as to the details of this, the first intimation being a telegram from the Senior Medical Officer, Nakuru, that he had been refused permission to inspect camps.

In March it was quite evident that things were not as they should be and inspection revealed that the medical arrangements were totally inadequate. The conditions which existed were shortly as follows :—

Work was proceeding and 34 camps were in existence over the first 70 miles of the route, while the labour strength approximated 4,500. The Medical Officer was stationed at Nakuru and had no means of transport being dependent on the good will of the Contractor's Agent for the use of a motor car when such was available. The Hospital accommodation consisted of a small hospital at mile 5 sufficient for 30 cases, while at mile 27 was a so-called hospital of three native huts in which patients lay on the ground and at mile 45 was a small wooden building of 26′ x 20′. It is only fair to state that accommodation was being provided at mile 27 for 30 cases. The medical and surgical equipment was hopelessly inadequate and consisted of a small stock which had been issued on loan from the Medical Store, while splints, operative appliances and laboratory materials were non-existent. There was no provision for the transport of sick. In addition to the medical officer the staff consisted of three compounders, one at least of whom was exceedingly ignorant. There was no evidence of any scheme for dealing with emergencies, for requirements then present, to be expected in the future, or for the necessary inspection of camps. Labour was being received in large numbers at Nakuru and the accommodation available was inadequate or badly managed, as large gangs had no shelter at all.

It was fortunately possible to detach a Senior Medical Officer, Dr. C. J. Wilson, to take charge of the medical arrangements and additional staff was cabled for to England, bringing the strength, with new local engagements, up to :—

Medical Officers	2
Orderlies (ex. R.A.M.C. N.C.O.'s)	5
Sanitation Supervisors	3
Hospital Assistants (Asiatic)	2
Dispenser	1
Store-keeper	1

A number of trained native attendants were also obtained from Uganda.

A scheme for the provision of hospitals was drawn up and put into execution by which the existing accommodation at mile 5 and mile 27 was increased to 50 beds, while a large main hospital of 100 beds at mile 53 was erected, with others at Londiani (60 beds), through which, after a few weeks, all the labour was received and repatriated, at Sabatia mile 37½ (25 beds), Narasha mile 74 (50 beds) and later in the year at mile 90. Considerable difficulties connected with transport occurred in the erection of the various hospitals and at times the number of patients was greater than the number for which accommodation was provided.

Detailed instructions were issued to all contractors with regard to the sanitation of camps and the sanitation supervisors were detailed to sections of the line as sanitary inspectors, their duty being to report sanitary defects to the Medical Officers.

By June the contractor's new Medical Officer arrived and took over charge but things remained unsatisfactory in that the Medical Officers were not stationed on the actual scene of construction. In September the new Medical Officer resigned his post and proposals were then made that the Medical Department should become responsible in fact, as well as in name, for the medical work in connection with construction. The proposals were agreed to and two Government Medical Officers were posted to take charge.

Is was obvious from conditions generally, that the majority of the work of attending the patients had to be undertaken by the subordinate members of the staff, the Medical Officers confining themselves chiefly to the prevention of disease and giving particular attention to the question of camp sanitation, the physique of labour and the clothing, feeding and housing thereof. For the foregoing the question of transport is all important and this has always proved a difficult matter, being as it is outside the direct control of the Department.

Labour.—For the first few months the great majority of the native labour force was obtained from the Kavirondo districts of the Nyanza province. These natives were engaged for the Contractors by labour agents stationed in the districts and were written on in each case for six months. This labour was then drafted out by the Contractors to the various sub-contractors. As is customary in the case of all labour engaged on contract by labour agents, these natives were in all instances carefully inspected by a Medical Officer before leaving the district where they were recruited, and though all came from a much warmer part of the country than that in which they were required to work, these Kavirondo withstood the rigorous conditions of construction remarkably well.

A small amount of labour was also brought from some of the less usual recruiting fields in the country, such as the highlands of the Kenya Province, but proved on the whole to be unsatisfactory, in spite of the fact that it came from fairly cool districts. Partly this was due to the fact that since labour recruiting is not a business in these areas the Officers by whom this labour was passed were less skilled in the examination of recruits than the Medical Officers in Kavirondo, partly it was due to the fact that the male natives of the Kenya Province are much slighter physically than the Kavirondo and probably also less accustomed to hard work.

A certain amount of labour was, in April, imported from the Tanganyika Territory but this was not found to be satisfactory either as regards physique or as regards its powers of resistance to respiratory infections. Many of the Tanganyika labourers fell sick very shortly after their arrival in this country and the mortality among them was very considerably greater than among the Kavirondo.

Later in the year the system of using contract labour recruited in the districts by labour agents and drafted out to the sub-contractors by the contractors-in-chief fell to some extent into disuse and the labour supply was thereafter kept up by one of the two following methods:—

(*a*) The sub-contractor engaged a partner who devoted most of his time to labour recruiting or the sub-contractor entered into partnership with a professional labour recruiter, who then became an employer.

(*b*) The sub-contractor relied on being able to supply himself with sufficient labour from those natives who might come to him looking for work.

Natives engaged in either of the above fashions are not required by law to be medically examined but as the Medical Officers on the construction were, by the time these methods came into vogue, Government Medical Officers, a safeguard was established by the fact that as such they were empowered by law to require the repatriation at the employer's expense or of any sick native or of any native unlikely to recover his health or of any native under the age of 16.

Partly the above change took place in order to avoid recruiting fees, partly it was due to the fact that work on the construction was not apparently entirely without attraction for a certain number of the native population.

That this alteration was not in all respects satisfactory is certainly true but as an offset to its disadvantages there may be placed the fact that where an employer himself engages native labour he is, at least in some cases, aware that it is not in his own interest to engage any but fit men or to retain in his employ those who are likely frequently to be in the sick list.

The housing of labour has been generally satisfactory and the sites of camps well chosen.

The rations issued are officially laid down as :—

Mealie meal, 2 lbs. daily.
Choroko (a small bean), 1 lb. weekly.
Dried fish, one ration weekly.

The issue of dried fish was not generally continued but, as the work progressed, sub-contractors recognised that the provision of an ample diet was a business proposition and a minimum of one meat ration a week became the general rule. One sub-contractor, at least, instituted a system by which payment for work over and above the daily task was made partly in meat. Butchers' shops were also instituted at which labour could purchase meat to supplement the ration.

Clothing.—The clothing issued consisted of two blankets per man, but there is no doubt that in many cases one of these was either sold or sent to the labourer's home. In the higher and bleaker part of the route the contractors were instructed to issue jerseys to the labour and this was done, but not till the colder and wetter part of the year was finished. Some of the sub-contractors issued an extra garment in the shape of a sack with holes for the head and arms, a very good type of garment, while one at least provided shorts and jumpers.

Sickness and Mortality.—As was to be expected, the chief cause of sickness was lung disease due to the extreme cold experienced at the high altitudes. Dysentery and bowel complaints were comparatively rare. Influenza was present more or less throughout the year and, doubtless, added very considerably to the total incidence of pneumonia, which was the chief cause of mortality. Deficiency diseases were not very evident, cases of scurvy or beriberi being rare (only six altogether were reported), but it is a matter for consideration as to whether a diet conforming more to physiological requirements might not have reduced the mortality. It is possible, though actual deficiency diseases were rare, that a proportion of the labour was on the verge of these and that in consequence the general bodily resistance was diminished. It is interesting to note that the sub-contractor already referred to as largely supplementing the rations only had one death up to the end of July among a large number of labourers. It is to be remembered that it was not possible for a large part of the year for the labourer to supplement the rations given him. The more serious epidemic diseases were, fortunately, practically absent, a few cases of cerebro-spinal-miningitis occurred, but small-pox and plague were entirely absent.

From the figures supplied by the Native Affairs Department the total number of deaths which occurred during the year amounted to 436, which works out at 46 per 1,000 per annum.

Of the above total of 436, 98 deaths are returned as of unknown cause and may be taken as having occurred outside hospital. Of the remaining 338, 205 are due to respiratory diseases, of which 183 are pneumonia. Influenza is given as the cause of death in 15 cases. Dysentery and diarrhœa account for 33 and 11 deaths respectively.

The hospital returns are only complete for the last six months of the year and show that during that period there were 2,892 admissions to hospital. The monthly admissions and the labour strengths are shown below :—

	Admissions.	*Labour strength.*
July	605	13,500
August	329	13,500
September ...	501	13,500
October	453	13,400
November ...	520	15,700
December ...	484	12,815

Analysis of the cause of admission shows that respiratory disease formed the largest group with a total of 822, of which pneumonia accounted for 279 and bronchitis 461, while 80 are labelled "cough." Dysentery and diarrhœa show totals of 68 and 117. Only 14 cases of cerebro-spinal-meningitis were admitted in all.

It may be commented that the number of deaths occurring out of hospital is unduly large, but the peculiar difficulties which exist should not be forgotten. Transport during a rainy season such as was experienced in 1922 was at times impossible, while a large proportion of the labour was uncivilized to a degree and very shy of reporting sick or of going to hospital. Many cases of sickness when discovered were too bad to be sent to hospital, sometimes a considerable distance, while others having been told to go to hospital either absconded or concealed themselves in the bush or in their huts.

Many lessons have been learnt from the experience gained during the past year in connection with the Uasin Gishu Railway Construction which cannot fail to be of great use in connection with future undertakings of the same kind. One point is especially prominent, and that is that the whole of the responsibility for the medical arrangements in connection with future railway construction should be in the hands of the Medical Department. A division of responsibility between the Contractors and the Medical Department has shown itself to be eminently unsatisfactory. The medical arrangements for an undertaking of the magnitude of an important railway construction should be as carefully thought out and arranged beforehand as the engineering details. Hospitals, which may be of a most temporary nature, should be ready before labour is drafted to the scene of operations and the same remark applies to the accommodation for the gangs, while details as to clothing and feeding should be laid down in advance of commencement of the work.

V.—MEAT AND FOOD INSPECTION AND CONTROL.

(A) SLAUGHTER HOUSES.

(1) *Kisumu.*—The daily inspection of carcasses at the slaughter house was carried out throughout the year by the European Sanitary Inspector attached to the Health Office. A large percentage of the cattle slaughtered were found to be infected with the cysticercus bovis. That this should be so is hardly surprising in view of the fact that these cattle come from a reserve where there is a comparatively dense population and where sanitation is unknown.

For the first two quarters of the year all infected carcasses were destroyed, but as there was no diminution in the number of infected animals brought to slaughter and undoubted hardship was being caused, arrangements were then made for the thorough sterilization by boiling of all infected meat.

The sterilizing is carried out under the supervision of the Health Office and there is a ready sale for the boiled beef.

722 oxen were slaughtered during the year and of these 151 were condemned.

A new slaughter house is required at Kisumu, the present structure being both inadequate and beyond repair.

(2) *Nairobi.*—All animals are slaughtered at the Municipal Slaughter House in the Town or at the slaughter house at Mbagathi which, though it is situated about seven miles outside Nairobi, is under municipal control. The distance which separates these slaughter houses renders inspection, supervision and control difficult and expensive. It is to be hoped that in the near future the Municipality will seriously consider the desirability of erecting one modern central slaughter house which should be situated somewhere in the neighbourhood of the offensive factory sites. If this scheme were adopted a marked improvement in the control of the meat supply of the town would immediately follow.

During the year 225 oxen, 81 sheep and goats, and 10 pigs were condemned. In addition 3,328 pounds of meat were seized at the Market or on butchers' premises in the town and condemned as unfit for human consumption.

(3) *Mombasa.*—The accommodation for slaughtering is exceedingly inadequate and as there is no room for hanging and cooling, slaughtering has to take place from 3 a.m. onwards. As a consequence it is impossible to ensure that all meat is seen. A new slaughter house where animals can be killed in the late afternoon and evening, properly dressed and hung over-night under fly-proof conditions is required. It would then be possible to ensure that no meat left the slaughter-house without inspection.

During the year the following animals were slaughtered :—

Cattle	2,870
Sheep and goats	8,355
Total	11,255

A small Pig Slaughter-house was erected and completed towards the end of the year.

(B) MILK.

During the year very comprehensive regulations for the control of the conditions under which milk is produced and sold have been drafted for promulgation under the Public Health Ordinance and are now receiving consideration by Government.

Should these rules be gazetted and should sufficient staff be available to carry them into effect, a considerable improvement in the present very unsatisfactory conditions should result.

At Mombasa work in connection with the milk supply has largely been limited to endeavouring to secure the maintenance of the cow-sheds and their neighbourhood in a comparatively tidy condition. No attempt has been made to secure radical structural improvements, as the area occupied by these sheds is both cramped, overcrowded and badly laid out, and any expenditure incurred in connection with the existing structures would but make more difficult the only really satisfactory course of action—their complete removal to a more commodious site on the mainland.

In Nairobi, pending the promulgation of regulations, action has largely been confined to prosecutions for adulteration and during the year considerable improvement was obtained. 60 prosecutions were undertaken and 54 convictions obtained and fines totalling Shillings 861/- were imposed.

124 cattle-sheds were cleansed as the result of sanitary notices and nine were closed. It is hoped during next year to secure the removal of all dairies to an area outside the Municipality.

It is also hoped during 1923 to carry out some inspection of the numerous dairy farms in the country outside Nairobi, and it is probable that considerable results may be forthcoming, as an increasing interest is now being taken by European dairymen in many parts of the country in the question of the production of clean milk.

That the Nairobi milk supply merits a good deal of attention is evidenced by the following figures kindly supplied by the Director of Chemical Research :—

NAIROBI MILK SUPPLY.

SAMPLES SUBMITTED FOR EXAMINATION AS TO ADULTERATION.

Submitted by.	Genuine.	Adulterated.	Per cent. Adulterated.	Average percentage of added water.
Private Individuals ...	14	13	38	13·5
Officials	180	138	43	18·5
TOTAL	194	151	43·7	18

A considerable number of samples were also submitted to the Laboratory for bacteriological examination. The results, for which reference should be made to the Bacteriologist's Report for the current year, show that anything in the nature of a clean milk is at present but rarely obtained.

(C) CONTROL OF FOOD AT PORTS.

At Mombasa and Kilindini the services of the Sanitary Inspectors are frequently required by importers, and Customs officials for the examination of doubtful consignments of food.

As the result of such inspections the following articles have been condemned and destroyed :—

Rice	37 bags.
Bacon	240 lbs.
Dried fish	1,100 lbs.
Biscuits	260 lbs.
Tinned milk	1,856 one pound tins.
Other tinned goods	1,600 lbs.

It would appear that various shippers have been endeavouring to get rid of old stocks of tinned goods, mostly of non-British make. As a general rule, the Medical Officer of Health is informed of the arrival of such goods and no difficulty is experienced in obtaining the surrender by the consignee or agents.

(D) GENERAL CONSIDERATIONS.

Except in the case of milk, meat and vegetables the Public Health Authority has not at present any power to regulate the conditions under which food is produced or sold, save in regard to the rat-proofing of premises and the prevention of the practice of sleeping in shops.

It follows that factories may be established and shops opened and food prepared and sold under conditions which, although not constituting a statutory nuisance, are most undesirable.

Provision for general sampling has not yet been made. The standard and production of ghee, for example, cannot at present be regulated.

General Food Regulations under the Public Health Ordinance, 1921, which would enable sampling, inspection and control effectively to be carried out are desirable and the drafting of these should be undertaken by the Department as soon as opportunity permits.

Laboratory facilities for the examination of milk and other foods will, however, require to be provided at Mombasa if any useful control of food is to be exercised in that Town.

VI.—SANITATION.

IN NATIVE RESERVES.

It is doubtful whether many even of those Europeans who come most closely in contact with the native in his own Reserves, fully realise how low the sanitary standard in these Reserves actually is. The European travelling in a Native District, by means of porters and servants carries with him in the form of tent and bed, food and filters, a bath and a change of clothing, a fairly sanitary environment. A bright sun, a warm climate, the dark skin of the native, the fact that for the most part it is only the more healthy of the male population who are usually in evidence and that the interior of a boma and still less the interior of a hut are seldom seen, tends to obscure the fact that large numbers of the population are not physically fit, that most are unwashed and that nearly all live under conditions which cannot be described otherwise than as grossly insanitary. A fair measure of the sanitary standard of a population is the infant mortality rate and that would appear in these parts to be in the neighbourhood of 400, that is to say, of every 1,000 children born, 400 die within the first 12 months of life.* Two facts favour the continued existence of the native populations of the Reserves; firstly, the high fertility rate of the women, secondly, the fact that the population of the country-side is nowhere very dense and seldom collected into villages of any size. It might almost be said that a third condition is necessary—a continued large infant mortality. Were the infant mortality rate to fall while the fertility rate and the sanitary standard remained the same as at present, no permanent increase of the population could reasonably be expected. A temporary increase there would be, but under existing sanitary conditions any considerable increase would but provide material for the constitution of an epidemic which would ravage the population to a degree unknown before.

The above hypothesis is not put forward as an argument against taking such measures as may at present be feasible for the preservation of infant life, but merely as an illustration of the degree to which insanitary conditions prevail and of the urgent need for tackling from the beginning the problem of advancing the public health. It is not sufficient to reduce the infant mortality; it is also essential to secure for the adult some possibility of living a healthy life.

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* The infant mortality rate for England for the year 1921 was 83 per 1,000.

It becomes necessary, therefore, to consider what conditions are required for the production and maintenance of a healthy community. Four things would appear to be essential: proper feeding, good housing, cleanliness and most essential of all a degree of culture which renders such things desirable. But none of these things are to be found to any extent in the Native Reserves.

Proper feeding is unknown. It is true that in ordinary seasons death from starvation is unknown in the Reserves—though it must not be forgotten that in times of famine many individuals may die and many children probably suffer permanent injury from the effects of starvation—nevertheless, nearly every year for some weeks or months before the harvest a large proportion of the population is more or less underfed. After the harvest, for a similar period, many suffer not only from over-feeding but from over-indulgence in fermented drinks made from the grain.

The evidence of native custom and belief which insists that a goat be sacrificed and eaten in connection with many events of not uncommon occurrence, would seem to show that there is a physiological need among most of these folk for flesh as an article of diet, but here again the result is a period of over-feeding on one particular food followed by weeks without it. The whole story is one of lack of organisation and waste.

Good housing is likewise conspicuous by its absence. The ordinary grass-roofed wattle and daub native hut is perhaps the most insanitary dwelling that can be constructed or imagined. It is small, largely without ventilation and absolutely devoid of light; it cannot be kept clean. Its walls and its floor give ready harbourage to insects which are frequently the carriers of disease, while its roof is the home of anything up to sixty rats. At night goats, calves and chickens are added to the population. In addition to its other drawbacks the native hut of these parts is not an economical structure; if it is to be kept in repair, an absurd amount of time has to be devoted to the matter.

Lack of housing, it is true, hardly exists, lack of anything approaching decent housing is almost complete. There are two reasons for this state of affairs, firstly, the almost entire absence of timber large enough to provide poles for a wall more than four feet in height, secondly, ignorance of any method of using alternative material. The art of sun dried brick-making is not known to one in ten thousand. If it were, it would be of little use. There is neither timber for the roofs nor the technical skill to work it, if it were available.

Cleanliness is dependent on many factors: it is dependent on housing and is always difficult in a house which has no windows and into which it is almost necessary to crawl to enter; it is always dependent on training; but whether in connection with one's person, one's clothes, or one's cooking pot, it is ever dependent on an adequate water supply. In the majority of places in the Native Reserves of Kenya, there is nothing even remotely resembling an adequate water supply. Only a very small proportion of the population live so near either to a lake or a river that a supply adequate at least in quantity, if not in quality, is available and even in these cases water for domestic use has to be carried by hand in small vessels. As a consequence no more is used than can be helped. In most places, however, the quantity is small, the quality bad, and the distance which it has to be carried frequently considerable. For the majority of the population the sole water supply that is available during most of the year consists of small water holes dug in a rapidly drying swamp or some small collection preserved by damming some rivulet during the rains. The art of well digging, perhaps fortunately, is still unknown.

As regards the outlook on life of the African native, all that need be said here is that it is perhaps almost as impossible for an European to conceive its present limitation as it is for him to guess to what extent it can be developed.

Apart from the instincts which prompt him to satisfy his hunger and reproduce his species, there is little but apathy. Death and sickness are only two of the many things which he accepts as a matter of course. Such efforts as he may have made in the past either to delay the former or alter the course of the latter have been too uniformly unsuccessful to encourage further effort, and it is hardly, therefore, surprising if such admonitions with regard to sanitary matters as have been addressed to the inhabitants of the Native Reserves by officers either of the Medical Department or of the Administration have been largely without lasting effect. That being so, it is a matter for immediate consideration to devise methods for securing sanitary improvement. Of the four things which were mentioned as essential to a healthy community, the first three are dependent on two conditions which again are interdependent, education and prosperity. The people must know how to use the available food and how to conserve it. They must grow timber or buy it and they must know how to use it. Water supplies must be conserved and food must not be wasted. All of these require money and knowledge as to how money should be used. But neither prosperity nor education are likely to be achieved, unless there be first obtained an outlook on life which suggests that their acquisition is worth while.

During the past twenty years very little alteration has taken place in the outlook of the average native of Kenya, and even where they have received some education either at a mission or elsewhere is at bottom but little different from that of their fathers. Presumably the outlook of the inhabitants of Europe was once much the same, and it might serve some purpose to consider how the change was brought about among these people who now are civilised. Largely it would seem that individuals have only advanced when and in so far as they have been welded together into communities and from being separate and therefore useless cogs have become part of a machine with a purpose, each cog serving a common end. At present the native population of Kenya is purely individualistic, and there is no community of purpose. The outlook on life does not extend beyond a plot of land and what it can produce. Can, then, interest and a purpose be supplied? It would appear that it can. The comparison between a town which has not achieved local government and the same town after it has been given some measure of control of its own affairs with the responsibility for finding funds for those improvements it may require seems to supply the answer.

Hitherto the benefits which the native has received from a settled and civilised Government have come to him independently of his own volition. Medical Officers, roads and other services materialize in a fashion which is not understood, and it is not realised that the money which pays for these comes from the people as a result of taxation. Were it possible to allot a sum of money, however small, to each district to be spent by the people themselves through the activities of a local council presided over by the District Commissioner, it would not be long before a glimmering of a common interest would be aroused, and could these funds be collected by the people themselves, that sense of responsibility would be engendered which is ever the forerunner of progress.

But all this would require direction. The welding of communities has always been the work of some unusual individual. So far the native populations of this part of Africa have never produced an unusual individual, and the individual must, therefore, be supplied.

It happens that in every district one is available in the person of the Commissioner, only too willing to carry out his proper function—the promotion of the welfare of the people under his charge—if only he had more time to devote to the matter. Under the Public Health Ordinance the District Commissioner and the Medical Officer constitute the Local Authority responsible

for the public health. The Ordinance will require to be amended if it is found necessary to remove any impression that the Officer administering a district can share the responsibility of promoting the public health with any one but the people themselves. In matters of policy the function of the Medical Officer should be confined to advice—in treatment only, should he be executive—the responsibility for taking action should be confined solely to the Administrative Officer, and he must have time and opportunity to give effect to his policy, when he is able to do so, but not earlier, sanitary progress will become possible.

TOWNSHIPS IN NATIVE RESERVES.

The townships in the Native Reserves are townships only in name. The populations are small and consist of the Government officers, interpreters, messengers, police, station labour, a few Swahili or Nubian traders, and perhaps half a dozen Indian shopkeepers and their families.

The maintenance of these stations in a satisfactory condition is largely a matter of field sanitation and, thanks to the attention which is given to the matter by the Administrative Officers concerned, a fairly high standard usually obtains, and the conditions under which the native inhabitants of these stations live represent a great advance on those which prevail in the surrounding Reserve.

SANITATION IN THE SETTLED AREAS AND TOWNSHIPS.

Sanitation in the settled areas presents problems which are just as difficult as and perhaps even more pressing than those presented in the Native Reserves.

Furthermore, the question of the standard of sanitation which may obtain in the settled areas is not a matter affecting only the present and the more permanent inhabitants of these areas; it is a matter of importance to the country as a whole.

It has already been said that the primative African native has but little idea of what is necessary to secure his own well-being in the Reserves; he has none at all as to what may be necessary in a town. As a consequence he makes few demands, and the attention of his employer, busy with the management of his own trade or business, is not attracted. Miniature slums arise. In a small town the effects are unlikely to be felt by any one but the employee, in a large town the effects would ultimately be deleterious to all sections of the community.

Furthermore, there is the question of education. More and more are natives coming to work in the larger towns. Some stay on, some after a few months or years return to their Reserves. If prosperity in these Reserves is to be followed by sanitary progress on the part of the inhabitants in the matter of feeding, housing and cleanliness, it will, to no small degree, be dependent on whether the sanitary standards in the towns, where some of them resided for a time, were high or low. But the attainment of a high sanitary standard in the towns and in the suburbs which are growing up around them is no light matter.

It is one thing for active, intelligent and educated Europeans to establish themselves in a new country and in new towns; it is another and much more difficult matter to establish the complicated machinery necessary to reproduce the high sanitary standards of the countries from which they came, or to provide the organisation necessary to work it.

To the majority of the inhabitants of England the very existence of many of the customs on which their comfort and convenience depend is unknown. The results of many of these customs are not always obvious, or where they are, they are accepted as a matter of course. It is not always realised by the householder that neither a decent water supply, modern drainage, nor an easy approach to his house by a well graded road would exist, were there not somewhere in the background a very complicated organisation.

Among the essential parts of that organisation must always be the following:—

(1) An engineer who looks on land not merely as something to be measured and divided, but as something which must be measured and divided so that it may ultimately be built upon with convenience; who looks on a building plan not only as the design for a structure but as the plan for a structure shortly to be inhabited.

(2) An officer acquainted with procedure and custom, with the various methods of raising funds, and skilled in the technique of collecting local revenue—the Town Clerk.

(3) A Medical Officer of Health and Sanitary Inspectors.

(4) An experienced authority.

And essential to the working of that organisation is the existence of a vast body of detailed law in the form of acts, regulations and bye-laws, the outcome of years of experience and development, to guide and correlate the activities not only of the authority but of its officers, to prevent their pursuing courses which experience elsewhere has shown to be unsatisfactory, to ensure continuity of policy, to impose a satisfactory standard of work on contractors and tradesmen, and to prevent endless discussion of minor questions to which the answers have long been known.

But in a new country such an organisation is not readily come by.

Authorities, whether they consist of a single officer or a body of townspeople, are not likely to be experienced in Municipal Government; not always is it even recognised that expert technical advisers or executive officers are necessary. It is never recognised that these officers must be even more expert, more numerous, more hardworking and possess more imagination than similar officers in an old country. For a long time it is not even recognised that essential work is not being done. A gap is not readily seen in the dark.

Usually the first of the ill results of unorganised development to become obvious to the authority charged with the government of a new town is the presence of dirt and disease. The town is recognised to be insanitary. A Medical Officer of Health is requisitioned and is the first of the necessary experts to be appointed, and because the authority itself has as yet no skill in these matters, he is made executive, and is required to deal with and to remove results. But he soon finds he is dealing with an Augean stable, and that every day he becomes more and more swamped by routine duties. He realises that if he is to be effective, the causes of these troubles must be found. He inspects his district and reviews the conditions which he finds to prevail. Usually they are worse than he imagined; sooner or later he perceives some of the causes and realises that prevention might be possible, but he realises also that single-handed he cannot remove these causes, and that the authority itself must take action, but he must advise them what to do. From having been an overpaid sanitary superintendent he becomes an exponent of preventive medicine. The chief duties of a Medical Officer of Health are to carry out inspection, to report results and to tender advice. In so far as he is required to be executive—and in the tropics and particularly in new towns executive

functions cannot always be avoided—he is hampered and hindered in his proper work, he has less time to realise by detailed inspection and survey what conditions are, less time to devise remedies, less time to inform himself what experience has been elsewhere or what remedies are being tried by others.

Meanwhile, the injunctions which he makes in his executive capacity on individual members of the public are met with the strongest opposition, and the advice which he gives to his authority is not always accepted, sometimes because it is impracticable, sometimes because it is financially impossible to do so, not infrequently because it is not appreciated.

It is at this point that the need for more detailed legislation becomes first apparent, and with increasing development this need becomes ever more urgent. In the townships of Kenya the necessity for specific legal powers to enable local authorities or, where they must still remain executive, Medical Officers of Health, to deal with specific sanitary requirements is to-day exceedingly pressing.

Existing legal powers are to a large degree very general, and as such are somewhat vague. They are certainly unspecific. It, therefore, follows that an executive health officer or a local authority has to consider every individual case on its merits and endeavour to find a suitable solution. Many of the matters which have to be dealt with are open to much controversy. With a change in executive personnel there will probably be a change of policy, or at least a change in the manner of interpreting or applying such vague law as may exist. No line of action has yet been laid down as a guide in many matters of vital sanitary importance. Changes in policy and in personnel give rise to definite cases of hardship among the general public, are a source of irritation to that public, embarrass and impair the efficiency of the local Health Office staff, and undermine the prestige of the Department. Any decision of the Health Officer, where he is executive, is liable to be contested as being a personal interpretation of his powers and not the administration of a specific legal provision. The question then becomes a matter to be decided by a magistrate, and the Executive Health Officer finds himself burdened in every case undertaken with the preparation of a case where he has to argue from the general principles of hygiene to the particular case at issue, and submit himself to an exhausting and distressing cross-examination. All the controversies of the past century which have attended the evolution of public health law in England are liable to be revived every time a case is undertaken. It is very necessary to remember that there are not in the towns of Kenya the stable conditions which are associated with old established towns in England. Here we have new towns in the process of making, always and anywhere difficult things to control. Time and experience, custom and usage have evolved many safeguards against insanitary developments in old established places. Here there are none of these safeguards. Development has outstripped legal provision to control it, and the executive staff are so overburdened with routine work that it is quite impossible for them to devise and frame the new legislation required. Particularly urgent at the present moment when the installation of a water borne sewage system would at last appear to have become a possibility of the immediate future in Nairobi, is the preparation of detailed drainage regulations. If these be not in being before connections in any number come to be made, most unfortunate conditions, difficult and expensive to remedy, will assuredly result. Almost equally urgent is the amplification, redrafting and codification of the many, varied and contradictory building rules which are at present in operation, while the rules regulating licensed premises require extensive alterations.

Improvement of the procedure at present in existence with regard to the sub-division and alienation of land and regulations to govern the manner in which it may subsequently be used are also urgently required.

A beginning has been made in the matter of drafting drainage regulations, while the preparation of a town-planning scheme for Mombasa shows promise of enabling the use of land in that town to be satisfactorily regulated. That is so much to the good, but even so, it is doubtful whether either of these matters can be carried to completion in the present year. It is certain, however, that the drafting of building regulations, licensing regulations and many other matters must remain over for another year.

One other point remains to be mentioned, a great deal of work in the nature of inspection of existing conditions and research with the object of ascertaining the causes of such of these conditions as may be found to be unsatisfactory and as to the methods of remedying the same, urgently requires to be undertaken by the Department; a perusal of the records of the work which has actually been carried out, more particularly in Nairobi and Mombasa during the past year, by the Medical Officers of health and the European Sanitary Inspectors in these towns suggests that these officers at present are being taxed to the utmost. If the ground which has been won is to be consolidated and if further progress is to be made, it is essential not only that the executive staff available for work in these towns should be increased but that the administrative division of the Department should be developed so that much necessary work in the nature of inspection and research with a view to subsequent legislation may be carried out as soon as possible.

SANITARY ADMINISTRATION.

(*a*) *In Farming Areas.*—It has not been possible for the Department to devote more time to these areas than has been necessary in order to deal with outbreaks or suspected outbreaks of infectious disease.

(*b*) *In the smaller Townships of the Settled Areas, e.g., Eldoret, Nakuru, etc.*—The townships of Eldoret and Nakuru are each in charge of a Resident Commissioner who is advised as to sanitary matters in the case of the former by the District Surgeon and in the case of the latter by the Medical Officer. The sanitary condition of neither of these towns is very satisfactory and they have now reached a size when they require that detailed inspection which only a qualified Sanitary Inspector can satisfactorily carry out. The full time services of an inspector are not yet, however, required for either of them, and it will probably be possible when the Uasin Gishu Railway is completed to secure adequate supervision by posting one inspector to give attention to both. The possible development of these towns as the result of the construction of the new line will require to be carefully watched.

(*c*) *In the larger Townships, Kisumu, Nairobi, Mombasa.*—

(1) *Kisumu.*—The township is administered by a Resident Commissioner. There is also a whole time Medical Officer of Health and a qualified European Sanitary Inspector. Conservancy is under the direction of a Superintendent of Conservancy who is also the collector of Inland Revenue and responsible, together with the Medical Officer of Health, for the scrutiny of all building plans. Conservancy is carried out in a very satisfactory manner and the town is probably the best cared for in the Colony. A very large amount of anti-malarial work chiefly of the nature of draining of swamps was carried out during the year. A new native location was laid out and various type plans for native housing produced. A matter of importance, which has still to be dealt with, is the improvement of the water supply. The existing arrangements are both unsatisfactory and precarious.

The total number of inspections carried out by the European Sanitary Inspector was as follows :—

Nuisance and general inspections	6,086
Licensed premises inspections	461
Native market inspections	328
Slaughter-house inspections	652
Total	7,509

Details with regard to sanitary notices are as follows :—

Sanitary notices served during year	267
Sanitary notices outstanding from last year ...	16
Sanitary notices not proceeded with	15
Sanitary notices cancelled	9
Sanitary notices complied with	222
Sanitary notices outstanding	5
Notifications of Nuisances sent to Uganda Railway	133
Notifications of Nuisances sent to Public Works Dpt.	35

Considerable attention is devoted to the maintenance of as many buildings as possible in a satisfactorily mosquito-proof condition.

(2) *Nairobi.*—The government of the town is administered by an elected Municipal Council who employ a Town Clerk, a Municipal Engineer, a water inspector and other necessary staff. The Medical Officer of Health and qualified European Sanitary Inspectors are not employed by the Municipality but are Government officers. The number of Sanitary Inspectors at present employed is three. A qualified European Nursing Sister is employed by the Medical Department on Infant and Child welfare work among the Native and Asiatic communities. Conservancy, which is on the single bucket system, is carried out under the direction of the Town Engineer. A considerable amount of work in connection with the improvement of the town water supply has recently been done which, when carried to completion, should result in a marked improvement not only of the quantity but of the quality.

The most important matter still before the Council is the question of the provision of adequate housing for the African population and the prevention of the growth of new, or the extension of existing insanitary areas. From the Medical Officer of Health's Annual Report an extract dealing with these matters is given below. The record of the work carried out as result of sanitary inspections which is also reproduced, shows that a very large number of permanent structural improvements have been obtained and a large number of serious nuisances abated.

HOUSING AND TOWN-PLANNING.

* EUROPEAN HOUSING.

The security of all building plans before they are passed enables the Health Department to exercise a certain amount of control in this matter. On the whole, the housing of the European population is fairly satisfactory, and there is practically no overcrowding. There is a tendency on the part of most people who have in the past acquired land in the town to hold on to this land in the hope of a future rise in value. The land thus remains undeveloped and is often kept in a foul and insanitary condition and becomes a harbourage for refuse and vermin. It is hoped in the ensuing year to force people in the town who own such plots to keep them in a reasonably clean and sanitary condition.

* Extracted from the Annual Report of the M.O.H., Nairobi, 1922.

If such owners cannot afford to keep their plots in proper condition, they should be forced to sell, in order that people who can, may have the opportunity of acquiring the land. The enforcement of sanitation in this way would do much to bring down the price of land, and cheap land is a first essential to cheap building. At the present moment, in many cases a person has to pay so much for a plot of land within a reasonable distance of the centre of the town that he has not enough capital left to develop the land to the best advantage when he has acquired it.

* ASIATIC HOUSING.

Asiatic Housing in the bazaar area now presents a new phase. Before the depression in trade set in, premises were overcrowded, as there was insufficient housing. During the present trade depression, certain premises are overcrowded, even the stores, kitchens, etc., being used as dwellings, but at the same time there are a large number of vacant premises. Tenants plead that business is so bad that they cannot afford to rent proper housing, but have to share one building amongst many as a measure of economy. 31 cases of overcrowding were dealt with during the year, the majority of cases occurring in the bazaar area. In most cases of over-crowding, the problem tends to resolve itself into one of chasing people from place to place. Four premises in the bazaar area have been demolished and entirely reconstructed on sanitary lines, in spite of the present financial depression, and it is hoped to continue this work during the ensuing year.

Investigations were made during the year into the general condition of Asiatic Housing in the commercial area. There would not appear to be any common lodging-houses in the town, but there are a large number of tenement dwellings. Most of these dwellings are far from sanitary, but, with a limited staff it is practically impossible to carry out improvements on an extensive scale. In many cases the only satisfactory way of dealing with such dwellings is by complete demolition and entire reconstruction on proper lines. The existing building regulations are quite inadequate in this matter and if the erection of such buildings is to be prevented in the future, more extensive powers will be required. An enormous proportion of the housing in the commercial area is distinctly insanitary. Plots overcrowded with buildings alternate with undeveloped plots and overcrowded buildings alternate with vacant ones. That such a state of affairs should exist, it is obvious that something is radically wrong. The over-crowding of land with buildings and with people should be prevented, as the more intensively land is used the more valuable it becomes, and the more valuable it becomes the more houses must the builder erect per acre in order to make his speculation pay. High rents and overcrowded dwellings go hand in hand and a vicious circle is thus established.

In a town in which it is possible so to develop the land with buildings of such cheap construction and so over-crowded with tenants that a landlord is able to recover his capital outlay in a very few years' time, it is no wonder that land values are high. It is most necessary to introduce legislation to restrict the number of dwellings per acre, as it is only by so doing that the present overcrowding can be stopped and the people provided with healthy housing; good and cheap housing is one the basic essentials of sanitation. Such legislation will lower the price of land, and owners will be able to provide housing at low rentals, while still obtaining a reasonable return on their capital. We shall, also by these means, strike at the root cause of insanitary housing conditions. The multiplication of slum dwellings will cease and vacant land which in itself is providing facilities for innumerable forms of nuisance will be developed on

* Extracted from the Annual Report of the M.O.H., Nairobi, 1922.

sound lines. The present policy of inaction in this matter invites land speculation with all its attendant evils. Prevention is better than cure and if we can prevent any more of such buildings being erected, distinct progress will have been made. Nairobi will have to face this problem sooner or later, and it is false economy to put off the evil day. When a town-planning scheme is eventually brought in large sums of money will have to be paid in compensation to remove the buildings that are being allowed to go up now, and the owners will be perfectly justified in demanding such compensation.

Building Plans have been submitted which contained proposals to construct dwellings showing tenancies of from 60 to 280 to the acre, and there is no specific existing legislation to prevent even worse proposals than these being given effect to. Such conditions are only approached in the very worst slum districts to be found in Europe or in the great towns of the East, and yet we are allowing such conditions to exist and multiply in the new town of Nairobi.

Little progress has been made with regard to the Asiatic Residential Area during the year, and it would appear to be a little doubtful if there is any real demand on the part of the Indian for plots in this area at the present moment.

* AFRICAN HOUSING.

Native Housing conditions in Nairobi remain practically as bad as ever and very little progress has been made in improving the situation during the year. The importance of the question of cheap and satisfactory housing for African natives has not yet been sufficiently realised Employers under the Master and Servants Ordinance are bound to provide adequate and proper housing for their native employees, but this Ordinance does not seem to be enforced to any great extent in this town. Government and the Municipality, the two largest employers of labour in the town, are the worst offenders in this respect and a large proportion of their native housing is totally unfit for human habitation. †

In the residential areas of the town, native housing is in most cases of very inferior type. In the Commercial Area, in the majority of cases, natives cannot reasonably be stated to be housed at all, odd corners, kitchens, passages, verandahs, bathrooms and even latrines being used by them, or in other words any odd place which provides some sort of roof.

The opening of the native location is a step in the right direction but so far it has only touched the fringe of the problem, in spite of the good progress made. The majority of the available plots have already been taken up by the inhabitants of Mombasa, Maskini and Kaburini villages who are building themselves houses of a fairly satisfactory type for the present. The difficulty of providing housing at the native location for casual labour which is not sufficiently wealthy to be able to provide housing for itself is already apparent, but the problem will become acute when native labour from the Commercial Area has to be dealt with. The policy of leaving the native to solve his own housing problem will break down when we reach that class, the casual unskilled labouring class, the housing of which is ever the real problem before the Local Authority. The majority of the people who have already moved and who are now moving into the native location have never been particularly badly housed. It was primarily the situation of their housing, not the class of housing, which was open to objection. They are also obviously sufficiently wealthy to provide themselves with housing. The natives with whom we are really concerned do not at present command any housing of their own worth

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* Extracted from the Annual Report of the M.O.H., Nairobi, 1922.

† Definite proposals for amelioration are now under consideration by Goverment and the Municipality, March, 1923.

the name, and are never likely to be able to provide such for themselves. They are a product of town life and a similar class exists in all our Western Towns. In all cases housing has to be provided for them, as they are never able to build houses for themselves. Adequate housing for these natives at an economic rental will have to be provided sooner or later, and this should be clearly realised at the outset. We cannot hope to move these natives from the Commercial Area until housing is provided for them elsewhere. It is of the utmost importance that the Municipality should discuss this problem at the earliest opportunity and consider the advisability of raising a loan for this purpose. Unless this problem is tackled immediately there is a great danger of the native location scheme coming to an end in a few months.

A certain amount of accommodation exists in the town for natives, more especially in Pangani Village in the form of " rooms let in lodgings." This provision has never touched the real problem in the past and a continuance of the system by native hut owners in the new location is not likely seriously to touch the problem in the future.

The demolition of 218 native huts in the town as an anti-plague measure has incidentally disclosed the fact that a large number of dwellings in the residential area are unprovided with either sanitary or adequate accommodation for native domestic servants.

Proper and sufficient accommodation for these servants will have to be provided or else the residence of such natives on the premises will have to be discontinued. A rather difficult position arises in this connection with regard to the obligation of tenants to provide housing for their employees under the Masters and Servants Ordinance. A certain amount of hardship will result if tenants in a somewhat floating town population are to be required to meet the expense of providing satisfactory accommodation for their domestic servants. The solution of the problem is to force the owner to do so through the tenant. If we restrict occupation to proper accommodation, a public demand for proper and adequate accommodation will arise and owners will, sooner or later, meet the demands of tenants. The position of the civil servant in this matter is going to be extremely difficult if Government should find itself unable or unwilling to provide proper and sufficient native housing in connection with Government Quarters for European Staff. Present conditions, however, cannot continue indefinitely, either proper accommodation for domestics must be provided or their residence on the premises must cease.

It will thus be seen that the whole question of native housing in Nairobi is one of paramount importance. The development of the native location scheme on proper lines and the provision of Municipal housing at economic rents in this location is probably the solution of the problem. The native population of Nairobi is considerable and this population is likely to increase, the tendency of the native throughout the Colony being to become more and more detribalised. This population may be divided into two classes :—

(1) Natives who are actually employed in the town and natives who cater for the legitimate requirements of other natives in the town.

(2) Natives who are not in regular employment in the town, but who are merely living in the town.

The former class have every right to live in the town and housing will have to be provided for them. The latter class do not require to be housed in the town. At the same time the latter class have largely become detribalised as a result of European influence. They do not wish to return to their reserves, and their Chiefs in many cases do not want them back. The present proposal is that these people should be allowed to live somewhere in the vicinity of the town if a suitable site can be found, though not actually within

the Municipal Area. The suggestion is that a Garden Allotment location should be formed for such natives, where they could be kept under a certain amount of supervision. The produce grown by these people might also have a considerable influence in the future in bringing down the general cost of living in Nairobi, more especially for the native.

SANITARY INSPECTIONS.

NAIROBI—1922.

House to House and General Inspections.

First inspections	6,185
Subsequent inspections	2,984
Trade inspections	8,818
Total	17,987

Sanitary and other Notices Served.

Outstanding from previous year	74
Served during the year	1,176
Not proceeded with	188
Complied with	940
Outstanding at the end of year	122

Results of Notices and Inspections.

Premises demolished	60
,, reconstructed	4
,, closed	24
,, cleansed	78
,, limewashed or painted	84
,, floors relaid	36
,, ,, repaired	57
,, yards or plots cleared of rubbish, &c. ...	73
Deposits of refuse, stone, etc., removed	74
Dumping ,, ,, stopped	47
Areas cleared of long grass, bush, etc.	490 acres
Yards paved	21
Passages and open areas paved	12
Yards cleansed...	57
Passages and open areas cleansed	21
New latrines provided	67
Latrines condemned	51
,, reconstructed	59
,, repaired	47
Sanitary buckets provided to latrines	141
Masonry or concrete trays provided to stand-pipes	38
Dustbins provided	239
Dustbin lids provided...	123
Masonry or concrete drains laid	281 yards
,, ,, ,, relaid or repaved ...	143 ,,
,, ,, ,, cleansed	245 ,,
Trestles for stacking foodstuffs provided	40
,, ,, firewood ,, ...	30
Kitchens provided	17
Store-rooms provided	15

SANITARY INSPECTIONS—*continued.*

Results of Notices and Inspections—*continued.*

Earth drains cut	572 yards
,, ,, regraded and cleansed	8,959 ,,
Borrow pits and hollows filled in	105
Waste-pipes provided and fixed	39
,, repaired	37
Soakaway pits provided	2
,, ,, cleansed	11
Cattle sheds and bomas cleansed	124
,, ,, ,, closed	9
Overcrowding stopped	31
Sleeping in kitchen and stores stopped	55
Eavesgutters and downpipes provided	56
,, ,, ,, repaired	48
Mosquito breeding places dealt with	68
Native huts demolished or burned	218

Licensed Premises.

Description.	Number of Premises.	Number of Inspections.	Applied for.	Approved.	Not Approved.	Remarks.
Aerated water factories...	7	70	7	7	nil.	—
Ice factories	1	21	nil.	nil.	nil.	—
Bakehouses	7	149	8	7	1	—
Butchers and fishmongers	39	693	67	39	28	—
Cattle sheds, stables and pig styes	78	609	nil.	nil.	nil.	Municipality do not enforce licensing.
Eating houses	67	452	83	67	16	—
Dhobies and laundries ...	8	41	9	8	1	—
Lodging houses	No records	nil.	nil.	nil.	nil.	Lodging house regulations are not enforced.
Trade premises	456	3,513	408	349	59	—
Vegetable sellers ...	23	193	26	23	3	—
Sweetmeat sellers ...	16	106	18	16	2	—
Total	701	5,847	626	516	110	—

Disinfections.

Number of premises	20 or 60 rooms.
,, ,, articles (approximately) ...	1,450
,, ,, ,, destroyed	20

Food Inspections.

Milk	266 samples
Aerated water	31 ,,
Pipe water supply	2 ,,
Getathura river water	1 ,,
Pangani well water...	1 ,,
Tinned fruit	348 tins

Fish, meat, fruit, vegetables, inspected every day at market.

SANITARY INSPECTIONS—*continued.*

Food Condemned.

Milk	16 galls. (approx.)
Meat	3,328 lbs. ,,
Tinned fruit	36 tins
Aerated water	9 samples
Fruit and vegetables...	110 lbs. (approx.)
Fish	15 ,, and 3 boxes

Building Plans and Applications.

Building plans submitted	189
,, ,, sent back for amendment	87
,, ,, re-submitted	85
,, ,, approved	180
,, ,, disapproved	7

Prosecutions.

Offence complained of.	Number of cases.	Number of convictions.	Number withdrawn.	Number dismissed.	Penalties.
Handling meat without proper clothing	1	1	nil.	nil.	Shs. 3/–
Street encroachments ...	2	2	nil.	nil.	Shs. 40/–
Hawking foodstuffs without a license	15	15	nil.	nil.	Shs. 50/–
Attempting to bribe a public servant... ...	1	1	nil.	nil.	Shs. 300/–
Selling adulterated milk...	60	54	6	nil.	Shs. 861/– and 7 Totos each received five strokes with a cane.
Total	79	73	6	nil.	Shs. 1254/– and 7 Totos each received five strokes with a cane.

(3) *Mombasa.*—The government of the town is administered by the Resident Commissioner. The Medical Officer of Health and three or four qualified European Sanitary Inspectors are appointed from the staff of the Medical Department of the Colony. Conservancy is a function of the Health Office and is carried out under the direction of one of the European Sanitary Inspectors who devotes his whole time to the matter. An European Building Inspector is employed who is responsible to the Resident Commissioner and the Medical Officer of Health. There is no Town Engineer but some of the duties of a Town Engineer are carried out by an Executive Engineer of the Public Works Department, who has, however, in addition to the town, the charge of the Seyidie Province. The duties of Port Health Officer are carried out by the Medical Officer of Health.

An advisory Committee, consisting of the Resident Commissioner (Chairman), the Executive Engineer of the Public Works Department, the Medical Officer of Health, the Assistant Land Officer and several unofficial Europeans, Asiatics and Arabs, meets weekly for the discussion of township matters.

Scavenging, cleansing and the removal of night soil.—This work has continued to be carried out as one of the activities of the Health Office. It receives, as is necessary if satisfactory results are to be achieved, the whole attention of one officer. The many narrow alleys and passages of the town have been kept remarkably clean and free from nuisance throughout the year, and refuse is disposed of in a four celled Horsfall Destructor. In March the old single pail system of night soil removal which had long been in vogue in the European quarter and elsewhere was replaced by a complete double bucket system. The results have been exceedingly satisfactory. During the year four new fly-proof public latrines were erected. There were now eleven such latrines in the town with a total of 64 seats.

A matter which will greatly facilitate the working of conservancy and cleansing was the completion during the year of new and adequate labour lines for the housing of the large conservancy staff.

Housing and Town-planning.—An extract from the Annual Report of the Medical Officer of Health, which gives a comprehensive view of housing conditions as they are to-day and also of what has been done with regard to the production of a scheme for the town-planning of the undeveloped part of the Island, is given below. For a full appreciation of the amount of work which has been involved in the production of this plan and of the urgent need for the same, the following points should be borne in mind.

The Island of Mombasa has an area of about 3,500 acres.

The majority of the inhabitants are housed in the old Town, which has an area of only some three or four hundred acres. Only a small portion of the remainder of the Island has been developed. This undeveloped portion (apart from Government owned land at Kilindini and elsewhere) is divided up into several hundred privately owned plots of all shapes and sizes, is practically without roads of any description and is held in freehold. From time to time portions of these holdings have changed hands at very high prices. For many years past the erection of substantial buildings in this undeveloped area has been forbidden by the Township rules, except where the plot to be developed fronted on a road at least 50′ wide. By this means town-planning has remained a possibility and on account of the war and the trade depression which has followed, there has been no great desire on the part of the owners to develop. Now, however, that a large wharf is being constructed at Kilindini and there is a possibility of some revival of trade, there is likely soon to be a considerable demand for development. It is highly desirable that the town-planning scheme now before Government should not only receive approval but should largely have been carried into effect before that demand for development becomes pressing.

A point of importance which demands consideration is the means by which effect is to be given to the scheme which has been produced. The preparation of the scheme has been chiefly the work of those technical Government officers who are members of the Town-planning Authority and it has been performed in addition to their ordinary routine duties. To carry a scheme of this magnitude into effect it is absolutely essential that the local executive staff should be materially strengthened, and strengthened, if possible, by the appointment of an officer with previous experience in the execution of work of this nature. There is not at present in Mombasa any officer with the particular and essential experience of a Town Engineer and none with that technical knowledge and experience of Municipal matters which are usually provided by a Town Clerk. Unless the authority responsible for the execution of the town-planning scheme be provided with officers experienced in these directions, the carrying out of the scheme will not be possible, and an opportunity for developing the Island of Mombasa in a sound, sanitary and economical fashion will have been lost. It is unlikely that a similar opportunity will ever recur.

*HOUSING AND TOWN PLANNING.

MOMBASA.

Housing.

Very little in the nature of new house building has taken place during the year.

Only 26 stone buildings have been erected.

The number of new native mud houses was 295, and a considerable number of houses of all kinds have undergone alterations and repairs, the total number sanctioned being 700.

Of European Housing little need be said, save that the number of available houses of the type required is insufficient for the needs of the European population.

The majority of privately owned houses in the European area are of good modern type.

There is a tendency on the part of the more wealthy Indians and Arabs to build houses out of the town in the more western portion of the Island. Several houses have been built there and it is probable that more will follow.

Apart from these the Indian, Arab and Native population for the most part occupy the Old Town, *i.e.*, the portion east of Salim Road, and the newer town consisting almost entirely of mud houses in the Nazi Moja and Miembeni districts.

The latter having grown up in more recent times there is some attempt in places to obtain a lay-out and a certain amount of alignment has been obtained.

These houses are for the most part of good type consisting of, on an average, four rooms.

They are, however, much too close together, and in many places number 28 per acre. Kitchens and latrines are internal but speaking generally the housing in this district is by no means bad. On the East side of Salim Road there are large areas where conditions are of the very worst.

High stone buildings border and project into the alleys which are dignified by the name of street.

The upper storeys of these buildings frequently consist of ramshackle corrugated iron erections.

The buildings are cramped together, internal rooms abound, light and ventilation in many of them are unknown luxuries.

Behind and between these rows of stone buildings, reached by narrow passages are huddled other houses of stone or mud.

Surveys of various areas containing one storey mud houses have been made and the number of houses, with their occupants, counted.

The number of houses per acre in many parts is 32 to 36.

Estimating the average number of persons per house at 5 which is undoubtedly in many cases too low an estimate, the population per acre is 160-180.

In the case of areas containing high stone houses the figure would be higher but no surveys have been made.

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* Extracted from the Annual Report of the M.O.H., Mombasa, 1922,

The Mombasa type of native mud houses can unquestionably provide good housing for natives at a relatively low cost.

It is, however, essential that such houses be given considerable supervision in the lay-out and construction.

It is necessary to peg out the position of the huts to ensure adequate space being left, the walls must be pegged in order to obtain rooms of sufficient size and the arrangement of external kitchens and latrines demonstrated to the owner in each case and thorough supervision maintained throughout; unless such is done, the result is chaotic, and difficult or impossible to alter. It is a matter of education and doubtless in time the native will understand what is required. Already he is becoming accustomed to the external latrines and now it is the rule for properly constructed windows to be placed in walls in substitution of the small openings or no openings at all, customary until a short time ago.

Existing houses when repaired are as far as possible altered to accord with modern requirements but little can be done to increase the space between them.

An endeavour has been made on a plot of Crown land at Kilifi to obtain a standard type house. Applicants pay an annual temporary occupation license of 4/- and obtain a plot large enough to erect a four roomed mud house.

Some thirty huts have been erected here with great success.

It is intended to extend this scheme to other plots of Crown land. It is the intention, if possible, to assist by importation of poles and boritis at cost price. The present cost of such a hut varies from Shs.800-1400 according as whether material is cheap or expensive, and to the time taken in the construction, etc.

It is frequently the habit for an owner to buy poles and then, having no more money, to complete with the operations, to leave these poles lying on the beach, paying rent for the same, until he has collected funds to continue.

It is hoped to prepare a complete scheme of this nature for the coming year.

The stone houses in the Old Town present considerable difficulties.

Some permit of alteration and reconstruction.

Walls can be removed, windows enlarged and various works carried out which result in considerable improvement, and amelioration of conditions previously rendering such houses unfit for human habitation.

Much work of this nature has been accomplished by Sanitary Inspector Mr. Ling, who devotes the greater portion of his time to this section of his duties, but so many are the houses requiring such attention that the work accomplished seems to be swallowed up in that still remaining to be done. In many cases, however, no such alterations are possible of attainment. Perforce such buildings must remain, and remain occupied, there being no alternative accommodation available in which to place dehoused persons.

The solution to this difficulty lies in the more comprehensive undertaking of Town Planning.

Housing of Government Labour.

The housing accommodation for natives employed in Government service is for the most part very poor.

The Police Lines, a portion of the Gaol Warder lines, a portion of the Railway Quarters are of stone or brick, and although not by any means ideal, are fairly satisfactory.

A considerable number of Railway employees, some of the Gaol Warders, P.W.D. labourers and Customs askaries are accommodated in iron buildings of a bad type or in a state of disrepair or both.

The accommodation of the Customs askaries at Kilindini is very bad. There are two buildings and of these one is of iron with an earth floor. There are no windows and under the same roof are a kitchen and a latrine of presanitarian type. The other is a wood and iron building with in parts the remains of a wood floor. The building is wood lined and is, as might be expected, infested with rats. Both buildings, were they privately owned, would be made the object of an application for a closing order.

For the Conservancy staff there existed a mud hut capable of housing perhaps a quarter of them. The remainder slept in the street or on barazas as most convenient. There have now been erected sufficient coral landis to house them all. These landis are the only really good type labour landis in the Island outside the Railway area. These will be occupied within a few weeks. It would be desirable if all Government Departments could provide similar housing for their native labour.

So far the example set to the private individual has not been a high one and one is frequently asked when taking action in the matter of insanitary and bad houses why Government demands from private individuals a considerably higher standard than that which it is content to accept for its own labour. The answer to this is difficult to find.

Town Planning.

From the standpoint of the advancement of the public health in Mombasa the event of greatest significance during the year 1922 is the progress which has been made in the preparation of the Town Planning Scheme for the Island.

Following on much discussion of the relative merits of two road schemes which had for some time occupied the minds of the Town Planning Authority a road scheme differing considerably, both in the main features and detail, from anything previously submitted, was prepared by the Asst. Land Officer, Mr. L. C. Wright.

This scheme was accepted by the Town Planning Authority and thereupon the A.L.O. embarked on the task of pooling and computing the land in the Island and preparing plans showing the proposed roads and the various holdings so adjusted as to give every owner a frontage on at least one road.

In order to obtain the necessary land for the roads each owner under the scheme is required to surrender a maximum of 20 per cent. of his plot area.

In September, 1922, the whole Island was proclaimed as an area for which a Town Planning Scheme was to be prepared. The Town Planning Sub-Committee set to work to prepare a draft scheme containing provisions for the carrying out of the proposed road scheme, the adjustment of holdings to conform thereto, for the regulation of type and number of buildiugs to be erected in the area, the sub-division of land, and provision for securing the general amenity of the Island.

The various plans were completed, and the draft scheme had been submitted by the Sub-Committee to the Town Planning Authority at the end of the year, and it is hoped that the complete scheme, with its relative plans, will be published for objections and suggestions by persons interested early in the new year.

Several of the principles involved in the scheme in its present form are said to be viewed with disfavour by a majority of persons owning land in the Island, chief among these being the principle that owners of land should be responsible for the construction of new roads upon which their lands abuts. It is difficult to imagine what alternative compatable with equity can be adopted. It will be interesting to see what arguments can be deduced in support of the land owners' claims that their land should be developed by road construction at the expense of any one other than themselves.

Doubtless, considerable amendment in the draft scheme will be required before final approval can be given, but the Town Planning Authority have made every effort to produce what is in their opinion the best and most equitable method of dealing with the Town Planning of the Island, viewed not from the standpoint of any section of the community, but from that of the people as a whole.

No attempt has been made to deal in this scheme with the Old Town.

The present scheme deals with the Island, excluding that portion which lies east of Salim Road and north of Kilindini Road—*i.e.*, the Old Town and neighbourhood.

The view has been expressed by some that it is far more necessary to deal with the Old Town and remedy the existing deplorable conditions there than to devote time and money to the undeveloped portion of the Island ; that the widening of existing streets in the Old Town, etc., is of greater urgency than the provision of new ones in other parts of Mombasa. This line of reasoning is unsound for several reasons.

Firstly :—The widening of streets is by no means the most important object in Town Planning.

Secondly :—In the Old Town it is not the streets nor the houses abutting thereon which most require to be dealt with, but rather the areas behind and between these streets, and for this reason to deal adequately with them it will be necessary to treat large portions as insanitary areas, demolish all or most buildings in such areas, giving compensation for same, and having done so, replan and redevelop. To do this necessitates the dehousing of a considerable number of people, and until other land and other housing is available elsewhere this cannot be attempted.

Thirdly :—To deal with one slum while permitting another to grow up elsewhere is futile. This would certainly happen if no steps were taken to town plan the newer portion of the town, no matter how much energy were to be expended on the old.

Fourthly :—The problem of dealing with the Old Town will be considerably easier when the development which will follow on the planning of the newer areas, has come to pass, for as a result of this the value of land and property in the old town will probably fall, thus making the reconstruction of the latter a less expensive undertaking.

Fifthly :—Sufficient funds with which to tackle so great a problem as the Town Planning of the Old Town are not available.

It is to be hoped that the coming year will see the scheme, in some form or other, receive the approval of His Excellency and it is not perhaps too optimistic to suggest that before the end of the year there may be something tangible accomplished to justify the work of the Town Planning Authority.

SANITARY INSPECTIONS.

MOMBASA—1922.

LICENSED PREMISES.

Licenses Recommended.

Class of Premises.	Applied for.	Approved.
Billiard Saloon	1	1
Bars	4	4
Butchers' Shops	2	2
Aerated Soda Factories	4	4
Cowsheds	24	24
Milk Sellers	5	5
Eating Houses	75	62
Vegetable Sellers	2	1
Dhobies	28	28
Ice Factory	2	2
Donkey Sheds	10	9
Bakeries	10	9
Tembo Shops	16	12
Hotels	4	4
Lodging Houses	6	4

INSPECTION OF LICENSED PREMISES.

Class of Premises.	No. of Premises.	Inspections.
Aerated Water Factories	4	83
Bakeries	10	179
Butchers	2	17
Cattle Sheds	24	370
Dhobies	28	379
Eating Houses	71	1,068
Hotels	5	45
Ice Factories	2	32
Tembo Shops	12	47
Vegetable Sellers	1	10
Lodging Houses	6	63
Bars	4	41
Billiard Saloon	1	8
	170	2,342

COMPLAINTS.

Complaints made	80
Premises inspected on complaint	80

MOMBASA WATER SUPPLY.

Applications made	38
„ approved	27
„ not approved	11
Inspections made	79

SANITARY INSPECTIONS—*continued.*

SANITARY AND GENERAL NOTICES.

Notices served during the year	677
,, outstanding from last year	22
,, cancelled	Nil
,, complied with	690
,, outstanding	9
,, final served	31

RESULTS OF INSPECTIONS AND NOTICES.

Premises demolished	14
,, repaired, cleaned and limewashed	1,242
Cesspits repaired	95
,, filled in	37
,, constructed and provided with covers ...	62
Plots cleared of bush, &c.	56
Depositing of rubbish stopped...	106
Dustbins provided	193
Rainwater tanks repaired	49
,, ,, removed or sealed	44
,, gutters removed	—
Wells closed	—
Pail closets erected or made to type	52
Mosquito breeding places and likely mosquito breeding places abated	1,351
Improvements effected and nuisances abated at licensed premises	113
Total	3,414

MOSQUITO PREVENTION.

Works carried out.

Well	1
Barrels	470
Rainwater tanks emptied	Nil
Cesspools and soakaways	410
Pools (average per week)	6
Area (approx.) cleared of bush	278
Holes, borrow pits, &c., filled in	4
Amount of material used (cart loads)	Nil
Loads of tins, &c., buried	Nil
Number of Native Mosquito Inspectors	2
,, inspections by Native Inspectors (approx.)	8,000

DISINFECTION.

Premises disinfected	41
Number of rooms	126
,, articles disinfected (approx.)	5,802

SANITARY INSPECTIONS—*continued.*

FOOD, ETC., INSPECTIONS.

Class of Food, &c., Inspected.	Quantity Inspected.	Quantity Condemned.
Beef	As far as possible market inspected daily	1,965 lbs.
Sheep Lungs	... ...	48
Ox Hearts	... ...	16
Mutton	... ...	689 lbs.
Dhall and Rice...	47 bags	37 bags
Milk, Condensed	6,331 tins	1,830 tins
Ox Tongues	... ...	14
Sheep's Head	... ...	6
Ideal Milk	22 tins	22 tins
Tomato Sauce	199 tins ($5\frac{3}{4}$ oz.)	199 ,,
Salmon	480 tins	480 ,,
Biscuits	13 cases	13 cases
Bacon	240 lbs.	240 lbs.
Custard Power	... ...	116 lb. tins
Arrowroot	... ...	57 ,,
Pineapple	... ...	27 tins
Jam	... ...	1 tin
Semolina...	... ...	37 tins
Green Peas	... ...	17 ,,
Sardines	... ...	306 tins (8 oz.)
Mushrooms	... ...	5
Preserved Fruits	1,852 tins	670 tins
Tea	... ...	1,613 lbs.

INSPECTIONS BY EUROPEAN INSPECTORS.

Water supply inspections	79
Nuisance and general inspections ...	5,445
Licensed premises inspections	2,336
Disinfection inspections	15
Food, etc., inspections	49
(Market and slaughter house as far as possible inspected daily)	
Total	7,924

REPORT ON PLANS.

Number of plans submitted	60
,, ,, ,, recommended	46
,, ,, ,, sent back for alteration ...	9
,, ,, ,, not recommended ...	5

BUILDING APPLICATIONS.

Building applications submitted	632
,, ,, recommended ...	560
,, ,, not recommended ...	72

SANITARY INSPECTIONS—*continued.*

PROSECUTIONS.

Class of Prosecution.	Number.	Convictions.	Fines.
Licensed premises rules ...	4	4	40/- and 3 days.
Breeding mosquitoes... ...	65	58	387/-.
Master and Servant Ordinance	6	6	One month to complete work, failing 100/- fine or one month.
Township rules	3	3	20/-.
Nuisance rules	8	6	150/-.
Building infringements ...	1	—	—
Unregistered bake-house ...	1	—	—
,, cowsheds ...	11	10	59/-.

ORDERS.

Closing orders	2
Nuisance ,, ...	2
Eviction ,, ...	1

Maternity and Child Welfare.—Early in the year a clinic was opened at the Health Office where children could be seen and treated for minor ailments. The success which has attended this venture has been very considerable and the greatest credit is due to the Health Sister, Miss M. A. Perkins, to whose energy, hard work and enthusiasm that success has been due. Her report on the in-door and out-door work carried out during the year is appended

MATERNITY AND CHILD WELFARE.

REPORT BY HEALTH SISTER, MOMBASA.

The maternity and child welfare scheme on a small scale was undertaken during the year 1922 with the object of trying to obtain and maintain some improvement on the physical condition of the women and children and a better state of hygiene and cleanliness in their homes, persons, and clothing.

The work has centred mainly in the visiting of homes and schools and in the office clinic.

The clinic was opened on January 3rd, 1922, for practical demonstrations and educational purposes and for the treatment of minor ailments.

Instruction has been given in :—

(*a*) Proper cleansing, care and treatment of wounds.

(*b*) The feeding, washing and care of infants and children.

In the case of both Natives and Indians the lack of elementary knowledge is surprising. Food such as pineapple, mango, banana and mealie cob is considered a suitable diet for infants of a few months old, or the other extreme is reached and children of 1½ years are dieted with milk only, sometimes with the addition of water. Much surprise is expressed when told that the convulsions which follow the one, and the weakness following the other, are caused mainly by faulty feeding.

(*c*) The prevention of the spread of disease by contact from discharging wounds, ulcers, rashes, eyes, sputum, etc.

(*d*) The cleaning of verminous heads, the prevention of the breeding of vermin, and the treatment of sore and ulcerated heads caused by vermin.

(*e*) The treatment of scabies, measles, fevers, coughs, worms, indigestion, bad eyes, otitis media and simple ailments. The necessary medicines are supplied with the instructions for giving or applying.

(*f*) Douching and general treatment for gonorrhœa and other forms of venereal disease, the seriousness of its infection, the precautions necessary for the prevention of spreading by contact, the garments of the women and the clothing needing special attention. A special room is used for these cases with an ordinary native bed where women are taught to douch with an ordinary bottle. Local treatment is carried out either daily or as often as necessary.

The number of attendances at the clinic during the year was as follows :—

January	209	July	711
February	228	August	735
March	314	September... ...	741
April	386	October	834
May	548	November	728
June	578	December	795

Total number for the year 6,859.

Outside work has comprised mainly the visiting of homes wherein are sick women or children, visiting of pregnant and lying-in women, a certain amount of medical work being done where women cannot see a male medical, and school visiting.

Instruction has been given in :—

(*a*) The cleaning of the room, the disinfecting of the bed, and the washing of clothing and rags to be used at and after the confinement. A considerable number of women suffer from septic infection after the confinement, the usual custom being to keep any dirty rags for use on the bed during the lying-in period.

(*b*) The care of the baby's eyes, mouth, and navel (the usual method for treatment of the cord is to tie a string to it and thence round the neck and so to pull it out by the roots !

(*c*) The care of the breasts and the necessity for aperients.

In the case of illness instruction is given in :—

(*a*) Washing of the patient.

(*b*) Ventilation of the rooms. Darkness and closed windows are considered necessary for the sick, particularly amongst certain Indian communities.

(*c*) Feeding of patients.

(*d*) Making of poultices, gargling, douching, etc. Owing to the lack of utensils in the homes and the inability of the people to procure them, one needs to make use of very primitive arrangements. Also owing to the restrictions of their different religions in regard to food, fresh air, exercise, etc., the work is hindered to a considerable extent but progress has been made, and maintained in a considerable number of the cases attended.

The number of outside visits made was as follows:—

January	400	July	359
February	370	August	475
March	357	September... ...	499
April	381	October	307
May	251	November ...	261
June	308	December	228

Total number of outside visits 4,196.

During the later months many of the women have come to the clinic instead of my going to their homes.

Total number of clinic attendances	...	6,859
Total number of outside visits ...	...	4,196
Total	...	11,055

The number of people requiring treatment, to whom free treatment, medicine, etc., have been given, is as follows:—

Number of Cases	*1,769*	
Improved	1,620	1,769
Sent to Hospital ...	63	
Deaths	4	
Removals (notified)	11	
Removals (not notified) ...	44	
Remaining on Books ...	27	

School Work.

This work has only just been commenced but is progressing. It consists in the examination of all the children attending the schools—Native and Indian mixed schools and Indian Girls' schools.

The children get individual examination and are then classified as:—

(*a*) The physically fit.

(*b*) The children with minor ailments.

(*c*) The children unfit for attendance at school.

Class B.—Children with minor troubles such as small sores, suppurating ears, etc., who are fit to attend but need treatment, either are allowed to come to the clinic for treatment or are treated at home by parents who are visited and instructed.

Class C.—Children suffering from infectious disease whose attendance is a source of infection to others are either sent home for treatment, where the case is followed up, or to Hospital.

Vaccinations.

April 10th—Washiri Tribe children	61
April 21st— „ „ „	100
June 26th—Public Works Department boys	39
January to December—Infants (Europeans and Indians)	35
Total number ...	235

PORT SANITATION.

MOMBASA.

A total of 1,773 vessels entered the port (Mombasa and Kilindini Harbours) during 1922, as follows :—

Dhows.			Other Vessels.		
Local.		Foreign.	Local.		Foreign.
1,251	1,353	102	156	420	264

Passengers were disembarked as follows :—

Local.	Foreign.	Total.
1,488	9,094	10,582

The term " local " signifies plying between or travelling from ports within the Protectorates of Kenya, Tanganyika and Zanzibar.

Bills of health were issued to the following out-going vessels :—

Dhows...	190
Other vessels	377
Total ...	567

Boarding of Vessels by Port Health Staff.

With the exception of local dhows arriving from ports in the Kenya Protectorate, south of Lamu, all vessels are boarded on arrival by the Medical Officer of Health or Assistant Surgeon.

The number of vessels so boarded was :—

Dhows...	286
Other vessels	420
Total ...	706

Infectious Diseases on Vessels.

No case of infectious disease was discovered or notified as occurring on board ships while lying in the harbour.

The following vessels were specially dealt with on account of infectious disease :—

(1) s.s. " TUNA."—This vessel arrived in Mombasa Harbour on 19th May, 1922. The Medical Authorities at Kismayu reported by wire previous to her arrival that certain deck passengers disembarked at Kismayu on 17th May " had recently had smallpox."

In view of this, the crew and passengers were vaccinated and the passengers landed and their effects disinfected at the Infectious Diseases Hospital. They were then allowed to proceed.

The vessel unloaded and loaded cargo by her own crew.

(2) s.s. " MARECHAL GALLIENE " arrived in Kilindini Harbour on 20th March, having had plague on board during the voyage.

(3) s.s. "DUMBEA" arrived in Kilindini Harbour on 1st October, 1922, having landed two cases of plague at Dijibouti seven days previously. An account of the circumstances and the action taken is given under the heading PLAGUE in the section dealing with epidemic diseases.

Precautionary Measures Against Introduction of Infectious Disease.

Up till the present time no measures other than routine boarding by the Health Officer have been adopted.

Until the latter part of the year there existed no wharf or pier alongside which vessels could be berthed with the single exception of the pier at the Magadi Soda works.

It followed, therefore, that all transference of cargo in both harbours took place by lighterage.

Now, however, the pier at Mbaraki is at work, and although at the present date only one vessel has been laid alongside, it is probable that in the near future vessels will be berthed there continually.

Further, the completion of the Government Deep Water pier is not far distant.

The nature of the port is, therefore, changing, in that the berthing of ships alongside until now comparatively infrequent, will shortly become a routine occurrence.

The facilities for the landing of plague infected rats will become very greatly increased.

That such has always been possible is unquestionable, seeing that it is by no means difficult for rats to make their way into lighters, at night particularly, and also from the fact that dhows are brought on the foreshore in Mombasa harbour for careening.

Now, however, the opportunities will be more and easier and the question of precautionary measures to be adopted is one which will require to be thoroughly dealt with.

Little in the nature of the rat proofing of buildings, godowns, sheds, etc., exists in the present harbour area. It is desirable that no more such buildings be erected unless they are designed and constructed in such a way as to reduce to a minimum the opportunity for rat harbourage.

Quarantine Station.

The Sanitary Station at Zanzibar is still the Quarantine Station for this port.

The site at Kipevu is most unsuitable for the purpose.

It is a considerable distance from Kilindini, is perched on the top of a hill, and in every way would be most difficult to administer.

To establish a Quarantine Station for Mombasa would be an expensive undertaking. To deal adequately with any demands which might be made on it, such station would need to provide accommodation for at least 400 persons.

Upwards of 50 passengers can be quarantined in the Infectious Diseases Hospital, and in this way small coasting vessels can be dealt with.

It is doubtful, however, if the present Hospital at Mzizima is in a satisfactory situation for a large quarantine, or whether the very large expenditure which would be required to establish such a station any nearer than Zanzibar can yet be justified.

Port Health Regulations.

Regulations which will facilitate the control of infected shipping and allow additional measures to be taken to prevent the importation of infected rats, second hand clothing, etc , etc., and allow of action being taken with regard to nuisances in ports were drafted during the year. With the object of unifying procedure along as much of the East African Seaboard as possible the very satisfactory Port Health Regulations of the Union of South Africa were adopted as a model.

VII.—HOSPITALS, DISPENSARIES AND INSTITUTIONS.

(1) GENERAL REMARKS.

Analysis of the figures of admissions to hospital throughout the country for the year reveals the following :—

	In-patients.			Deaths.		
	1922.	1921.	1920.	1922.	1921.	1920.
European Officials	635	592	574	5	4	4
Non-European Officials	3,337	3,951	4,439	6	10	12
Gen. European Population	1,106	728	858	21	31	29
Gen. Native Population	37,384	23,634	20,001	820	809	854

Note.—For the purposes of statistics, in-patients include all patients confined to quarters.

It will be noted that there is a further large increase in the figures relating to the General Native Population due in great part to the extension of facilities in the Native Reserves, though at the same time there has been an increased attendance at all hospitals.

There unfortunately appears to be no prospect at present of increased facilities for pathological research and the lack of these continues to be a handicap at centres outside Nairobi.

(2) EUROPEAN HOSPITALS.

The chief item of note is that, as a result of the curtailment of expenditure, the European Hospital at Eldoret, together with all equipment, has been handed over by Government to the local community and will in future be run by trustees and be financed by money received from hospital fees and subscriptions raised locally. Under the new arrangement the present District Surgeon will act as Medical Superintendent, but patients will be attended by any doctor whom they may choose. The hospital bills will not in future cover medical attendance, which will be a matter between the patient and the medical man concerned. The arrangement for such Government patients as may require admission to hospital will be that they themselves will be responsible for fees on the scale as laid down for Government Hospitals, the Government accepting the remainder. The European Hospital, Eldoret, remained a Government institution until the close of the year and was taken over locally as from January 1st, 1923.

There is nothing to record in the way of structural improvement to European Hospitals during the year, and such work as has been executed has been in the direction of necessary repairs to existing buildings.

The scheme for the enlargement of the European Hospital, Nairobi, as a War Memorial, out of funds collected by public subscription, was definitely abandoned during 1922, as the up-keep of such would have meant increased provision in the estimates and this was not possible in view of the necessary curtailment of expenditure.

The total number of cases treated in the various European Hospitals shows :—

	1922.	1921.	1920.
Total number of beds	46	46	34
Total number treated	748	667	608
Total number discharged	709	618	552
Total number of deaths	22	27	22
Total number remaining	17	22	34

In the various hospitals 162 admissions were of officials and 585 of non-officials as against 195 and 472 in the preceding year. Five officials died and 17 non-officials as against 4 and 23 in 1921.

The distribution of the various cases was as follows :—

	Officials.	Non-Officials.
Mombasa	60	183
Nairobi	76	265
Eldoret	11	86
Kisumu	15	52

Malaria was again the chief cause (34·6 per cent.) of admission to hospital and showed considerable increase over last year, totalling 259 cases as against 198.

A large number of cases of surgical disease and surgical operations have again come under notice, though the total of operations is not so large as in the preceding year. The numbers of operations (excluding minor ones) performed were :—

Mombasa	21
Nairobi	153
Eldoret	4
Kisumu	0
	178

The cases were of every variety and every degree of severity. Two deaths occurred following operation, one a case of gunshot wound of the leg in which gas gangrene supervened and the second a gangrenous appendix with general peritonitis.

(3) NATIVE HOSPITALS AND DISPENSARIES.

The curtailment of the number of sub-stations has already been described under "Administration," and the detailed list of dispensaries which have had to be closed as a result of the financial position has been given under the same section.

One good result of retrenchment is that the old and insanitary native hospital at Nairobi has been at last done away with. In order to reduce estimates to the limits required, it was evident that only three members of the

Medical Staff, including the Resident Surgical Officer and the Medical Officer of Health, could be available for posting at Nairobi. It was also evident that under the new conditions it was impossible to continue to maintain both the old native hospital and the King's African Rifles Hospital. The King's African Rifles Hospital, largely built during the war, had become much too large for peace requirements and was likely to become more so, in view of the probable cutting down of the military forces. The hospital was well situated outside the town and adjoining the K.A.R. Lines on the top of a hill affording good drainage and on a murrum and rocky soil with ample room for extension. The buildings were of a very good pattern, well ventilated, with good cement concrete floors and with corrugated iron walls and roofs, the latter with open ridge ventilators. The walls were built with the timber framing outside to facilitate cleansing. A very efficient operating theatre was in existence with stores, pack store, latrines, incinerator, etc., and it required very little addition to provide accommodation for both civil and military patients. On the position being submitted to Government, money was made available to construct three new wards, a new mortuary, a bathing place and attendants' quarters, the material being largely obtained by the demolition of the old civil hospital buildings. The result is a clean and sanitary hospital in which Medical Officers can take a legitimate pride, well away from the Town with its temptations to patients to stray away to the bazaar, and with ample accommodation for 150 patients.

The Medical Staff allotted to the new combined Hospital consists of—

Medical Officer	1
Nursing Sisters	2
Sub-Assistant Surgeon	1

with the Resident Surgical Officer in charge of the surgical side.

It was feared at first that for a time patients might be chary of entering the new hospital on account of its proximity to the K.A.R. Lines and of its previous military status, but such was not the case and the numbers have shewn a steady tendency to increase. This increase has been particularly noticeable among female patients and children, probably due to the presence of the Nursing Sisters and of two native female attendants who, under the supervision of the European Staff, are performing good work.

A rapid increase in the amount of surgery performed has been another feature since the removal of the hospital, and under the new conditions there is no hesitation in undertaking complicated procedures in connection with bone surgery and severe abdominal operations, *e.g.*, the removal of large uterine fibroids and ovarian cysts, while the results have been most gratifying.

The out-patient department and dispensary remain in their old situation, and patients needing admission to hospital are conveyed there by motor ambulance, being accommodated, if necessary, in a small ward while awaiting transport.

There are few important changes to chronicle in connection with the other native hospitals of the country. Additions have been made in the shape of mud and wattle buildings of a superior type to the Mombasa and Fort-Hall Hospitals, giving accommodation to 16 and 14 extra patients respectively. The addition at Mombasa was provided and paid for by Messrs. Paulings, Ltd., the contractors for the new harbour works at Kilindini, in order that their sick labourers might be admitted to the central Government Hospital on payment of the usual fees for maintenance. At Fort-Hall a small wood and iron operating theatre has been constructed, and at Mombasa arrangements are being made to provide a pack store and better facilities for the treatment of gonorrhœa. At Chuka additional accommodation has been provided in the shape of wards providing space for 24 beds and dressing sheds.

The record of admissions, and deaths, to the various native hospitals is as follows :—

	1922.		1921.		1920.	
	In.	Out.	In.	Out.	In.	Out.
Admissions	37,384	165,538	23,634	154,198	20,001	109,737
Deaths	821	—	809	—	854	—
Death rate per 1,000 of admissions	21·96	—	34·23	—	42·69	—

It has not been possible during 1922 to proceed with the scheme for training native hospital assistants. The general position was completely changed as the result of retrenchments, and a certain amount of disorganisation necessarily occurred. The provision of an efficient native hospital at Nairobi introduced an entirely new factor into the situation, and it is probable that the school when started will be placed at Nairobi.

(4) NATIVE RESERVES.

The medical centres in the Native Reserves have again proved their usefulness and large numbers of natives have attended for treatment. The effect of the Novarsenobillon treatment for yaws and the prevalence of the disease still proves a large factor in inducing attendance. It is argued by the natives that a medicine so potent for one disease is probably as effective in others with the result that every kind of case puts in an appearance. Though there is a certain amount of disappointment if Novarsenobillon is withheld, yet undoubtedly the native begins to see the advantages of European methods of treatment, though it will be a very long time before the majority give up trying their own remedies first. There can be no doubt that as a result of the existence of centres for treatment of the sick it will be easier in the future to institute public health measures in the Reserves, and when vaccination is carried out to a larger extent than at present, as it must before long, the opposition to this will be less than it otherwise would have been. It is, to say the least, doubtful whether the anti-plague campaign in Kavirondo could have been carried out and maintained as it has been done without the prior extension of hospital and dispensary facilities.

The economic value of the work done in Native Reserves cannot but make itself felt in the country generally. The large numbers of cases of ulcers which have been cured in Kavirondo or which have been treated must, in the future, result in increased labour available either for work on European farms or to increase production in the Reserves.

The system of dispensaries in connection with the central hospitals has been continued and developed. In the South Kavirondo district two dispensaries have been opened. In the Fort-Hall district the number of dispensaries have been increased from four to seven, including the yaws camp which was established last year, and the numbers treated at these institutions during 1922 totalled 13,591. In the Machakos area five dispensaries have been opened during the year and in all 4,386 cases received treatment thereat. In Chuka one dispensary was started and treated 910 cases in nine months. There has been no increase in the numbers of dispensaries in either the Central or North Kavirondo districts.

The amount of work done at the Medical Centres in Native Reserves can be gauged from the totals of cases treated at the following :—

	In-patients.	*Out-patients.*
Chuka	4,470	552
Kisii	5,624	3,565
Kakamega ...	2,179	27,071

The above three stations are specially quoted as they are essentially Native Reserve stations and are not situated near areas of European settlement.

Reference was made in last year's report to the large numbers of cases of ulcers which had been cured in North Kavirondo; there is no reason to doubt that ulcers are now far less common in that district than formerly, and the numbers attending for treatment have shown a large decrease during 1922. As previously, yaws accounts for the majority of cases at Kisii and Fort-Hall, while Chuka, as was expected, is also chiefly concerned with the treatment of yaws.

It has already been recorded that for reasons of finance it has been necessary to cease contributions to Missionary Societies who do medical work among natives. Comments have been made in previous reports as to the policy involved in subsidising missions to do the work which should more properly be carried out by Government.

(5) LUNATIC ASYLUM.

The following table gives the number of admissions and deaths during the past three years :—

	Admissions.			Deaths.		
	1922.	1921.	1920.	1922.	1921.	1920.
Males	67	70	78	35	22	22
Females	19	18	9	4	1	6

During the year the total number of patients treated was 168.

The varieties of insanity for which patients were admitted were :—

Mania	56
Melancholia	2
Dementia	5
Delusional Insanity ...	7
Other Mental Diseases ...	16

Thirty-nine deaths occurred, one an European, giving a percentage of 23·2 to the total number of patients treated.

Forty-one cases were discharged.

The percentage ratio of discharges to admissions was 47·6.

Eighty-eight patients remained at the close of the year.

During the year 13 Europeans were admitted to the Asylum and one died. The great majority of the European admissions was again caused by alcohol.

There is nothing to record in the way of new buildings at the Asylum, and such works as have been carried out have been in the nature of necessary repairs. Four acres outside the present boundary of the Asylum have been put under cultivation during the year, and besides providing work of a suitable nature for the native inmates reduces the expenditure on foodstuffs.

(6) GAOLS.

The gaols and gaol conditions of the country were the subject of a thorough investigation by a Committee specially appointed for the purpose during 1922. The members of the Committee were the Deputy Principal Medical Officer, the Senior Provincial Commissioner and the Officer Commanding Troops. A comprehensive report was issued and forwarded to the Secretary of State in the latter part of the year. Attention was specially drawn in the report to the generally overcrowded condition of prisons and recommendations were made as to the improvement desirable in the dietary for native prisoners, the clothing and the sleeping accommodation. It is hoped that some, at any rate, of the recommendations will be adopted and be given effect to during 1923.

During the year the Government experimental farm at Mazeras was handed over to the Prisons Department and will be kept under cultivation by prison labour with the object of producing foodstuffs for use in the gaols. It is expected that in future the Mombasa Prison will be furnished from Mazeras with a plentiful supply of fresh vegetables.

The general conditions as regards gaols and gaol hospitals are in the main as reported on previously. As before, Nairobi returns the largest number of deaths, as might be expected, being far the biggest prison in the country but the percentage of deaths to the average number resident has dropped. Kisumu has had more deaths than usual, though conditions are unaltered from previous years.

Pneumonia was again the chief cause of mortality and accounted for 20 of the 23 deaths at Nairobi, two at Kisumu and two at Mombasa.

The figures relating to the three largest prisons are as follows :—

	Mombasa.		Nairobi.		Kisumu.	
	1922.	1921.	1922.	1921.	1922.	1921.
Total number of prisoners on 1st January	322	300	716	746	85	107
Number admitted during the year ...	1,262	1,127	1,209	2,393	519	592
Average daily number in gaol ...	332·9	274	738	760	145·6	93
Total number placed on sick list ...	352	268	888	1,133	77	48
Total number of days on sick list ...	2,911	2,927	15,001	17,476	890	448
Average number of sick daily ...	8·27	8·02	47·10	47·87	2·43	1·23
Total number of deaths	4	1	23	43	6	—
Percentage of deaths to average daily strength	·36	·36	3·1	5·65	4·1	—

RETURNS.

TABLE I.

ADMINISTRATIVE DIVISION.

	Dr. J. L. Gilks	Principal Medical Officer.
	Dr. C. L. Chevallier	Deputy Principal Medical Officer.
	Dr. A. R. Paterson	Chief Sanitation Officer.
(1)	Mr. R. Stanley, M.B.E. ...	Office Superintendent.
(2)	Mr. H. Ogden	... ...
	Mr. D. S. Wardle	Accountant.
	Mr. G. E. Scattergood	Clerk.
	Mr. T. R. Wilson, D.C.M. ...	,,
	Mr. J. S. Robertson, M.B.E. ...	Medical Storekeeper.

MEDICAL DIVISION.

	Dr. F. L. Henderson	Senior Medical Officer.
	Dr. G. R. H. Chell	,, ,, ,,
	Dr. J. Pugh	,, ,, ,,
	Dr. C. J. Wilson, M.C.... ...	,, ,, ,,
	Dr. N. P. Jewell, M.C.... ...	,, ,, ,,
	Dr. H. H. V. Welch	Resident Surgical Officer.
	Dr. A. D. J. B. Williams, O.B.E.	Medical Officer.
	Dr. T. F. Lumb...	,, ,,
	Dr. T. H. Massey, M.C. ...	,, ,,
	Dr. P. F. Nunan	,, ,,
	Dr. J. H. Thomson	,, ,,
	Dr. V. M. Fisher	,, ,,
	Dr. A. S. Mackie	,, ,,
	Dr. F. T. Auden	,, ,,
(3)	Dr. R. C. Briscoe	,, ,,
(4)	Dr. N. B. Peacock	,, ,,
	Dr. B. W. Dakers	,, ,,
	Dr. C. V. Braimbridge	,, ,
	Dr. G. W. Pope...	,, ,,
	Dr. F. J. C. Johnstone... ...	,,
	Dr. K. T. K. Wallington ...	,,
	Dr. E. A. Davidson	,, ,
	Dr. J. O. Beven...	,, ,
	Dr. R. A. W. Procter, M.C. ...	,, ,,
	Dr. R. J. Harley-Mason ...	,, ,,
	Dr. J. C. J. Callanan	,, ,,
	Dr. C. H. Brennan, M.C. ...	,, ,,
	Dr. R. N. Hunter	,, ,,
	Dr. J. A. Ross	,, ,,
(5)	Dr. A. H. Mitchell	,, ,,
	Dr. W. H. Kauntze, M.B.E. ...	Bacteriologist.
	Dr. P. A. Clearkin	1st Assistant Bacteriologist.
	Dr. G. V. Allen...	2nd Assistant Bacteriologist.

TABLE I—*continued.*

MEDICAL DIVISION—*continued.*

	Mr. F. A. Bailey	Lab. Assistant.
(6)	Dr. V. G. L. van Someren ...	Dental Surgeon.
(7)	Dr. H. R. A. Philp	District Surgeon.
(8)	Dr. J. Forbes	,, ,,
	Dr. C. J. Caddick	,, ,,
	Mr. H. Ogden	Dispenser.
(9)	Miss F. L. Neave	,,
	Mr. E. R. Edmonds	,,
	Mrs. E. R. Barrett	Matron.
(10)	Miss H. M. Whitburn	Nursing Sister.
	Miss I. Wilson	,, ,,
	Mrs. S. J. Harrison	,, ,,
	Miss M. I. Rhind	,, ,,
	Miss A. B. Wharin	,, ,,
	Miss F. O'Neill	,, ,,
	Miss H. M. Friedricks	,, ,,
	Miss R. Anderson	,, ,,
	Miss P. S. Joubert	,, ,,
	Miss A. G. Leary	,, ,,
	Miss V. B. Painter	,, ,,
(11)	Miss A. L. Stuart	,, ,,
	Miss E. B. Wishart	,, ,,
	Miss H. Masters	,, ,,
(12)	Miss E. M. Froneman	,, ,,
	Miss M. Edwards	,, ,,
	Miss H. Hayward	,, ,,
(13)	Miss I. Cameron	,, ,,
	Miss M. Aitken...	,, ,,
(14)	Miss M. B. Munro	,, ,,
	Miss G. M. Buckley	,, ,,
	Miss D. M. Kenny	,, ,,
	Miss F. M. Biggar	,, ,,
	Mr. W. Henfrey	Superintendent, Lunatic Asylum.
	Mrs. L. A. Henfrey	Matron ,, ,,
	Miss E. Hamilton	Assistant Matron ,, ,,
	Mr. S. J. Bosch...	Warder ,, ,,
	Mr. F. J. B. Jordan	Warder ,, ,,

SANITATION DIVISION.

(15)	Dr. G. Walker	Medical Officer of Health.
	Dr. E. W. N. Guinness, O.B.E.	,, ,, ,,
	Dr. H. S. de Boer, M.C. ...	,, ,, ,,
	Mr. F. Strawbridge	Senior Sanitary Inspector.
	Mr. A. F. Dennett	Sanitary Inspector.
(16)	Mr. B. E. F. Wetkin	,, ,,
	Mr. E. E. Williams	,, ,,
	Mr. P. Cairns	,, ,,
	Mr. J. P. Cook	,, ,,
(17)	Mr. E. Holness, M.M.	,, ,,
	Mr. R. C. Mills	,, ,,
(18)	Mr. F. R. Crighton	,, ,,

TABLE I—*continued.*

SANITATION DIVISION—*continued.*

Mr. A. P. Ling ...	... ...	Sanitary Inspector.
Mr. H. E. Taylor	... ...	,, ,,
Mr. A. Bunker ...	... ...	,, ,,
Mr. D. P. Broad	... ...	,, ,,
Miss M. A. Perkin	... ...	Nurse.
Miss R. K. Sharp	... ...	,,
Mr. W. J. Edwards	... ...	Superintendent, Infectious Diseases Hospital.

REMARKS.

(1) Retired, 11-10-22.
(2) Promoted, 12-10-22.
(3) Agreement expired, 7-6-22.
(4) Agreement expired, 16-10-22.
(5) Engaged, 26-1-22. Retrenched, 26-11-22.
(6) Retrenched, 9-10-22.
(7) Agreement terminated, 31-7-22.
(8) Engaged, 1-5-22.
(9) Resigned, 25-7-22.
(10) Retired, 6-11-22.
(11) Retrenched, 29-9-22.
(12) Agreement terminated, 17-11-22.
(13) Invalided, 4-2-22.
(14) Resigned, 31-8-22.
(15) Agreement terminated, 10-11-22.
(16) Retrenched, 31-12-22.
(17) Services terminated, 21-4-22.
(18) Services terminated, 24-8-22.

TABLE II.

FINANCIAL.

The sanctioned Medical Budget for the year 1922 was a total of £194,032, as compared with £232,898 for the preceding twelve months.

Of the 1922 grand total, £143,333 was expended, leaving an unexpended sum of £50,699.

The savings were chiefly due to buildings for three Government Medical units, Mombasa Conservancy, Retrenchments and curtailed activities owing to the financial situation.

The unexpended balances under "Special Expenditure" have been devoted to meet expenditure during next year under the same heading.

The headings under which the vote was arranged were as follows:—

SCHEDULE XIV.—MEDICAL DEPARTMENTS.

ADMINISTRATIVE DIVISION.

	Estimates.	Actual Expenditure.
	£	£
Personal Emoluments	12,912	12,095
(Under this heading are included the salaries of the Principal Medical Officer, Deputy Principal Medical Officer, Chief Sanitation Officer, Office Superintendent, Medical Storekeeper, Accountant, Clerical Establishment, messengers and packers.)		

TABLE II—*continued.*

	Estimates. £	Actual Expenditure. £
Medical Division.		
Personal Emoluments ... ... (Under this heading are included the salaries of the Senior Medical Officers, Resident Surgical Officer, Dental Surgeon, Medical Officers, Nurses, Superintendent, Warders, Matron, Assistant Matron, Lunatic Asylum, Assistant Surgeons, Sub-Assistant Surgeons, Compounders, Native Hospital Attendants and Lunatic Asylum Attendants.)	68,854	56,964
Sanitation Division.		
Personal Emoluments ... ... (Under this heading are included the salaries and duty allowances of the Medical Officers of Health, Sanitary Inspectors, Nurses, Vaccinators, Native Attendants for Infectious Diseases Hospitals, Leper Lazaretto and Quarantine Stations, Clerical Establishment, Mechanics for Clayton disinfectors, office boys and messengers.)	21,924	15,489
Laboratory Division.		
Personal Emoluments ... ... (Under this heading are included the salaries of the Senior and Assistant Bacteriologists, European and Asiatic Laboratory Assistants and Native attendants.)	5,018	4,567
Medical Departments.		
Other Charges ... ... (Under this heading are included Medical and Surgical Stores, Contingencies, Transport, Up-keep of Hospitals, Uniforms, Furniture and equipment, Electric Lighting, Water Supplies, Epidemics, Bush clearing, Ambulance and motor services, etc., Medical Mission units and Medical Work in Native Reserves.)	68,728	47,078
Special Expenditure ... ... (Contribution to Nakuru War Memorial Hospital, Contribution to War Office for purchase of salvage stores, Furniture and equipment, Conservancy requirements, Mombasa, etc.)	16,596	9,456

REVENUE.

The total amount of revenue collected as hospital fees, sales of medicines and surgical stores, bills of health and registration fees, was as follows :—

	£
Hospital fees, sales of medicines and registration fees	6,987
Bills of Health...	547
Laboratory Fees	556
Total	£8,090

Last year the total revenue collected amounted to £5,599 5s. 0d.

TABLE III.

RETURN OF STATISTICS OF POPULATION FOR THE YEAR 1922.

Kenya Colony and Protectorate.	Europeans and Whites.	Africans and Others.	Asiatics.
Number of Inhabitants in 1922	9,651‡	2,500,000*	25,880‡
Number of Births registered in 1922	261	†	†
Number of Deaths registered in 1922	89	†	†
Number of Immigrants during 1922	3,088	1,437	5,966
Number of Emigrants during 1922	(Figures not obtainable.)		
Number of Inhabitants during 1921	9,651	3,000,000	25,880

* Approximately. † Not registered. ‡ 1921 Census.

TABLE IV.

1.—SUMMARY OF ROUTINE SANITARY WORK DONE DURING THE YEAR IN THE TOWN OF NAIROBI.

For the Year ending 31st December, 1922.

	Approximate Area.	Number of proclaimed Open Spaces.
1922	7 sq. miles ...	Public Parks. Jeevanjee Garden. Arboretum. Municipal Forest. Show Ground, Parklands.
1921		
1920		

2.—POPULATION.

	Number of Natives.	Asiatics, etc.	Number of Europeans.	Total Approx.
1922	12,200	8,530	2,867	23,587
1921	12,088	9,449	2,929	24,466
1920	...	...	...	...

3.—HOUSING.

	Number occupied by Europeans.	Number occupied by Natives and Asiatics.
Number of Houses:—		
1922	770	602
1921	743	595
1920	695	459

Number of Huts:—

1922	1,224
1921	1,442
1920	1,463

TABLE IV.—*continued.*

4.—ERECTION OF NEW BUILDINGS DURING THE YEAR.

	1922.	1921.	1920.
Number of houses built without sanction	Nil	...	...
Number of huts built without sanction	3*	...	...

* These were demolished.

5.—LATRINES.

	For Males.		For Females.	
	Number.	Number of Seats.	Number.	Number of Seats.
Number of public latrines :—				
1922...	27	199	...	...
1921...	9	90	9	54
1920...	24	...	...	...
Number of new public latrines erected during the year :—				
1922...	9	90	9	54
1921...	...	At Native	Location.	...
1920...	...	...	...	...

	1922.	1921.	1920.
Number of private latrines	2,645	2,538	2,477
Average number of pails of nightsoil daily removed	11	29	2,834
Average number of soiled pails removed and clean pails substituted	...	...	...
Number of nightsoil men employed to clean latrines and to remove excreta	80	104	122
Number of cesspools	...	1	1
Number of cesspools cleaned	...	1	1
Number of new cesspools constructed during the year ...	...	...	...
Number of old cesspools abolished	...	...	...
Number of cesspools oiled regularly by Department	...	...	...

6.—REMOVAL OF REFUSE.

	1922.	1921.	1920.
Number of dustbins	1,175	1,614	1,593
Number of carts at work daily to remove refuse from streets	21	33	27
Amount of refuse removed daily	525 cub. ft. approx.	104	90
Number of carts at work daily to remove refuse from yards and premises	21	29	26
Amount of refuse removed daily from yards and premises ...	32	15	10
Number of men employed for removing refuse	32	64	56

TABLE IV.—*continued.*

7.—MODE OF DISPOSAL OF EXCRETA, REFUSE AND OFFAL.

	Daily average number of pails of excreta.			Daily average number of cartloads of refuse.			Daily average number of cartloads of slaughter-house and market offal.		
	1922.	1921.	1920.	1922.	1921.	1920.	1922.	1921.	1920.
Buried or trenched	2,645	342	300	...	...	...	...	3	2
Burnt	...	...	...	61	...	...	5	3	2
Thrown into sea	...	...	...	...	...	...	...	...	...
Otherwise dealt with	...	...	...	...	...	...	...	...	...

8.—AVERAGE DAILY NUMBER OF CARTLOADS OF CANS, BOTTLES, BROKEN CROCKERY AND OTHER INCOMBUSTIBLE MATERIAL REMOVED FROM HOUSES, HUTS AND COMPOUNDS.

	1922.	1921.	1920.
Cartloads	31	31	25

9.—WATER SUPPLY.

Nature of Water Supply.	1922	1921.	1920.
Pipe-borne water :—			
Source (river, lake or spring)—	Spring.		
Number of linear yards	...	...	...
Number of standpipes along roads	*Nil*	4,355	...
Number of standpipes in compounds and houses ...	1,617	1,319	1,207
Wells :—			
Public—			
Number	...	...	...
Number with pumps protected against surface water and mosquito-protected	...	...	...
Private—			
Number	1	...	...
Number with pumps protected against surface water and mosquito-protected	...	...	...
Tanks :—			
Public—			
Number under ground	*Nil*	*Nil*	*Nil*
Number mosquito-protected and served by pumps ...			
Number above ground			
Number mosquito-protected			
Number of 400 gallons capacity or less			
Number above 400 gallons			
Private—			
Number under ground	...	...	...
Number mosquito-protected	...	...	...
Number above ground...	...	155	155
Number mosquito-protected	...	155	155
Number of 400 gallons capacity or less	...	43	43
Number above 400 gallons	...	112	112
Nature of tanks :—			
Wood	...	...	...
Iron	...	...	...
Concrete	...	...	...
Barrels :—			
Number	...	...	...
Number mosquito-protected	...	...	...

TABLE IV.—*continued.*

10.—DRAINAGE.

	Public.	Private.
Masonry Drains—		
Linear yards of masonry drains—		
1922	40,290	No information
1921	40,009	,,
1920	40,009	,,
Linear yards reconstructed during the year—		
1922	...	,,
1921	...	,,
1920	...	,,
Linear yards repaired during the year—		
1922	143	,,
1921	175	,,
1920	175	,,
Linear yards of new drains constructed during the year—		
1922	281	,,
1921	3,535	,,
1920	3,535	,,
Earth Drains or Ditches cleansed—		
Number of linear yards of ditches cleansed—		
1922	354,457	,,
1921	354,457	,,
1920	354,457	,,
Number of linear yards of ditches dug and graded—		
1922	300,584	,,
1921	300,584	,,
1920	300,584	,,
Average frequency of clearing ditches of grass—		
1922	...	,,
1921	...	,,
1920	...	,,

11.—INSPECTIONS AND PROSECUTIONS.

	1922.	1921.	1920.
Number of Inspectors employed	6	5	3
Number of premises inspected	9,169	...	5,416
Number of houses where larvæ were found	...	...	642
Number of notices served to remove conditions causing the breeding of larvæ	...	...	230
Number of persons fined for having mosquito larvæ on premises	...	...	1
Number of notices served to remove insanitary conditions on premises	1,176	...	534
Number of persons fined for not removing insanitary conditions after notice	...	...	3
Number of soda and ærated water factories inspected	3	4	7

TABLE IV.

1.—SUMMARY OF ROUTINE SANITARY WORK DONE DURING THE YEAR IN THE TOWN OF MOMBASA.

FOR THE YEAR ENDING 31ST DECEMBER, 1922.

	Approximate Area.	Number of proclaimed Open Spaces.
1920	...	1 public garden.
1921	...	
1922	Township, 8¾ sq. miles Island, 3,500 acres ...	

2.—POPULATION.

	Natives.			Asiatics and Arabs.			Europeans.			Total Approx.
	Males.	Females.	Children.	Males.	Females.	Children.	Males.	Females.	Children.	
1921 ...	7,438	6,826	3,719	5,537	3,191	4,962	383	175	95	32,334
1922 ...	11,676	10,253	5,240	5,839	2,854	4,161	499	108	145	40,775

3.—HOUSING.

	Number occupied by Europeans.	Number occupied by Natives and Asiatics.
Number of Houses (Stone and Mud):—		
1920	170	4,804
1921	190	4,957
1922	200 (approx.)	5,100 (approx.)

Number of huts :—

1920	...	...	...	—
1921	...	...	...	—
1922	...	...	...	—

TABLE IV.—*continued.*

4.—LATRINES.

	For Males.		For Females.	
	Number.	Number of Seats.	Number.	Number of Seats.
Number of public latrines:—				
1920	9	33	...	...
1921	7	28	...	...
1922 { Town	11	64	...	...
1922 { Uganda Railway	6	22	...	...
Number of new public latrines erected during the year:—				
1920	3	24	...	...
1921	4	4	...	...
1922 { Town	4	36	...	...
1922 { Uganda Railway	2	4	...	...

	1920.	1921.	1922.
Number of private latrines	...	242	267
Number of latrines, Government Offices	...	129	118
Number of latrines, Uganda Railway	...	...	157
Average number of pails of night-soil daily removed { Town	331	399	449
Average number of pails of night-soil daily removed { Uganda Railway	...	...	760
Average number of soiled pails removed and clean pails substituted	28	28	449
Number of night-soil men employed to clean latrines and to remove excreta { Town	52	62	64
Number of night-soil men employed to clean latrines and to remove excreta { Uganda Railway	...	...	37
Number of cesspools	No figures available.		
Number of cesspools cleaned	70	70	Unknown.
Number of new cesspools constructed during the year ...	86	76	62 (approx.)
Number of old cesspools abolished	41	39	37 (approx.)
Number of old cesspools oiled regularly by Department ...	...	...	...

5.—REMOVAL OF REFUSE.

	1920.	1921.	1922.
Number of dustbins { Private	1,500	1,500	Unknown.
Number of dustbins { Public	63	66	7 permanent 60 portable
Number of dustbins { Uganda Railway	...	...	140
Number of carts at work daily to remove refuse from streets {	23 carts 1 mot'r lorry	20 carts 1 mot'r lorry	16 carts ...
Amount of refuse removed daily { Town	56 loads	57 loads	48 loads approx.
Amount of refuse removed daily { Uganda Railway ...	...	...	5 lds. „
Number of carts at work daily to remove refuse from yards and premises		Included in	C.
Amount of refuse removed daily from yards and premises ...		Included in	C.
Number of men employed for removing refuse { Town	227	236	207
Number of men employed for removing refuse { Uganda Railway	...	...	36

TABLE IV.—*continued.*

6.—MODE OF DISPOSAL OF EXCRETA, REFUSE AND OFFAL.

	Daily average number of Pails of Excreta.			Daily average number of Cartloads of Refuse.			Daily average number of Cart-loads of Slaughter-house and Market Offal.		
	1920.	1921.	1922.	1920.	1921.	1922.	1920.	1921.	1922.
Buried or trenched ...	...	...	...	...	...	...	...	...	...
Burnt { Town	...	...	...	60	57	48	1	1	1
Burnt { Uganda Railway	...	...	760	...	...	12	...	...	..
Burnt { Labour Camp...	...	...	50	...	...	...	...	...	...
Thrown into sea from disposal station	331	339	449	...	...	...	...	...	...
Otherwise dealt with ...	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

7.—AVERAGE DAILY NUMBER OF CARTLOADS OF CANS, BOTTLES, BROKEN CROCKERY AND OTHER INCOMBUSTIBLE MATERIAL REMOVED FROM HOUSES, HUTS AND COMPOUNDS.

1920.	1921.	1922.
4	4	6

8.—WATER SUPPLY.

Nature of Water Supply.	1920.	1921.	1922.
Pipe-borne water—			
Source (river, lake, or spring)—	Springs.	Springs.	Springs.
Number of linear yards	...	...	...
Number of stand-pipes along roads	1	13	32
Number of stand-pipes in compounds and houses ...	125	266	390
Wells :—			
Public—			
Number	28	28	
Number with pumps protected against surface water and mosquito-protected	...	...	100 approx.
Private—			
Number	81	61	
Number with pumps protected against surface water and mosquito-protected	...	...	
Tanks :—			
Public—			
Number underground	...	...	...
Number mosquito-protected and served by pumps ...	...	...	...
Number above ground	...	...	...
Number mosquito-protected	...	...	...
Number of 400 gallons capacity or less	...	...	...
Number above 400 gallons	...	...	...
Private—			
Number underground	82	82	100 approx.
Number mosquito-protected	82	82	100 approx.
Number above ground	...	...	Unknown.
Number mosquito-protected	...	...	,,
Number of 400 gallons capacity or less	...	...	,,
Number above 400 gallons	...	...	,,
Nature of Tanks :—			
Wood	...	...	...
Iron	...	...	...
Concrete	82	82	100 approx.
Barrels :—			
Number	...	...	Unknown.
Number mosquito-protected	...	...	...

TABLE IV.—*continued.*

9.—DRAINAGE.

	Public.	Private.
Masonry Drains :—		
Linear yards of masonry drains :—		
1920	No figs. available	
1921	Nil	
1922	No figs. available	
Linear yards reconstructed during the year :—		
1920	...	
1921	Nil	
1922	Nil	
Linear yards repaired during the year :—		
1920	...	
1921	...	
1922	Nil	
Linear yards of new drains constructed during the year :—		
1920	...	
1921	...	No figures available.
1922	Nil	
Earth drains or ditches cleansed—Number of linear yards of ditches cleansed :—		
1920	...	
1921	...	
1922—Uganda Railway	3,055	
Number of linear yards of ditches dug and graded :—		
1920	...	
1921	...	
1922—Uganda Railway	50	
Average frequency of clearing ditches of grass :—		
1920	...	
1921	...	
1922	...	

10.—INSPECTIONS AND PROSECUTIONS.

	1920.	1921.	1922.
Number of Inspectors employed	3	2	2
Number of houses inspected, *i.e.* house inspections ...	23,311	9,011	7,860
Number of houses where larvæ were found	238	548	No figures available.
Number of notices served to remove conditions causing the breeding of larvæ	320	662	180
Number of persons fined for having mosquito larvæ on premises	4	30	61
Number of notices served to remove insanitary conditions on premises	1,042	644	677
Number of persons fined for not removing insanitary conditions after notice	12	15	23
Number of soda and ærated water factories inspected	4	4	4

TABLE IV.

1.—SUMMARY OF ROUTINE SANITARY WORK DONE DURING THE YEAR IN THE TOWN OF KISUMU (NYANZA PROV.)

FOR THE YEAR ENDING DECEMBER, 1922.

	Approximate Area.	Number of proclaimed Open Spaces.
1920	19·6 sq. miles	1
1921	19·6 sq. miles	1
1922	19·6 sq. miles	1

2.—POPULATION.

	Number of Natives.		Number of Europeans.		Total approx.
	Males.	Females.	Males.	Females.	
1920 ...	Natives 4,320 Asiatics 960	Natives 2,200 Asiatics 360	150	60	8,050
1921 ...	Natives 2,945 Asiatics 901	Natives 998 Asiatics 301	96	48	5,289
1922 ...	Natives 2,945 Asiatics 901	Natives 998 Asiatics 301	96	48	5,289

3.—HOUSING.

	Number occupied by Europeans.	Number occupied by Natives and Asiatics.
Number of Houses :—		
1920	57	150
1921	57	152
1922	57	152

Number of Huts :—

1920	1,230
1921	1,240
1922	1,240

4.—ERECTION OF NEW BUILDINGS DURING THE YEAR.

	1920.	1921.	1922.
Number of houses built without sanction	*Nil*	*Nil*	*Nil*
Number of huts built without sanction	*Nil*	*Nil*	*Nil*

TABLE IV.—*continued.*

5.—LATRINES.

	For Males.		For Females.	
	Number.	Number of Seats.	Number.	Number of Seats.
Number of public latrines :—				
1920...	15	101	...	...
1921...	15	101	...	...
1922...	17	106	...	...
Number of new public latrines erected during the year :—				
1920...	2	12	...	...
1921...	1	6	...	...
1922...	2	5	...	...

	1920.	1921.	1922.
Number of private latrines	320	325	325
Average number of pails of nightsoil daily removed	682	688	693
Average number of soiled pails removed and clean pails substituted...	*Nil*	*Nil*	196
Number of nightsoil men employed to clean latrines and to remove excreta	45	45	4
Number of cesspools	146	148	156
Number of cesspools cleaned	Above cleaned daily.		
Number of new cesspools constructed during the year ...	7	2	11
Number of old cesspools abolished	1	*Nil*	3
Number of old cesspools oiled regularly by Department ...	...	...	...

6.—REMOVAL OF REFUSE.

	1920.	1921.	1922.
Number of dustbins	400	410	420
Number of carts at work daily to remove refuse from streets	4	4	4
	cart	loads.	
Amount of refuse removed daily	40	39	40
Number of carts at work daily to remove refuse from yards and premises	10	11	11
			cart-loads.
Amount of refuse removed daily from yards and premises ...	36	27	30
Number of men employed for removing refuse	34	34	36

7.—MODE OF DISPOSAL OF EXCRETA, REFUSE AND OFFAL.

	Daily average number of pails of excreta.			Daily average number of cartloads of refuse.			Daily average number of cartloads of slaughter-house and market offal.		
	1920.	1921.	1922.	1920.	1921.	1922.	1920.	1921.	1922.
Buried or trenched	679	688	693	22	*Nil*	1	1	1	1
Burnt	*Nil*	*Nil*	...	9	27	30	*Nil*	*Nil*	*Nil*
Thrown into sea	*Nil*	*Nil*	..	*Nil*	*Nil*	1	*Nil*	*Nil*	*Nil*
Otherwise dealt with	*Nil*	*Nil*	...	*Nil*	12	10	*Nil*	*Nil*	*Nil*

TABLE IV.—*continued.*

8.—AVERAGE DAILY NUMBER OF CARTLOADS OF CANS, BOTTLES, BROKEN CROCKERY AND OTHER INCOMBUSTIBLE MATERIAL REMOVED FROM HOUSES, HUTS AND COMPOUNDS.

1920.	1921.	1922.
3	2	3

9.—WATER SUPPLY.

Nature of Water Supply.	1920.	1921.	1922.
Pipe-borne water :—			
Source (river, lake or spring)—	Lake	Lake	Lake
Number of linear yards	12,600	15,890	16,590
Number of standpipes along roads	...	...	...
Number of standpipes in compounds and houses ...	82	85	86
Wells :—			
Public—			
Number			
Number with pumps protected against surface water and mosquito-protected			
Private—	*Nil*	*Nil*	*Nil*
Number			
Number with pumps protected against surface water and mosquito-protected			
Tanks :—			
Public—			
Number under ground			
Number mosquito protected and served by pumps ...			
Number above ground			
Number mosquito-protected	*Nil*	*Nil*	*Nil*
Number of 400 gallons capacity or less			
Number above 400 gallons			
Private—			
Number under ground	*Nil*	*Nil*	*Nil*
Number mosquito-protected			
Number above ground	195	195	201
Number mosquito-protected	195	195	201
Number of 400 gallons capacity or less	64	64	64
Number above 400 gallons	131	131	137
Nature of Tanks :—			
Wood	*Nil*	*Nil*	*Nil*
Iron	81	81	77
Concrete	114	114	124
Barrels :—			
Number	*Nil*	*Nil*	*Nil*
Number mosquito-protected			

TABLE IV.—*continued.*

10.—DRAINAGE.

	Public.	Private.
Masonry Drains :—		
Linear yards of masonry drains—		
1920	110	*Nil*
1921	110	*Nil*
1922	110	500
Linear yards reconstructed during the year—		
1920	*Nil*	*Nil*
1921	*Nil*	*Nil*
1922	*Nil*	*Nil*
Linear yards repaired during the year—		
1920	70	*Nil*
1921	*Nil*	*Nil*
1922	*Nil*	*Nil*
Linear yards of new drains constructed during the year—		
1920	20	*Nil*
1921	*Nil*	*Nil*
1922	*Nil*	500
Earth drains or ditches cleansed :—		
Number of linear yards of ditches cleansed—		
1920	40,000	*Nil*
1921	20,000	*Nil*
1922	37,600	*Nil*
Number of linear yards of ditches dug and graded—		
1920	3,600	*Nil*
1921	*Nil*	*Nil*
1922	17,600	*Nil*
Average frequency of clearing ditches of grass—		
1920	Monthly	Monthly
1921	,,	,,
1922	,,	,,

11.—INSPECTIONS AND PROSECUTIONS.

	1920.	1921.	1922.
Number of Inspectors employed	1	1	1
Number of houses inspected	3,367	5,300	6,700 approx.
Number of houses where larvæ were found	1	1	66
Number of notices served to remove conditions causing the breeding of larvæ	3	3	114
Number of persons fined for having mosquito larvæ on premises	1	*Nil*	*Nil*
Number of notices served to remove insanitary conditions on premises	123	167	267
Number of persons fined for not removing insanitary conditions after notice	3	3	*Nil*
Number of soda and ærated water factories inspected	1	1	1

TABLE V.

METEOROLOGICAL RETURN FOR THE YEAR 1922.

NAIROBI.

MONTH.	TEMPERATURE.						RAINFALL.		WINDS.		REMARKS.
	Solar Maximum.	Maximum on Grass.	Shade Maximum.	Shade Minimum.	Range.	Max. and Min. Mean combined.	Amount in inches.	Degree of Humidity.	General Direction.	Average Force.	
								%		—	
January ...	145·0		81·0	54·0	27·0	67·5	2·08	64		—	
February ...	147·0		82·0	57·0	25·0	69·5	1·81	66		—	
March ...	146·0		80·0	58·0	22·0	69·0	9·72	81		—	
April ...	145·0		76·0	59·0	17·0	67·5	7·88	84		0·6	
May	141·0		73·0	55·0	18·0	64·0	3·92	83		0·8	
June	143·0	Not observed.	73·0	55·0	18·0	64·0	0·06	81	N.E.	0.7	
July	126·0		69·0	51·0	18·0	60·0	0·61	81		0·9	
August ...	125·0		70·0	54·0	16·0	62·0	1·46	84		0·7	
September ...	141·0		76·0	55·0	21·0	65·5	0·68	71		0·9	
October ...	147·0		78·0	54·0	24·0	66·0	2·50	71		1·0	
November ...	146·0		76·0	58·0	18·0	67·0	2·57	80		2·2	
December ...	141·0		75·0	56·0	19·0	65·5	4·99	74		2·6	
Year Average...	141·0	—	76·0	56·0	20·0	65·5	Total 38·28	76	—	1·2	

MOMBASA.

MONTH.	TEMPERATURE.						RAINFALL.		WINDS.		Remarks.
	Solar Maximum.	Maximum on grass.	Shade Maximum.	Shade Minimum.	Range.	Max. and Min. Mean combined.	Amount in inches.	Degree of Humidity.	General Direction.	Average Force.	
								%			
January ...			86·0	72·0	14·0	79·0	0·08	68			
February ...			86·0	72·0	14·0	79·0	0·02	68			
March ...			87·0	75·0	12·0	81·0	5·78	73			
April			87·0	74·0	13·0	80·5	2·99	73			
May			82·0	72·0	10·0	76·0	5·01	84			
June	Not observed.	Not observed.	81·0	70·0	11·0	75·5	41·08*	80	Not observed.		* Highest recorded monthly rainfall over a recording period of 33 years.
July			84·0	68·0	16·0	75·0	3·48	81			
August ...			79·0	69·0	10·0	74·0	1·73	79			
September ...			80·0	70·0	10·0	75·0	1·12	75			
October ...			83·0	71·0	12·0	77·0	0·27	71			
November ...			83·0	76·0	7·0	79·5	8·46	79			
December ...			83·0	73·0	10·0	78·0	4·25	78			
Year Average	—	—	83·0	72·0	11·0	77·5	Total 74·27	75	—	—	

TABLE V.—*continued.*

METEOROLOGICAL RETURN FOR THE YEAR 1922—*continued.*

FORT-HALL.

Month.	Temperature.						Rainfall.		Winds.		Remarks.
	Solar Maximum.	Maximum on grass.	Shade Maximum.	Shade Minimum.	Range.	Max. and Min. Mean combined.	Amount in inches.	Degree of Humidity.	General Direction.	Average Force.	
								%			
January ...			84	52	32	68·0	0·28	·0			
February ...			88	50	38	69·0	1·87	·0			
March ...			90	50	40	70·0	6·85	·0			
April... ...			77	50	27	63·5	14·54	·0			
May			70	49	21	59·5	6·54	·0			
June			75	63	12	69·0	0·30	88			
July			72	56	16	64·0	0·54	87			
August ...	Not recorded.		74	53	21	63·5	0·29	97	Not recorded.		
September ...			80	56	24	68·0	0·12	77			
October ...			81	59	22	70·0	6·41	60			
November ...			80	54	26	67·0	1·37	78			
December ...			79	49	30	64·0	5·38	79			
							Total.				
Year Average	—	—	79	53	26	66·0	44·49	81	—	—	

KISUMU.

Month.	Temperature.						Rainfall.		Winds.		Remarks.
	Solar Maximum.	Maximum on grass.	Shade Maximum.	Shade Minimum.	Range.	Max. and Min. Mean combined.	Amount in inches.	Degree of Humidity.	General Direction.	Average Force.	
								%			
January ...			86·0	66·0	20·0	76·0	1·01	47			
February ...			84·0	65·0	19·0	74·5	3·40	49			
March ...			82·0	67·0	15·0	74·5	9·46	68			
April... ...			81·0	67·0	14·0	74·0	8·16	78			
May			82·0	67·0	15·0	74·5	4·28	63			
June			87·0	65·0	22·0	75·0	1·51	51			
July			81·0	68·0	13·0	74·5	1·59	52			
August ...	Not recorded.	Not recorded.	80·0	67·0	13·0	73·5	6·45	51	Not recorded.		
September ...			81·0	68·0	13·0	74·5	4·40	53			
October ...			84·0	69·0	15·0	76·5	1·69	50			
November ...			85·0	69·0	16·0	77·0	0·52	53			
December ...			84·0	67·0	17·0	75·5	3·40	47			
							Total				
Year Average	—	—	83·0	67·0	16·0	75·0	45·87	55	—	—	

TABLE SHOWING MEAN ANNUAL RAINFALL AT VARIOUS POINTS IN THE DIFFERENT AREAS FOR THE YEAR 1922.

Station.	COAST AREA.	1922.
Malindi	55·28 ins.	
Mombasa	74·27 „	
Mackinnon Road	46·34 „	
Voi	24·19 „	

MOUNTAINOUS AREA.

Masongaleni	32·12 ins.	
Makindu	40·16 „	
Kiu	26·71 „	
Athi River	21·53 „	
Nairobi (Department of Agriculture)	38·28 „	
Kabete Reformaiory (near Nairobi)	54·80 „	
Naivasha	30·45 „	
Nakuru	34·67 „	
Molo	60·19 „	
Eldama Ravine	34·46 „	

NYANZA AND KIKUYU PROVINCES.

Lumbwa	39·08 ins.	
Muhoroni	75·08 „	
Kisumu	45·41 „	
Kakamega	84·59 „	
Kericho	76·76 „	
Nandi	56·89 „	
Fort-Hall	44·49 „	
Nyeri	34·47 „	
West Kenya (Kenya Park)... ...	18·79 „	

DESERT AREA.

Kismayu	9·86 ins.	
Gosha Alexandra	29·62 „	

TABLE VI.

RETURN OF DISEASES AND DEATHS (IN-PATIENTS) FOR THE YEAR 1922.

DISEASES.	EUROPEAN OFFICIALS.					NON-EUROPEAN OFFICIALS.					GENERAL EUROPEAN POPULATION.					GENERAL NATIVE POPULATION.				
	Remaining in Hospital at end of 1921.	Yearly Total.		Total cases treated.	Remaining in Hospital at end of 1922.	Remaining in Hospital at end of 1921.	Yearly Total.		Total cases treated.	Remaining in Hospital at end of 1922.	Remaining in Hospital at end of 1921.	Yearly Total.		Total cases treated.	Remaining in Hospital at end of 1922.	Remaining in Hospital at end of 1921.	Yearly Total.		Total cases treated.	Remaining in Hospital at end of 1922.
		Admissions.	Deaths.				Admissions.	Deaths.				Admissions.	Deaths.				Admissions.	Deaths.		
Infective Diseases:—																				
Beri-beri	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	28	...	31	...
Cerebro-spinal fever	...	...	...	...	...	...	1	1	1	...	...	...	...	...	...	...	23	18	25	...
Chicken-pox	...	...	...	...	...	...	2	...	2	...	...	2	...	2	...	60	469	...	529	8
Cholera	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dengue	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Diphtheria	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dysentery	...	...	15	...	15	1	...	31	...	31	...	1	24	...	25	...	9	534	72	543	25
Endocarditis—Infective	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Enteric Fever	...	...	...	...	1	5	1	6	1	...	1	...	1	...	...	19	1	19	...	2	13	2	15	...
Erysipelas	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	3	...	3	...	...	5	...	5	...
Gonorrhœa	...	...	...	...	...	...	...	...	...	...	1	1	...	2	...	...	...	...	...	13	271	1	284	6
Influenza	...	...	...	...	...	111	...	111	...	6	612	...	618	2	...	62	...	62	...	15	1473	21	1488	8
Kala Azar	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Leprosy (*a*) Nodular	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	53	32	2	85	69
(*b*) Anæsthetic	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8	18	...	26	...
Malaria (*a*) Sub-Tertian	...	...	1	16	...	17	...	8	14	...	22	...	1	88	1	89	...	19	146	3	165	...
(*b*) Benign Tertian	...	...	2	43	...	45	6	...	...	...	...	...	...	26	2	26	2	14	33	4	47	...
(*c*) Quartan	...	...	...	...	...	...	...	2	1	...	3	...	2	4	...	6	...	1	...	...	1	...	1	...
(*d*) Undifferentiated	...	...	...	138	...	138	...	...	1211	...	1211	12	...	256	2	256	1	10	3314	34	3324	34
(*e*) Blackwater	...	...	1	2	1	3	...	...	8	3	8	...	...	12	2	12	...	...	13	4	13	1
Measles	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	4	3	7	69	...	76	2
Malta fever	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	2	4	1
Plague	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	11	5	11	...
Pneumonia	...	...	...	...	...	3	1	3	...	...	5	2	5	...	...	7	3	7	...	26	845	239	871	24
Rabies	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Relapsing fever	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	34	...	34	3
Rheumatic fever	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Septicæmia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	12	10	12	...
Trypanosomiasis (Sleeping sickness)	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...	...	23	2	25	8
Small-pox	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Syphilis (*a*) Primary	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
(*b*) Secondary	...	...	...	...	...	1	...	1	...	...	1	...	1	...	...	...	...	...	...	51	1453	8	1504	80
(*c*) Inherited	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	72	5	73	...
Tetanus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	9	8	10	...
Tuberculosis	...	...	...	...	...	...	...	...	...	...	1	...	1	..	1	...	...	1	...	9	186	70	195	13
Whooping cough	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	67	1	67	4
Yaws	...	...	...	...	...	...	...	...	9	...	9	...	...	...	...	...	...	311	18547	27	18858	87
Yellow fever	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mumps	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	25	1	25	...
Anthrax	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	33	3	34	...
Typhus	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...
Other Infective Diseases	...	...	...	4	...	4	...	...	20	...	20	...	...	1	...	1	...	1	123	7	124	6
Intoxications:—																				
Alcoholism	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2	...	...	1	...	1	...
Morphinism	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Others	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
General Diseases:—																				
Anæmia	...	...	...	...	...	...	...	...	3	...	3	...	...	...	...	...	...	3	46	2	49	1
Anæmia—Pernicious	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Diabetes	...	...	...	...	...	...	...	...	3	...	3	...	...	...	...	...	...	...	2	2	2	...
Exophthalmic goitre	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...
Gout	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Leucocythæmia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hodgkin's disease	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...
Myxœdema	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Purpura	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Rickets	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Scurvy	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6	...	6	...
Other General Diseases	...	...	...	9	...	9	...	3	17	...	20	...	2	20	...	22	...	6	52	5	58	2
Local Diseases:—																				
Diseases of the Nervous System:—																				
Sub-section 1.																				
Neuritis	...	...	...	...	...	...	...	...	2	...	2	...	...	...	...	...	...	...	16	...	16	...
Meningitis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	5	4	6	1
Myelitis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	2	4	...
Hydrocephalus	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...
Encephalitis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	7	6	7	...
Abscess of brain	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1	...
Congestion of brain	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...
Other Diseases	...	...	...	...	...	2	...	2	...	...	3	...	3	...	...	2	...	...	9	...	9	1
Sub-section 2.																				
Apoplexy	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	2	...	2	1
Paralysis	...	...	...	...	...	...	...	...	...	...	2	...	2	...	...	...	...	5	35	7	40	7
Chorea	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Epilepsy	...	...	...	...	...	...	...	...	1	...	1	...	...	3	...	3	...	1	11	1	12	...
Neuralgia	...	...	...	...	...	8	...	8	...	...	39	...	39	...	...	9	...	...	67	...	67	...
Hysteria	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2	1
Other Nervous Diseases	...	...	...	7	...	7	...	2	31	...	33	...	...	15	...	15	...	3	40	1	43	3
Mental Diseases—																				
Sub-section 3.																				
Idiocy	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	1	...	3	2
Mania	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	4	4	35	64	27	99	46
Melancholia	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2	...	1	2	1	3	...
Dementia	...	...	...	...	...	...	...	...	...	...	...	...	2	1	...	3	3	17	10	6	27	7
Delusional insanity	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	2	2	8	9	5	17	7
Other Mental Diseases	...	...	...	...	...	...	...	...	5	...	5	...	1	10	1	11	3	12	30	...	42	14

TABLE VI.—RETURN OF DISEASES AND DEATHS (IN-PATIENTS) FOR THE YEAR 1922—(*contd.*).

DISEASES.	EUROPEAN OFFICIALS.					NON-EUROPEAN OFFICIALS.					GENERAL EUROPEAN POPULATION.					GENERAL NATIVE POPULATION.				
	Remaining in Hospital at end of 1921	YEARLY TOTAL. Admissions.	YEARLY TOTAL. Deaths.	Total cases treated.	Remaining in Hospital at end of 1922.	Remaining in Hospital at end of 1921	YEARLY TOTAL. Admissions.	YEARLY TOTAL. Deaths.	Total cases treated.	Remaining in Hospital at end of 1922.	Remaining in Hospital at end of 1921.	YEARLY TOTAL. Admissions.	YEARLY TOTAL. Deaths.	Total cases treated.	Remaining in Hospital at end of 1922.	Remaining in Hospital at end of 1921.	YEARLY TOTAL. Admissions.	YEARLY TOTAL. Deaths.	Total cases treated.	Remaining in Hospital at end of 1922.
LOCAL DISEASES—*continued* :—																				
Diseases of the Eye—																				
Conjunctivitis	...	3	...	3	...	...	48	...	48	...	...	1	...	1	...	4	230	...	234	...
Keratitis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	13	...	13	...
Ulceration of cornea	...	...	...	...	...	1	10	...	11	...	...	1	...	1	...	1	24	...	25	1
Iritis	...	1	...	1	...	...	1	...	1	...	...	...	...	...	...	...	14	...	14	1
Optic neuritis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...
Cataract	...	...	...	...	...	...	3	...	3	...	...	...	...	...	...	2	10	...	12	...
Other Eye Diseases	...	3	...	3	...	...	29	...	29	...	...	2	...	2	...	1	46	...	47	1
Diseases of the Ear :—																				
Inflammation	...	...	...	...	...	...	10	...	10	...	...	...	...	...	..	...	42	...	42	...
Other Diseases	...	2	...	2	...	...	6	...	6	...	...	6	...	6	...	...	35	...	35	...
Diseases of the Nose	...	1	...	1	...	...	50	...	50	...	...	3	...	3	...	1	50	...	51	...
Diseases of the Circulatory System —																				
Pericarditis	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Endocarditis	...	...	...	...	...	...	...	...	...	...	...	2	1	2	...	...	...	...	...	...
Valvular, Mitral	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	1	19	9	20	...
,, Aortic	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	1	4	...
,, Tricuspid	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
,, Pulmonary	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Arterial sclerosis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Aneurism	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...
Other Diseases	...	2	...	2	...	...	1	...	1	...	...	7	1	7	...	...	22	9	22	1
Diseases of the Respiratory System :—																				
Laryngitis	...	1	...	1	...	...	5	...	5	...	...	...	...	...	...	...	8	...	8	...
Bronchitis	...	26	...	26	1	2	137	...	139	...	...	19	...	19	1	16	842	2	858	7
Broncho-pneumonia	...	...	...	...	...	...	2	...	2	...	...	...	...	...	...	1	69	23	70	1
Abscess of lung	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Gangrene of lung	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Emphysema	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Pleurisy	...	2	...	2	1	...	2	...	2	...	...	2	...	2	...	1	31	1	32	2
Empyema	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	1	2	...
Other Diseases	...	6	...	6	...	1	36	...	37	...	1	23	...	24	...	2	42	1	44	1
Diseases of the Digestive System :—																				
Stomatitis	...	...	...	...	...	...	2	...	2	...	...	1	...	1	...	...	20	1	20	...
Caries of teeth	...	3	...	3	...	...	28	...	28	...	...	2	...	2	...	...	8	...	8	...
Sore throat	...	...	...	...	...	...	8	...	8	...	...	2	...	2	...	1	56	...	57	1
Inflammation of tonsils	1	27	...	28	1	...	41	...	41	...	3	50	...	53	3	1	48	...	49	...
Gastritis	...	7	...	7	...	...	20	...	20	...	...	25	...	25	1	...	18	...	18	...
Ulceration of stomach	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	1	2	...
Hæmatemesis	1	...	...	1	...	...	...	...	...	...	...	1	1	1	...	...	..	...	...	...
Dilatation of stomach	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Stricture of stomach	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dyspepsia	...	4	...	4	...	1	23	...	24	...	...	9	...	9	...	...	47	...	47	1
Enteritis	...	8	...	8	1	...	...	...	...	...	...	6	...	6	1	...	20	5	20	...
Appendicitis	...	6	...	6	1	...	5	...	5	...	2	19	...	21	...	...	1	...	1	...
Colitis	...	2	...	2	...	...	6	...	6	...	...	7	...	7	...	1	22	...	23	...
Ulceration of intestines	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1	...
Sprue	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...
Hernia	...	3	...	3	...	...	3	...	3	...	...	5	...	5	...	2	41	2	43	2
Diarrhœa	...	15	...	15	...	1	79	...	80	...	1	40	...	41	1	11	440	6	451	3
Constipation	...	1	...	1	...	...	65	...	65	...	...	12	...	12	1	...	76	...	76	...
Colic	...	14	...	14	...	...	78	...	78	...	1	23	1	24	...	...	107	3	107	1
Hæmorrhoids	1	2	...	3	...	...	16	...	16	...	...	4	...	4	...	...	5	...	5	1
Pancreatitis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2	2	...
Hepatitis (Acute)	...	6	...	6	...	...	2	...	2	...	...	5	...	5	3	...	14	...	14	...
Abscess	...	2	...	2	...	...	...	...	...	...	...	7	...	7	...	...	5	2	5	1
Cirrhosis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	5	3	6	1
Jaundice	...	1	...	1	...	...	2	...	2	...	...	3	...	3	...	...	10	...	10	...
Peritonitis	...	...	...	...	...	...	...	...	...	...	...	1	1	1	...	...	10	8	10	...
Ascites	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	12	1	13	1
Other Diseases	...	6	...	6	...	1	26	...	27	..	1	20	...	21	1	3	55	9	58	1
Diseases of the Lymphatic System :—																				
Splenitis	...	...	...	...	...	...	5	...	5	...	...	...	...	...	...	...	40	1	40	4
Inflammation of lymphatic gland	...	2	...	2	...	...	8	...	8	...	...	...	...	...	...	6	122	...	128	5
Suppuration of lymphatic gland	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	15	...	15	1
Lymphangitis	...	2	...	2	1	...	...	...	...	...	...	...	...	...	...	...	3	...	3	1
Elephantiasis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	33	...	35	...
Other Diseases	...	1	...	1	...	...	...	...	...	...	...	1	...	1	...	...	14	...	14	...
Diseases of the Urinary System: —																				
Acute nephritis	...	1	...	1	...	...	2	...	2	...	...	2	...	2	1	1	8	5	9	...
Bright's disease	...	1	1	1	...	...	...	...	...	...	...	1	...	1	...	...	11	3	11	...
Pyelitis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Calculus	...	1	...	1	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...
Renal colic	...	...	...	...	...	...	3	...	3	...	...	1	...	1	...	...	3	...	3	...
Cystitis	...	2	...	2	...	...	4	...	4	...	...	1	...	1	...	...	8	...	8	...
Vesical calculus	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...
Suppression	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...
Hæmaturia	...	3	...	3	...	...	...	...	...	...	...	...	...	...	...	...	5	...	5	...
Chyluria	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Other Diseases	...	1	...	1	...	..	3	..	3	...	...	...	...	...	...	...	8	...	8	1

TABLE VI.—RETURN OF DISEASES AND DEATHS (IN-PATIENTS) FOR THE YEAR 1922—(*contd.*).

DISEASES.	EUROPEAN OFFICIALS.					NON-EUROPEAN OFFICIALS.					GENERAL EUROPEAN POPULATION.					GENERAL NATIVE POPULATION.				
	Remaining in Hospital at end of 1921.	Yearly Total.		Total cases treated.	Remaining in Hospital at end of 1922.	Remaining in Hospital at end of 1921.	Yearly Total.		Total cases treated.	Remaining in Hospital at end of 1922.	Remaining in Hospital at end of 1921.	Yearly Total.		Total cases treated.	Remaining in Hospital at end of 1922.	Remaining in Hospital at end of 1921.	Yearly Total.		Total cases treated.	Remaining in Hospital at end of 1922.
		Admissions.	Deaths.				Admissions.	Deaths.				Admissions.	Deaths.				Admissions.	Deaths.		
LOCAL DISEASES—*continued*—																				
Diseases of the Generative System :—																				
Male Organs :—																				
Urethritis	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	1	...	1	...
Gleet	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	4	...
Stricture	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	11	1	11	...
Prostatitis	...	...	...	...	...	...	...	...	...	...	...	2	...	2	...	...	...	...	...	...
Soft chancre	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	25	...	25	...
Condyloma	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6	...	6	1
Inflammation of scrotum	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...
Hydrocele	...	...	...	...	..	2	...	2	1	...	2	...	2	...	...	...	45	1	46	4
Orchitis	...	...	...	...	...	2	...	2	...	1	4	...	5	...	...	...	51	...	53	2
Epididymitis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	3	...
Abscess of testicles	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Other Diseases	...	...	...	...	...	4	...	4	...	...	...	...	...	...	...	3	49	...	52	...
Female Organs :—																				
Ovaritis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...
Ovarian cyst	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...
Endometritis	...	...	...	...	...	2	...	2	...	...	...	...	...	...	...	...	1	...	1	...
Displacement of uterus	...	...	...	...	...	1	...	1	1	...	...	7	...	7	...	...	1	...	1	...
Vaginitis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Amenorrhœa	...	...	...	...	...	...	...	...	...	...	...	5	...	5	...	...	...	...	...	...
Dysmenorrhœa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...
Menorrhagia	...	...	...	...	...	...	...	...	...	...	...	3	...	3	...	...	2	...	2	...
Leucorrhœa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Abortion	...	...	...	...	...	...	...	...	...	...	1	8	...	9	...	...	12	1	12	...
Delayed labour	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	17	3	17	...
Post-partem hæmorrhage	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2	2	...
Retained placenta	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...	4	...	4	...
Premature birth	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Puerperal septicæmia	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...
Mastitis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...
Abscess of breast	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...	2	...	2	1
Other Diseases	...	...	...	...	...	...	...	...	...	...	...	32	...	32	1	...	39	2	39	1
Diseases of the Organs of Locomotion :—																				
Osteitis	...	...	...	...	...	...	31	...	31	...	...	...	...	...	...	2	32	2	34	1
Arthritis	...	...	...	...	...	2	...	2	...	1	...	...	...	1	...	6	141	1	147	3
Spondylitis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	2	...
Bursitis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2	2
Other Diseases	...	...	...	...	...	6	...	6	...	2	158	...	160	...	...	19	...	19	1	33	593	...	626	18
Diseases of the Connective Tissue :—																				
Cellulitis	...	...	...	...	...	6	...	6	...	...	7	...	7	...	...	10	...	10	...	13	341	4	354	8
Abscess	...	...	...	...	...	2	...	2	...	1	32	...	33	...	...	12	...	12	...	20	356	8	376	12
Elephantiasis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	11	1	11	...
Other Diseases	...	...	...	...	...	2	...	2	...	...	6	...	6	...	...	4	...	4	...	26	288	4	314	...
Diseases of the Skin :—																				
Urticaria	...	...	...	...	...	1	...	1	...	...	10	...	10	...	...	...	...	...	...	...	11	...	11	...
Eczema	...	...	...	...	..	4	...	4	...	...	11	...	11	...	...	1	...	1	...	...	33	...	33	1
Boil	...	...	...	...	...	6	...	6	...	...	20	..	20	...	...	14	...	14	...	1	50	...	51	2
Carbuncle	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	5	...	5	...
Herpes	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2	...
Psoriasis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	3	...	4	...
Oriental sore	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Tinea	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	1	...	1	...
Scabies	...	...	...	...	...	...	...	...	...	...	3	...	3	...	...	...	...	...	...	8	268	...	276	8
Acne	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	4	...
Prickly heat	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	2	...	2	...
Other Diseases	...	...	...	...	...	6	...	6	...	...	8	...	8	...	1	10	...	11	1	48	89	...	137	17
Injuries—General	...	...	...	...	...	...	...	...	...	...	3	...	3	...	...	...	...	...	...	13	51	13	64	3
Local	...	...	...	...	2	52	...	54	1	8	229	...	237	3	1	66	3	67	...	173	3030	42	3203	170
Gun-shot Wounds	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Surgical Operations *	...	...	...	...	...	(18)	...	(18)	...	...	...	...	...	...	...	(28)	...	(28)	...	(3)	(439)	...	(442)	...
Tumours	...	...	...	...	...	3	1	3	...	...	2	...	2	...	...	2	...	2	...	3	77	6	80	...
Malformations	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	3	...
Poisons	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	6	1	6	...	...	30	1	30	2
Parasites—Animal	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Protozoa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Trematoda (Flukes)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	1	60	...	61	...
Cestoda—																				
Tænia solium	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	3	...	3	...	1	76	...	77	...
Tænia saginata	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	5	100	...	105	...
Nematoda—																				
Ascaris	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	9	103	...	112	...
Tricocephalus dispar	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	4	...	3	15	...	18	...
Trichina	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dracunculus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...
Filariasis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	3	...
Strongylus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	7	...	9	...
Ankylostomiasis	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	7	147	9	154	2
Oxyuris	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	35	...	35	...
Insecta—																				
Myiasis	...	...	...	...	...	...	...	...	...	1	6	...	7	...	...	...	...	...	...	1	21	...	22	2
Other Diseases	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
TOTAL	...	...	...		10	635	5	645	17	43	3337	6	3380	17	31	1106	21	1137	34	1152	37384	820	38536	773

* Recorded under respective diseases.

TABLE VII.

RETURN OF DISEASES (OUT-PATIENTS) FOR THE YEAR 1922.

DISEASES.	EUROPEAN OFFICIALS.		NON-EUROPEAN OFFICIALS.		GENERAL EUROPEAN POPULATION.		GENERAL NATIVE POPULATION.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
Infective Diseases:—								
Beri-beri	...	...	...	...	...	...	1	...
Cerebro-spinal fever	...	...	...	...	...	...	2	...
Chicken-pox	...	...	...	...	...	...	110	8
Cholera	...	...	...	...	...	...	...	...
Dengue	...	...	...	...	...	...	...	...
Diphtheria	...	...	...	...	...	...	...	...
Dysentery	...	...	4	...	6	2	435	99
Endocarditis—Infective	...	...	...	...	...	...	...	...
Enteric fever	...	...	...	...	..	...	...	...
Erysipelas	...	...	...	...	...	...	2	...
Gonorrhœa	...	...	2	...	11	...	790	32
Influenza	...	...	57	...	14	15	4,175	536
Kala Azar	...	...	...	...	...	...	...	...
Leprosy (*a*) Nodular	...	...	...	...	...	...	20	5
(*b*) Anæsthetic	...	...	...	...	...	...	6	...
Malaria (*a*) Sub-Tertian	...	...	34	...	...	...	283	19
(*b*) Bening-Tertian	...	...	...	...	2	1	11	...
(*c*) Quartan	...	...	...	...	...	...	141	53
(*d*) Undifferentiated	...	1	248	...	32	39	12,678	2,395
(*e*) Blackwater	...	...	...	...	...	...	4	...
Measles	...	...	...	...	3	...	21	2
Malta fever	...	...	...	...	...	...	...	...
Plague	...	...	...	...	...	...	...	...
Pneumonia	...	...	...	...	...	...	105	31
Rabies	...	...	...	...	...	...	...	...
Relapsing fever	...	...	...	...	...	...	7	...
Rheumatic fever	...	...	...	...	...	...	...	...
Septicæmia	...	...	...	...	...	...	1	1
Trypanosomiasis (Sleeping Sickness)	...	...	...	...	...	...	...	...
Small-pox	...	...	...	...	...	...	...	...
Syphilis (*a*) Primary	...	...	...	...	...	...	...	...
(*b*) Secondary	...	...	1	...	3	...	906	334
(*c*) Inherited	...	...	...	...	...	...	80	51
Tetanus	...	...	...	...	...	...	3	2
Tuberculosis	...	...	...	...	...	...	104	19
Whooping cough	...	...	...	...	3	...	20	14
Yaws	...	...	1	...	1	...	1,842	1,334
Yellow fever	...	...	...	...	...	...	...	...
Mumps	...	...	...	...	...	...	24	4
Anthrax	...	...	...	...	...	...	11	...
Typhus	...	...	...	...	...	...	...	...
Other Infective Diseases	...	...	...	...	1	...	89	11
Intoxications:—								
Alcoholism	...	...	...	...	...	...	1	...
Morphinism	...	...	...	...	...	...	...	...
Others	...	...	...	...	...	...	...	...
General Diseases:—								
Anæmia	...	...	4	...	...	5	336	152
Anæmia—Pernicious	...	...	...	...	...	...	...	1
Diabetes	...	...	2	...	...	...	2	...
Exophthalmic Goitre	...	...	...	...	...	...	1	1
Gout	...	...	...	...	...	...	11	...
Leucocythæmia	...	...	...	...	...	...	...	...
Hodgkin's Disease	...	...	...	...	...	...	...	...
Myxœdema	...	...	...	...	...	...	...	...
Purpura	...	...	...	...	...	...	...	...
Rickets	...	...	...	...	...	...	2	2
Scurvy	...	...	...	...	...	...	11	4
Other General Diseases	...	...	5	..	40	38	187	28
Local Diseases:—								
Diseases of the Nervous System	...	3	91	...	13	27	3,908	384
Mental Diseases	...	...	...	...	1	...	24	8
Diseases of the Eye	...	...	47	...	7	6	4,035	1,576
,, ,, Ear	...	2	31	...	16	11	1,927	442
,, ,, Nose	...	...	53	...	13	8	874	53
,, ,, Circulatory System	...	1	1	...	14	4	56	6
,, ,, Respiratory System	...	2	205	...	38	25	14,907	2,621
,, ,, Digestive System	...	3	362	...	138	128	17,053	3,327
,, ,, Lymphatic System	...	2	8	...	...	2	1,051	221
,, ,, Urinary System	...	0	2	...	5	3	60	14
,, ,, Generative System	...	2	58	...	8	32	451	277
,, ,, Organs of Locomotion	...	...	41	...	14	4	5,450	975
,, ,, Connective Tissue	...	...	19	...	12	8	3,619	512
,, ,, Skin	...	1	79	...	57	36	8,668	1,822
Injuries:—								
General	...	...	...	...	...	...	102	29
Local	...	3	120	...	99	50	45,915	13,258
Gun-shot wounds	...	...	...	...	...	...	...	...
Surgical Operations*	...	...	...	...	...	...	(866)	(45)
Tumours	...	...	...	...	2	3	27	22
Malformations	...	...	...	...	1	2	...	1
Poisons	...	...	...	...	...	...	72	2
Parasites—Animal	...	...	9	...	9	4	3,073	1,138
TOTAL	...	26	1,484	...	563	453	133,694	31,826

* Recorded under respective Diseases.

TABLE VIII.

EUROPEANS.

RETURN OF INFECTIVE DISEASES TREATED AT THE VARIOUS HOSPITALS AND DISPENSARIES IN THE COLONY & PROTECTORATE OF KENYA DURING 1922.

DISEASES.		Mombasa.	Malindi.	Vol.	Lamu.	Kisumayu.	Kilindini.	Moyale.	Serenli.	Mandera.	Kisumu.	Kericho.	Kakamega.	Nandi.	Kisii.	Fort-Hall.	Kyambu.	Meru.	Kitui.	Nyeri.	Embu.	Nairobi.	Makindu.	Machakos.	Muteresi.	Nakuru.	Naivasha.	Eldama Ravine.	Londiani.	Narok.	Rumuruti.	Kabarnet.	Kacheliba	Eldoret.	Total.
Chicken-pox	Cases	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
	Deaths	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	—
Dysentery	Cases	10	...	2	...	...	...	...	...	...	6	...	1	...	...	...	...	2	...	4	...	16	...	1	2	1	...	1	...	...	...	...	...	1	47
	Deaths	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	—
Enteric Fever	Cases	3	...	...	...	...	...	...	...	...	4	...	...	...	...	...	...	...	...	...	...	17	...	...	...	...	...	...	..	...	...	...	...	24
	Deaths	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	2
Influenza	Cases	67	...	9	2	...	16	...	...	...	4	5	6	8	...	2	...	1	1	19	...	60	1	...	...	9	1	2	...	...	...	...	...	2	215
	Deaths	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	—
Malaria	Cases	244	1	13	1	5	101	2	3	2	70	6	1	...	6	9	1	4	...	15	2	110	10	11	8	3	1	1	3	1	1	3	6	61	705
	Deaths	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	..	...	...	...	...	...	...	1	5
Blackwater Fever	Cases	8	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	3	...	...	1	...	...	...	...	...	...	...	...	1	14
	Deaths	2	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	3
Measles	Cases	...	...	...	...	...	...	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	2	7
	Deaths	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	—
Pneumonia	Cases	2	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	3	...	1	...	1	...	1	..	...	...	...	...	1	10
	Deaths	2	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	4
Typhus	Cases	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1
	Deaths	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	—
Yaws	Cases	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
	Deaths	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	—

TABLE VIII.

NATIVES (INCLUDING ASIATICS).

RETURN OF INFECTIVE DISEASES TREATED AT THE VARIOUS HOSPITALS AND DISPENSARIES IN THE COLONY & PROTECTORATE OF KENYA DURING 1922.

DISEASES.		Mombasa.	Malindi.	Voi.	Lamu.	Kismayu.	Kilindini.	Moyale.	Serenli.	Mandera.	Kisumu.	Kericho.	Kakamega.	Nandi.	Kisii.	Fort-Hall.	Meru.	Nyeri.	Embu.	Kitui.	Chuka.	Makindu.	Machakos.	Nairobi.	Kyambu.	Muceesi.	Nakuru.	Naivasha.	Eldama Ravine.	Londiani.	Kabarnet.	Kachelliba.	Eldoret.	Narok.	Rumuruti.	Total.
Beri-beri	Cases ...	...	...	2	1	...	...	...	1	21	2	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	29
	Deaths ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	—
Cerebro-spinal fever ...	Cases ...	1	...	...	...	...	...	...	...	...	12	...	...	2	...	...	...	...	...	...	...	...	...	9	...	...	1	...	1	...	1	1	...	...	...	28
	Deaths ...	1	...	...	...	...	...	...	...	...	9	...	...	1	...	...	...	...	...	...	...	...	...	5	...	...	1	...	...	...	1	1	...	...	...	19
Chicken-pox	Cases ...	36	...	6	...	6	...	...	...	...	29	11	12	...	78	24	2	1	...	1	...	4	16	175	2	...	107	13	14	1	...	...	32	19	...	589
	Deaths ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	—
Dysentery	Cases ...	178	5	16	22	27	35	37	...	3	114	20	2	8	6	22	33	33	5	9	4	41	60	256	8	8	69	6	23	11	...	12	27	2	1	1,103
	Deaths ...	18	...	2	...	...	1	...	...	...	12	...	...	...	...	1	...	1	...	...	1	7	...	19	...	...	7	...	2	...	...	...	1	...	...	72
Enteric fever	Cases ...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	12	...	...	...	...	...	...	...	...	...	...	...	14
	Deaths ...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	2
Influenza	Cases ...	465	50	91	52	...	83	16	...	...	...	235	112	237	...	434	589	338	38	158	2	10	6	2,143	65	...	831	38	290	33	8	105	9	354	...	6,852
	Deaths ...	1	...	2	...	...	...	...	...	...	...	...	2	...	...	4	...	3	1	4	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	21
Leprosy	Cases ...	3	...	...	...	...	...	...	...	...	20	...	9	2	1	20	...	2	...	4	9	...	...	9	...	...	...	...	...	...	...	1	1	...	81
	Deaths ...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Malaria	Cases ...	1,841	2,238	490	1,586	477	1,196	225	131	269	2,534	215	108	271	361	1,452	661	859	137	663	55	287	626	1,990	507	210	117	80	175	126	90	125	305	10	164	20,581
	Deaths ...	5	...	1	...	...	...	...	...	...	...	1	1	...	...	...	1	...	...	...	...	1	...	21	6	1	...	...	...	...	...	...	3	...	...	41
Blackwater fever ...	Cases ...	9	...	...	1	...	3	...	...	...	7	...	...	...	1	1	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	1	...	25
	Deaths ...	4	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...	7
Measles	Cases ...	3	...	...	...	...	2	...	...	...	5	1	6	1	2	6	...	1	...	...	...	...	...	33	2	...	7	3	6	...	...	...	1	10	3	92
	Deaths ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	—
Malta fever	Cases ...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
	Deaths ...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Plague	Cases ...	...	...	...	...	...	...	...	...	...	...	...	...	...	8	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	11
	Deaths ...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	5
Pneumonia	Cases ...	108	...	7	...	2	9	...	1	6	65	7	4	1	37	11	8	27	...	2	1	7	11	403	15	5	118	17	28	31	...	...	34	16	5	986
	Deaths ...	35	...	1	...	1	1	...	...	...	16	2	1	...	10	3	1	17	...	...	1	...	...	97	4	1	23	2	10	2	...	...	10	2	1	241
Relapsing fever	Cases ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	18	...	...	3	4	6	...	1	9	...	...	...	...	...	...	...	...	...	...	...	41
	Deaths ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	—
Trypanosomiasis ...	Cases ...	...	...	...	...	...	...	...	...	...	1	...	1	2	19	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	25
	Deaths ...	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Tuberculosis	Cases ...	61	...	2	11	55	...	...	...	...	14	5	6	1	16	34	8	3	...	4	4	...	4	62	...	1	4	...	3	...	1	...	6	5	...	310
	Deaths ...	26	...	...	...	3	...	...	...	...	4	...	2	...	...	9	1	2	...	1	1	...	...	18	...	...	...	...	...	...	...	...	3	...	...	79
Yaws	Cases ...	2,076	427	2	72	28	3	3	...	...	1,049	3	50	...	5,242	8,636	34	243	29	224	3,577	1	3	106	6	...	5	8	2	...	...	2	3	107	1	21,733
	Deaths ...	2	...	...	...	...	...	...	...	...	2	...	...	...	1	1	...	...	...	...	21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	27
Mumps	Cases ...	8	...	3	...	...	...	...	...	...	1	5	...	4	2	1	...	...	...	...	...	...	1	18	...	...	2	1	2	...	...	...	...	5	...	53
	Deaths ...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Anthrax	Cases ...	...	...	...	...	...	...	...	...	...	1	9	...	...	3	...	...	4	...	...	...	...	...	16	1	...	6	...	3	...	...	...	1	...	...	44
	Deaths ...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	3

N.B.—This Table only gives the numbers *actually* treated at Government Institutions.

TABLE IX.

STATISTICS REGARDING ENTERIC FEVER AMONG EUROPEAN RESIDENTS IN THE COLONY AND PROTECTORATE OF KENYA DURING 1922.

Total Number Admitted on Account of Enteric.				Number Admitted who had been Previously Inoculated Against Enteric.		Number of Cases who Died.				Total Number Inoculated Against Enteric Fever During the Year.	
						Previously Inoculated.		Not Previously Inoculated.			
Officials.		Non-Officials.		Officials.	Non-Officials.	Officials.	Non-Officials.	Officials.	Non-Officials.	Officials.	Non-Officials.
Cases.	Deaths.	Cases.	Deaths.								
5	1	19	1	—	1 (doubtful)	—	1 (doubtful)	1	—	5	17

The occurrence of the cases was as follows :—

Nairobi	... 17	...	1 death.
Kisumu	... 4	...	1 death.
Mombasa	... 3	...	—

APPENDIX "A."

ANNUAL REPORT OF THE PROCEEDING OF THE BOARD OF HEALTH FOR THE YEAR 1922.

(The Public Health Ordinance, 1913.)

(1) The membership of the Board consisted of:—

The Hon. Principal Medical Officer (President).
The Chief Sanitation Officer.
The Hon. Director of Public Works.
The Hon. Commissioner of Lands.
The Director of Surveys.
A. C. Tannahill, Esq.

(2) Summary of work done:—

(*a*)	Meetings held during the year	10
(*b*)	Applications for Sub-divisions outstanding from previous year	2
(*c*)	Applications for Sub-divisions submitted during the year .	24
(*d*)	Applications for Sub-divisions approved during the year .	21
(*e*)	Applications for Sub-divisions rejected during the year . .	3
(*f*)	Applications for Sub-divisions referred back for modification .	2
(*g*)	Applications for Sub-divisions re-submitted	3
(*h*)	Applications for Sub-divisions outstanding at end of year .	2

(3) The following matters of special interest present themselves as the outcome of the year's work:—

A number of sub-divisional schemes have been submitted with the object of opening up residential areas on the outskirts of existing townships. Some of these schemes may bring undesirable conditions into being, as they may give rise to scattered setttlements prohibitively expensive as well as difficult to administer with any degree of satisfaction. Insanitary conditions will inevitably come into existence as plots are taken up and occupied on some of these sub-divisions, due to the entire absence of any organisation to undertake primary sanitary services and to exercise that supervision over public affairs which experiences has shown is so necessary when close settlement takes place.

The position is to some degree aggravated by the delay in alienating Crown land in declared townships owing to political difficulties. The matter is one which will require the careful consideration of Government in the immediate future.

(4) In the course of their deliberations the Board decided that Sanitary Lanes should not be asked for in residential areas, where plots equalled one or more acres in extent. In areas where sub-divisional schemes included plots of less than one acre, the Board would consider each scheme separately and on its merits, so far as the provision of Sanitary Lanes was concerned.

(5) Muthaiga Estate having been declared a Township, applications for sub-divisions in this area ceased to be dealt with by the Board of Health.

(6) The following resolution was adopted by the Board during the year:—

"That in future a copy of all plans of proposed sub-divisions submitted should in every case be forthwith forwarded to the local authority, Resident Commissioner or District Commissioner concerned with a request for their recommendations and in the case of Nairobi District, the proposals be forwarded to the Nairobi Municipality as well as to the Resident Commissioner, Nairobi District."

(7) Two interesting points arose out of a proposal submitted to the Board.

(*a*) What action must the Board take to regularise the position where an owner had sub-divided his land without the sanction of the Board and where, at a later date, application for further sub-division was received by the Board, the original owner being dead or his whereabouts unknown?

(*b*) Were the Board entitled to approve applications for sub-divisions or to accept a bond for an undertaking called for under Section 4 (1) of the Ordinance from any person other than the owner of the land affected? It was improbable that an owner could be held responsible for the acts or undertakings of a lessee on the expiration of a lease.

(8) The problems to be faced by the Board in dealing with future sub-divisional schemes on the Kilimani, Upper Hill and Thomson Estates have been discussed. Development in these areas has reached a stage when some form of organisation is necessary to undertake primary sanitary services and exercise some measure of supervision. Suggestions have been made as to the advisability of the formation of a township for these areas or, alternatively, the formation of an advisory committee to advise the Resident Commissioner on local requirements and difficulties. And, further, whether some legal provision for rating should not be introduced to effect organised services.

(9) The need for some amendment of the Ordinance has been commented upon from time to time. The following are some of the points which arise:—

(*a*) Plans should be submitted in triplicate, not duplicate, as one copy has to be deposited with the Commissioner of Lands, one returned to the applicant and one copy is required for retention by the Board of Health.

(*b*) Lands not within a township nor within five miles of the limits of any Township nor within two miles of a Railway Station are exempt from the provisions of the Ordinance, except where the Governor by notice in the Gazette shall apply the provisions of the Ordinance to any special area. Freehold lands could be sub-divided into building sites and plots sold and a deal of mischief might be done before arrangements could be made to control such new development. It would be difficult, probably impossible, to rectify matters once a scheme has commenced to find expression in fact.

(*c*) Only division into lots of less than three acres can be dealt with by the Board. An uncontrolled layout into lots of three acres or just a fraction more could produce a condition of affairs which would present great difficulties with regard to road alignment and drainage once buildings were erected in such an area. A local authority having to administer such an area at a later date might find themselves under the obligation to purchase a lot of high-priced land before any satisfactory system of roads would be obtained. Heavy compensation for demolition of buildings might also be necessary, unless the idea of a satisfactory layout of roads was to be abandoned. It is improbable that any measure to control conversion of title from agricultural to township use would prevent such sub-divisions taking place, as plot holders could cite a strong case that three acres of land was being used for agricultural purposes in spite of the existence of a dwelling on the land; and voluntary conversions cannot be expected when the rent for the agricultural land is less than that for land devoted to township use and other conditions of lease are advantageous.

(*d*) Section 4 (1) of the Ordinance could be amended with advantage to provide that an undertaking shall be given where the Board consider public works necessary.

Section 4 (2) of the Ordinance could also be amended with advantage to read that the Board may, if they think fit, require surety for a bond; but a proviso should be added to this that where the estimated cost of the works required by the Board exceed a specified sum, the provision of surety should be compulsory.

JOHN L. GILKS,

President.

APPENDIX "B."

ANNUAL REPORT OF THE PROCEEDING OF THE CENTRAL BOARD OF HEALTH FOR THE YEAR 1922.

(The Public Health Ordinance, 1921.)

(1) *Members of the Board, Resignations, New Appointments.*—

(*a*) The Central Board of Health was established by His Excellency the Governor on the 25th October, 1921. The following were the members appointed :—

The Principal Medical Officer, J. L. Gilks, Esq., M.R.C.S. (England), L.R.C.P. (Lond.), F.R.C.S. (Edin.), (Chairman).

The Chief Sanitation Officer, A. R. Paterson, Esq., M.B., Ch.B. (Glasg.), D.B.H. (Camb.), D.T.M. & H. (Camb.).

G. V. W. Anderson, Esq., M.B., B.S. (Lond.), F.R.C.S. (Eng.).

Lieut.-Col. E. W. N. Guinness, L.R.C.P. & S. (Irel.), D.P.H. (Lond.).

W. H. Kauntze, Esq., M.B., B.S. (Lond.), M.D., D.P.H. (Vict.).

W. McGregor Ross, Esq., B.A., M.Sc., B.E., M.Inst. C.E.

Lieut.-Col. O. F. Watkins, C.B.E., D.S.O., M.A. (Oxon).

J. A. Watson, Esq.

The Hon. Mr. T. A. Wood, M.B.E., M.L.C.

F. Strawbridge, Esq., Secretary.

(*b*) The Hon. Mr. McGregor Ross resigned his position on the Board towards the end of the year, as he was leaving the Colony. His resignation was a distinct loss to the Board.

(*c*) To fill the vacancy resulting from the resignation of the Hon. Mr. Macgregor Ross, the following new appointment was made on the 30th November, 1922 :—

H. L. Sykes, Esq., B.A., B.E., A.M.Inst., C.E., F.G.S.

(*d*) Two members of the Board were absent overseas during the major portion of the year.

(2) *Meetings of the Board.*—Nine meetings of the Board have been held since its inception, the first meeting being held on the 9th December, 1921.

(3) *Procedure Regulations for Board.*—Regulations governing the convening and holding of meetings of the Board, the quorum thereof, and the procedure thereat, were adopted by the Board at their first meeting. These Regulations were submitted to Government, were approved, and published in the Official Gazette under Government Notice, No. 7, dated the 30th December, 1921.

(4) *Regulations Submitted to Board for Confirmation.*—The following Regulations were submitted to the Board by the Nairobi Municipality for approval and confirmation in accordance with Section 16 of the Ordinance :—

(*a*) *Regulations requiring the construction of connecting drains at joint expense.*—These were referred back for amendment. They have not been re-submitted.

(*b*) *Siting of outbuildings to provide for general amenity.*—These were approved and confirmed by the Board. They were subsequently approved by Government and published in the Official Gazette under General Notice, No. 652, dated the 18th July, 1922.

(*c*) *Prohibition of spitting upon public side-walks.*—These were approved and confirmed by the Board. They were subsequently approved by Government and published in the Official Gazette under General Notice, No. 690, dated the 30th October, 1922.

(*d*) *Control of Burial Grounds.*—These were approved and confirmed by the Board. They have not, as yet, been published in the Official Gazette.

(5) *Drainage Regulations.*—The Board have considered the desirability of representing to Government the urgent necessity for a Drainage Ordinance. They have been advised by the Attorney-General, however, that the whole of the matters involved in such a measure could be adequately dealt with by Regulations under the Public Health Ordinance, 1921.

Drainage Regulations are now being drafted.

(6) *Private Street Ordinance.*—The delay in bringing forward a Private Streets Ordinance has been discussed by the Board. The Chairman of the Board has endeavoured to expedite the bringing forward of this measure.

(7) *Milk and Dairies Regulations.*—Draft Milk and Dairies Regulations were laid before the Board by the Chief Sanitation Officer. After lengthy consideration and some amendment, these Regulations were approved by the Board.

The Regulations have been submitted to and are now receiving consideration by Government.

(8) *Regulations to Prohibit the Importation, &c., of Rat Viruses.*—The Board have had under consideration the danger from food poisoning that was associated with the use of certain bacterial preparations known as Rat Viruses. Experiments conducted in the Colony with certain Rat Viruses showed that these Viruses did not kill rats. In consideration of these facts, the Board have recommended to Government that the importation into or the manufacture or use within the Colony and Protectorate of living basterial preparations for the destruction of rats be prohibited except under permit from the Principal Medical Officer and on such conditions as the Principal Medical Officer may specify.

Draft Regulations embodying the provisions of the recommendation were submitted by the Chief Sanitation Officer and approved by the Board. These Regulations are now receiving consideration by Government.

Certain Regulations adopted by the Board relating to this matter will be found in paragraph 14 (*e*).

(9) *Regulations for the Control of Nursing Homes.*—The Board have considered the question of what Regulations, if any, should be made to Control Nursing Homes. The Board have decided that the time has not yet arrived when Regulations are necessary, as existing public health and criminal law are quite adequate for the time being to deal with any irregularities which might arise.

(10) *Registration of Nursing Homes, and Licensing of Keepers thereof.*—Applications for Registration and Licence in respect of three Nursing Homes have been received during the year. All three applications were approved by the Board.

An endeavour will be made to secure compliance with the provisions of Section 153 of the Ordinance during the year, 1923, a circular having been sent out to the keepers of all Nursing Homes, &c., known to exist in the Colony and Protectorate.

(11) *Need for a Greater Measure of Control over suburban areas in the neighbourhood of Nairobi.*—The Board have had under consideration the need for some greater measure of sanitary and building control over the new residential areas springing up around Nairobi Township. They have placed on record the fact that they would welcome such increased control and would prefer to see control exercised by Government, should Government be able to provide the necessary staff for that purpose. Further, that in the preparation of any regulations for such increased control they are of opinion that consideration should be given to the housing needs of less affluent members of the community who desire to provide a residence for themselves by erecting buildings upon their own plots.

It appeared unlikely that the Nairobi Municipality would be prepared to undertake any added responsibilities at present in the shape of any extension of their Township boundaries.

Arising out of this discussion on the need for increased control, the Board have recommended to Government that certain restrictions should be placed upon the establishment of new residential areas in the vicinity of existing Townships arising from the conversion of land titles from Agricultural or other special purposes to an open lease without restrictions.

Certain Resolutions adopted by the Board relating to the matters set forth above will be found in paragraph 14 (*a*) and (*b*).

(12) *Report of the Land Tenure Commission.*—The Board have considered the recommendations to Government contained in the Report of the Land Tenure Commission.

Their attention was particularly directed to the principle outlined in paragraph 8, Term No. 3, page 5 of the Report which recommends that the time has now arrived when the conversion of leases from agricultural to township title should be allowed as a right and without restriction.

The Board have expressed their disapproval of the principle outlined above and have advised Government that in their opinion such a principle is not consistent with the interests of the Public Health which they consider would in many cases be adversely affected; further, that the principle referred to is in direct opposition to their previously expressed advice on this matter.

The Board have still further recommended to Government that for the purpose of ensuring the provision of funds for public health purposes in connection with new townships, consideration be given to the desirability of incorporating in any future legislation dealing with the alteration of land titles, a provision for securing to Government, or to any lesser public authority concerned, a proportion of the enhanced value accruing from a charge of title from agricultural to township purposes.

During the discussion which culminated in the framing of the recommendations referred to above, it was suggested that any leaseholder seeking conversion of title from agricultural to township purpose should give publicity to his intention by notice in the Official Gazette.

The Resolutions of the Board embodying the recommendations referred to above will be found in paragraph 14 (*c*) and (*d*).

(13) *Remission of Surety for an Undertaking to Execute Public Works.*—The Board were requested by Government to offer comment upon an application from a Syndicate for the remission of surety for a Bond to execute certain specified public works in connection with a proposed township sub-divisional scheme. The Bond with surety had been called for by the Board of Health appointed to administer the provisions of the Public Health Ordinance, 1913. The applicants' request for the remission of surety was based upon the plea that they were unable to find surety due to the financial circumstances existing in the Colony at present.

The Board were of opinion that any scheme such as the one under reference, should be secured by adequate guarantees, otherwise there was grave danger that the public would be burdened with the cost of construction and maintenance works. They could see no reason why the difficulties and liabilities of a private commercial undertaking should be off loaded on to the public.

A recommendation was, therefore, forwarded to Government that the proposed sub-divisional scheme be not approved without provision of the guarantees asked for by the Board of Health.

(14) *Resolutions embodying definite Principles adopted by the Board during the year.*—

(*a*) *Resolution No.* 4 adopted and *placed on record* by the Board:—

"That this Board would welcome proposals for increased sanitary and building control in suburban areas and would prefer to see such control exercised by Government should Government be able to provide the necessary staff for the purpose. In the preparation of any regulations for increased control, consideration should be given to the housing needs of the less affluent members of the community who desire to provide a residence for themselves by erecting buildings upon their own plots."

(*b*) *Resolution No.* 5 adopted by the Board and forwarded to the Colonial Secretary as a *Recommendation to Government*:—

"The establishment of new urban or suburban areas in the vicinity of existing townships by conversion of title from agricultural or other special purposes to an open lease without restrictions should not take place solely at the option of the landowners concerned, but only with the sanction of Government after publication of intention by the applicant and after reference to the local authority of the adjoining township for its recommendations."

(*c*) *Resolution No.* 13 adopted by the Board and forwarded to the Colonial Secretary as a *Recommendation to Government*:—

"For the purpose of ensuring the provision of funds for public health purposes in connection with new townships, the Central Board of Health wished to direct the attention of Government to the desirability of the incorporation in any future legislation dealing with the alteration of land titles of provision for securing to Government or to any lesser public authority concerned a proportion of the enhanced value accruing from a charge of title from agricultural to township purposes."

(*d*) *Resolution No.* 14 adopted by the Board and forwarded to the Colonial Secretary as a *Recommendation to Government* :—

"The Central Board of Health desires to record its opinion that the principle outlined in paragraph 8, Term No. 3, page 5, of the Land Tenure Commission Report is not consistent with the interests of the public health which in the opinion of the Board would in many cases be adversely affected.

"The Board desires to draw attention to the fact that the principle contained in the paragraph above referred to is in direct opposition to Resolution No. 13 of even date and to the principle contained in the Board's Resolution, No. 5, of the 23rd March, 1922, which was forwarded to the Honourable Colonial Secretary under cover of letter No. A/2/3/1, dated the 27th March, 1922, and which read as follows :—

"'The establishment of the new urban or suburban areas in the vicinity of existing townships by conversion of title from agricultural or other special purposes to an open lease without restrictions should not take place solely at the option of the landowner concerned, but only with the sanction of Government after publication of intention by the applicant and after reference to the local authority of the adjoining township for its recommendations.'"

(*e*) *Resolution No.* 30, adopted by the Board and forwarded to the Colonial Secretary as a *Recommendation to Government* :—

"That in view of the facts that different varieties of rat seem to be naturally immune to bacterial preparations, that immunity to such preparations may probably be acquired by all rats for a varying length of time which is not yet known and that bacterial preparations may possibly, under certain conditions as yet undetermined, acquire increased virulence so as to become dangerous to the smaller domestic animals, or even to man and in view of the fact that certain outbreaks of illness in man in Europe have been attributed to the contamination of food with such bacterial preparations and that such contamination of human food either directly or by means of the excreta of infected rats would, in view of the conditions under which both native and European foodstuffs are stored, prepared and consumed in this country, be not unlikely, this Board considers that the use by members of the public of such bacterial preparations commonly called rat viruses for the destruction of rats may be fraught with considerable danger and is of opinion that the importation into and the manufacture or use in the Colony or Protectorate of bacterial preparations for the destruction of rats should be prohibited except under a permit from the Principal Medical Officer and on such conditions as the Principal Medical Officer may specify."

It was further resolved by the Board :—

Resolution No. 31.—

"That in view of the facts recorded in the previous Resolution, No. 30, a copy of the same be forwarded to the Honourable Colonial Secretary through the Honourable Attorney-General with a request that His Excellency the Governor may be advised to prohibit the importation, manufacture or use of living bacterial preparations for the destruction of rats except on conditions specified in the said resolution and that the following draft notice be forwarded with the resolution for consideration and publication in the Official Gazette, should it be approved :—

"*Government Notice.*

"*Under the Public Health Ordinance*, 1921.

"NOTICE.

"'Whereas the use of living bacterial preparations usually called 'Viruses' is considered to be unsafe, Notice is hereby given that His Excellency the Governor in virtue of the powers conferred on him by Section 158 and 170 of the Public Health Ordinance, 1921, has been pleased to prohibit the importation into the Colony and Protectorate of Kenya or the manufacture or use therein of living bacterial preparations for the destruction of rats except under permit from the Principal Medical Officer and on such conditions as the Principal Medical Officer may specify.'"

Some technical objection to the draft notice submitted under the terms of Resolution, No. 31 has been offered by the Attorney-General and an amended notice has been submitted for the further consideration of the Board.

JOHN L. GILKS,
Chairman.

F. STRAWBRIDGE,
Secretary.

APPENDIX "C."

LIST OF GENERA AND SPECIES OF SMALL MAMMALS COLLECTED IN THE NORTH KAVIRONDO DISTRICT, 1921.

1. Crocidura nyansæ, Neum.
2. Crocidura fumosa, Thos.
3. Heliosciurus rufobrachiatus nyansæ, Neum.
4. Heliosciurus multicolor elegans, Thos.
5. Euxerus erythropus lacustris, Thos.
6. Protexerus stangeri, Subsp.
7. Graphiurus microtis saturatus, Dollm.
8. Taterona dundasi, Wrought.
9. Tachyoryctes ruddi, Thos.
10. Dendromus ærdeus, Wrought.
11. Grammomys surdaster elgonis, Thos.
12. Rattus rattus kijabius, Allen.
13. Rattus rattus frugivorus, Raf.
14. Rattus (æthomys) kaiseri medicatus, Wrought.
15. Rattus (mastomys) coucha ugandæ, de Wint.
16. Rattus (mastomys) coucha panya, Hell.
17. Laggada sorella, Thos.
18. Lophoromys ansorgei, de Wint.
19. Lophoromys aquilus rubeculus, Dollm.
20. Dasymys helukus, Hell.
21. Mylomys roosevelti, Hell.
22. Arvicanthis abyssinicus nubilans, Wrought.
23. Lemniscomys striatus massaicus, Pag.
24. Otomys tropicalis elgonis, Wrought.
25. Otomys angoniensis elassodon, Osg.

A specimen of the "brown" rat of Mombasa was determined as Rattus decumanus, Pall.

For the above determinations the Department is greatly indebted to the Authorities of the British Museum (Natural History) to whom the collection was submitted for investigation.

APPENDIX "D."

IDENTIFICATION OF CULICIDÆ BRED FROM LARVÆ IN POOLS, ETC., IN AND AROUND KISUMU TOWNSHIP.

CULICIDÆ:

Anopheles costalis, Theo.
Anopheles pharoensis, Theo.
Aedes (Stegomyia) argenteus, Poiret.
Aedes (Ecculex) hirsutus, Theo.
Aedes (Ecculex) ochraceus, Theo.
Aedes (Banksinella) lineatopennis, Ludl.
Mansonioides africanus, Theo.
Culex fatigans, Wd.
Culex laurenti, Newst.
Culex watti, Edw.
Culex univittatus var. neavei, Theo.
Lutzia tigripes, Grp.

This collection was made in 1922 by the Medical Officer of Health, Kisumu. For the determinations we are indebted to the Imperial Bureau of Entomology, London, to which the collection was submitted by the Government Entomologist.

COLONY AND PROTECTORATE OF KENYA.

Annual Report

OF THE

BACTERIOLOGICAL LABORATORY

FOR THE YEAR 1922.

VOL. XIII.

W. H. KAUNTZE,

M.B.E., B.A., M.D., Ch.B., D.P.H. (Vict.), M.B., B.S. (Lond.), M.R.C.S. (Eng.), L.R.C.P. (Lond.).

Senior Bacteriologist.

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Annual Report

GOVERNMENT BACTERIOLOGICAL LABORATORY COLONY AND PROTECTORATE OF KENYA.

1922.

SECTION 1.—ORGANISATION.

The Staff of the Laboratory has undergone some rearrangement during the course of the year owing to the necessity of financial retrenchment. At the commencement of 1922, it was as follows :—

Senior Bacteriologist	1
Assistant Bacteriologists	2
Laboratory Assistants, European	1
Laboratory Assistants, Indian	3
Laboratory Boys	7
Clerk, Goanese	1
Clerk, African	1

On 22nd May, 1922, the Senior Indian Laboratory Assistant, Mr. Pillay, was invalided on health grounds. As a measure of economy, it was then arranged that he should not be replaced, but that the Goanese clerk should be removed and his position taken by a European shorthand-typist who, by taking over the care of stores as well as the clerical work, would relieve the European Laboratory Assistant for more technical duties. The African clerk was dispensed with by a rearrangement of the telephone system.

The following Medical Officers of the Medical or Sanitation Divisions have been attached for temporary duty to the Laboratory during the course of the year :—

Dr. Hunter (October, 1921, to 4th June, 1922).

Dr. Mitchell (21st February to 21st August, and from 26th September to 7th October, 1922).

Dr. Callenan (30th March to 18th May, 1922).

Dr. Davison (13th November to 27th November, 1922).

As will be seen in the course of this report, a considerable amount of work, which could not otherwise have been undertaken, was carried out by these Officers.

Dr. Clearkin, the first Assistant Bacteriologist, proceeded on leave on 20th April, 1922, and did not return before the close of the year.

In concluding this section, due recognition must be given to those members of the Staff to whom has fallen the onerous duty of making the routine examinations, and without whose assistance the work of the Department could not have been carried on. Special mention must be made in this connection of Mr. Ramji Das, now acting as Senior Non-European Laboratory Assistant, who, in addition to his other duties, has most efficiently taken over those formerly carried out by Mr. Pillay.

SECTION 2.—GENERAL REVIEW OF LABORATORY POLICY IN 1922.

In addition to the changes in Staff recorded above, three other concessions had to be made in the interest of economy in the Medical Department. Firstly, the manufacture of plague vaccine for the Colony was undertaken; secondly, the Medical Officers of the Laboratory Staff had to take over the greater part of the visiting of sick officials in quarters in Nairobi; thirdly, these officers had to consent to administer anæsthetics and assist at operations at the European Hospital, Nairobi. The latter two concessions, especially the one last mentioned, interfere very greatly with the ordinary work of the Laboratory, and under present conditions the carrying out of research is difficult. It is hoped that the Staff will be relieved of duties outside the Laboratory as soon as an additional Medical Officer is available for Nairobi, leaving them free to carry out their real functions as research workers. The difficulty has been to induce the lay mind to comprehend the value of work which does not give an immediate result in revenue. When research ends in the production of a drug such as sodium potassium bismutho-tartrate, and the consequent saving to the Colony of some £5,000 involved in treating yaws with Novarsenobillon, the Laboratory receives due recognition, but the amount of work entailed, and the large number of blind alleys explored, prior to the production of the finished salt, are unrealised. For the meantime, therefore, as in the past, one can only hope to maintain the routine Laboratory services, and in the intervals of this work attempt to elucidate some of the problems that face the practitioner in the Tropics.

In these days of financial stricture it has been impossible to press for the building of the new Laboratory, the plans for which were passed by the Tropical Advisory Committee of the Colonial Office in 1920. Small improvements have however been made in the present structure by the addition of a small room to the vaccination shed, so that the whole of the preparation of vaccine lymph can be carried out under one roof. In addition, the ice plant, which arrived in 1920, has been erected, and though not at present working as satisfactorily as was expected, the maintenance of the lymph at a temperature approaching the freezing point of water, is now assured.

It must not however be thought that the urgency of the question of a new Laboratory building is any less than it was in 1919, when the plan was first mooted. If anything the need is even greater than was recognised in those days, for now that Africans are coming for training as Laboratory Assistants, the lack of suitable bench accommodation is most apparent. Furthermore it is an essential for good technique that the workers should be comfortable, an ideal impossible of realisation in the present Laboratory. As regards the finance of the plan, it was pointed out in the Annual Report for 1919 that a valuation of examinations carried out in the Laboratory showed a surplus over the actual estimates of expenditure of about £6,000. In addition to this, there is little doubt that, if a loan were raised to build a new Laboratory, it could be paid off almost immediately by the sale of the valuable plot in the commercial area of the town on which the present structure stands.

SECTION 3.—VACCINE LYMPH PRODUCTION.

A.—STAFF.

The personnel engaged in the production of calf lymph has been as follows :—

(*a*) One Assistant Bacteriologist. (Dr. Allen.)

(*b*) One Indian Laboratory Assistant. (Mr. Ramji Das.)

(*c*) Three boys.

Two of the boys spent their whole time looking after the ice-plant, calf-sheds and calves, while the remainder of the Staff carried out duties in this section in addition to their general laboratory work. It has been found impossible so far to arrange to set apart Assistants who would be employed solely in making calf lymph.

B.—BUILDINGS.

The buildings consist of a waiting shed and a vaccination shed. The latter has been enlarged by the addition of a small room, ten feet square, of corrugated iron, having a cement floor and wooden ceiling. Water and gas have been laid on, and the room fitted up as a small Laboratory, so that the vaccination shed now consists of three rooms, namely: 1, the vaccination room; 2, the preparation room; 3, one room containing four stalls for vaccinated calves. A second door in the preparation room opens a few feet from the cold storage chamber to permit of the transference of lymph to the latter without exposure to the sun. In the past, all the preparation of lymph took place in the main Laboratory building, where it ran the risk of accidental contamination with pathogenic organisms. It is now hoped to eliminate such a possibility by preparing the lymph in a building devoted entirely to the one purpose.

C.—CALVES.

Calves have been obtained this year from the Kyambu district. Their general condition has been better than in 1921, but it is still far from ideal. Calves most suitable for vaccination would be best obtained either by breeding at the Laboratory, or by buying selected calves, preferable from Europeans, on whose farms the calves have been fed on milk for some considerable time after birth. The first method is impossible at present, owing to the lack of suitable accommodation and grazing facilities, while the second involves too great an expenditure. The strictest economy has to be exercised at this period of financial stringency, and in view of the fact that the lymph produced gives very satisfactory results, the present method of obtaining calves, by hiring them from the natives, must suffice.

The calves obtained were all heifers, the age on the average being about ten months. Younger calves would have been more satisfactory, but these as a rule are so undeveloped that they are unsuitable for vaccinating. White calves were selected when possible; usually, however, there was no choice, and all the calves brought in had to be used, to keep up the supply of lymph. The number of calves hired was 97, but three of these died before being vaccinated.

While in the charge of the Laboratory, calves have been fed twice a day on cut grass, and crushed mealies, and given water to drink. An attempt to get them to eat oil-cake proved a complete failure. It is hoped to be able to supplement their present food with lucerne during 1923. On the average, each calf was kept for a fortnight.

D.—SEED LYMPH.

Three strains have been in use this year:—

1. The strain obtained from a smallpox patient in Zanzibar, in 1921, known as the "Z. Strain."

2. The strain obtained from Belgaum in 1921, known as the "B. Strain."

3. A strain from the Lister Institute, known as the "L. Strain."

The last strain was only used to vaccinate four calves in the earlier part of the year. The vesiculation was poor, in spite of rejuvenation by passages through rabbits, and its use was discontinued. The Belgaum and Zanzibar strains have been in constant use throughout 1922, and have given very satisfactory results.

TABLE I.

SYNOPSIS OF RESULTS OF VACCINATION OF CALVES WITH "Z," "B" AND "L" STRAINS OF SEED LYMPH.

Strain.	Number of Calves Vaccinated.			Weight of Pulp Collected, in grammes.			
	Total.	Successful.	Failed or not collected.	Total.	Average per Calf.	Maximum yield.	Minimum yield.
Zanzibar "Z" ..	51	37	14	599·7	11·8	41·5	3·5
Belgaum "B" ...	38	29	9	467·7	12·3	28·8	4·0
Lister Institute "L"	4	2	2	39·5	9·9	21·7	17·8
Mixed "Z" and "B"	1	0	1	—	—	—	—
Total	94	68	26	1106·9	11·9	41·5	3·5

Note.—One calf was found, when shaved, to have been vaccinated previously. It was re-vaccinated from curiosity, but failed completely. It has, therefore, not been included, when working out the averages.

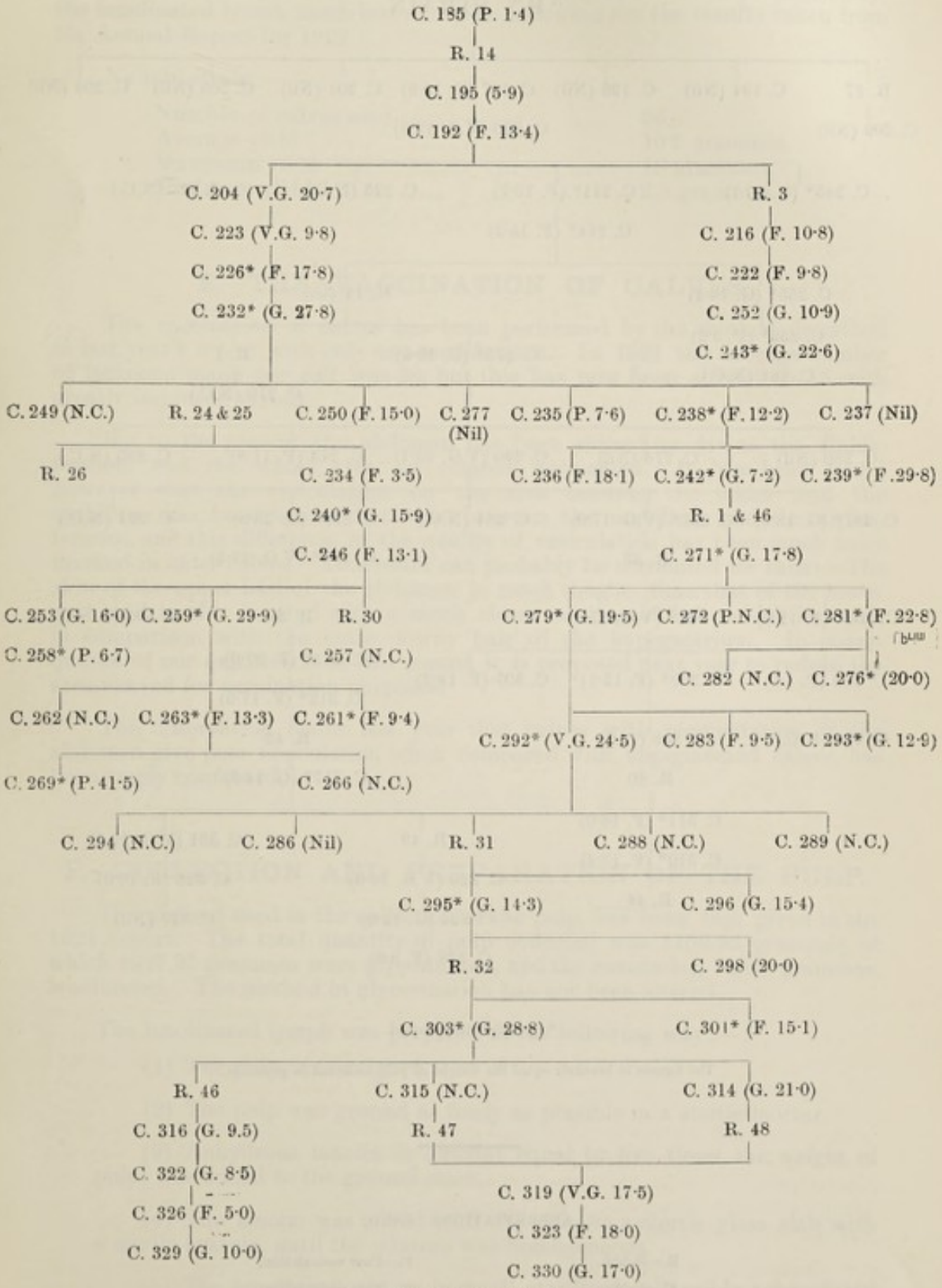
The number of calves that actually failed to take was small, since the majority of those shown as unsuccessfully vaccinated, gave a vesiculation, which, not being up to standard, was not collected. The main cause of low grade vesiculation was an unhealthy condition of the skin over the abdomen. Most of the calves show signs of tick bites, but their suitability for vaccination is very difficult to gauge before the event.

Several of the methods tried in previous years have been discarded. In 1919, the year in which the first improvements were made in the process of lymph production, the calves were divided into stock and paste calves. Only the very best calves were chosen as stock calves; the vesicles from them were selected, and the pulp thus collected was reserved for seed lymph, and used solely for the vaccination of calves. This practice has now been discontinued, and the lymph prepared from all calves is used for general issue, a small quantity being taken when required from a calf with good vesiculation for the vaccination of further animals. The maintenance of activity by the strains of lymph is ensured by passage through rabbits, usually after every third or fourth calf passage, or earlier if the lymph shows signs of deterioration.

Tables 2 and 3 give the results of all calves vaccinated during 1922, with the Zanzibar and Belgaum strains. They illustrate the principle followed in re-juvenation. It has been found that the first transfer from rabbit to calf does not give as good a result as the transfer from this calf to the next.

TABLE 2.

"Z" STRAIN.



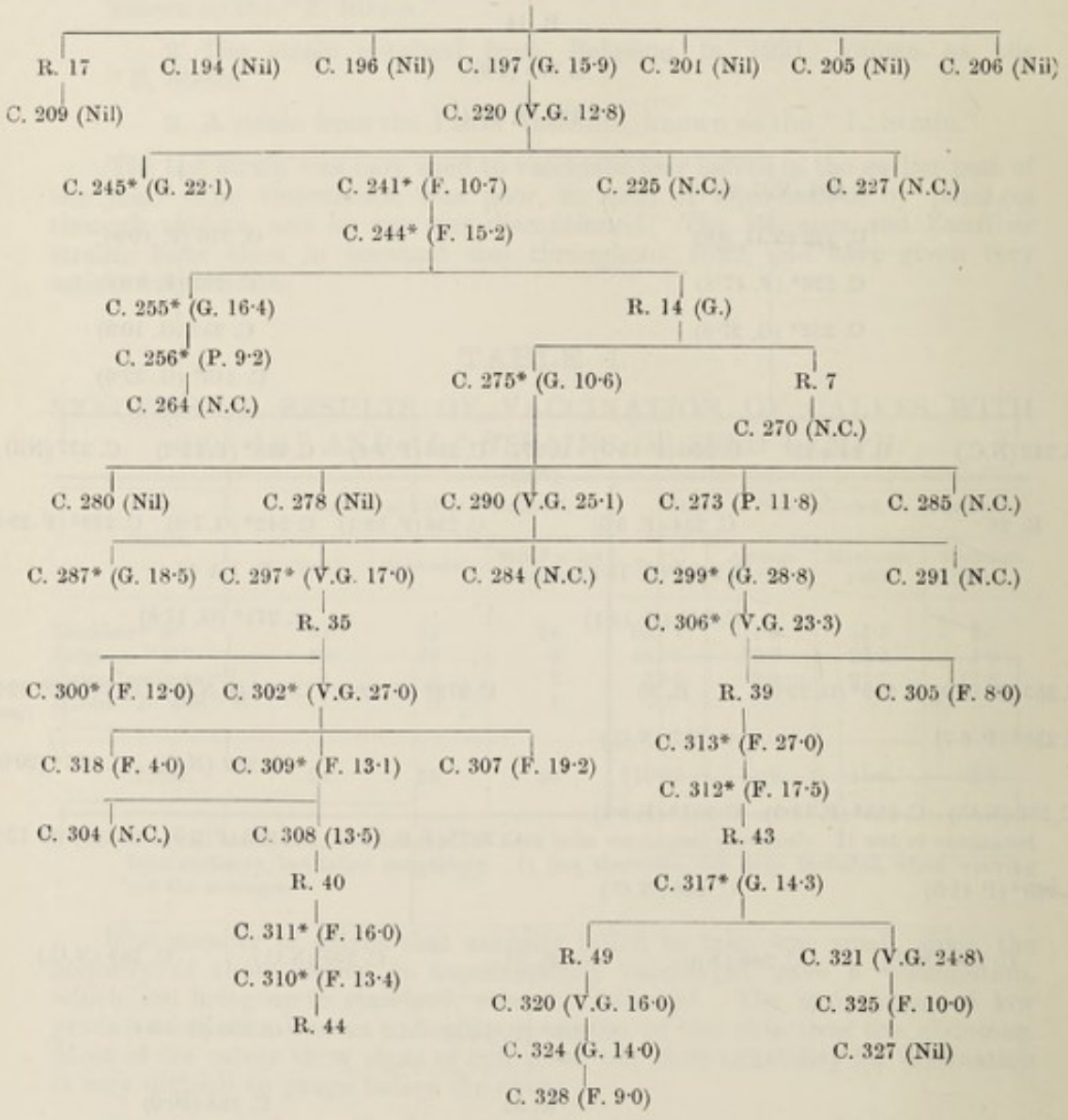
* Lymph batches issued.

The figures in brackets equal the weight of pulp collected in grammes.

N.B.—A list of abbreviations used will be found in Table 3.

TABLE 3.

"B" STRAIN.



* Lymph batches issued.

The figures in brackets equal the weight of pulp collected in grammes.

ABBREVIATIONS USED.

R.—Rabbit.	P.—Poor vesiculation.
C.—Calf.	F.—Fair vesiculation.
Nil.—Failed to take.	G.—Good vesiculation.
N.C.—Not Collected.	V.G.—Very Good vesiculation.

The Bacteriologist, Uganda, was supplied in July with 6·0 c.c.s of glycerinated and 10·0 grammes of lanolinated seed lymph from Lymph No. 295 Z. He reported that the glycerinated lymph was very satisfactory, the lanolinated lymph much less so. The following are the results taken from his Annual Report for 1922.

Nairobi strain :—

Number of calves used	36.
Average yield	10·3 grammes.
Maximum yield	18 grammes.
Minimum yield	2.5 grammes.

E.—THE VACCINATION OF CALVES.

The vaccination of calves has been performed by the method described in last year's report with only one modification. In 1921 the average number of incisions made per calf was 36, but this has now been altered to 18 with greatly improved results.

Up to the present the abdomen has been shaved as far as the xiphisternum, and the whole area so cleared vaccinated. It has been found however that the vesiculation on the area between the udder and the umbilicus has been better than that between the umbilicus and the xiphisternum, and this difference in the quality of vesiculation has been much more marked in older calves. This result can probably be accounted for thus :—The skin of the upper half of the abdomen is much tougher than that of the lower part, and is also covered with a much closer coating of hair, which is coarse in comparison with the more downy hair of the hypogastrium. In consequence of our experience in this regard, it is proposed next year to reduce the area shaved for vaccination purposes.

The observation made last year that calves with pigmentation of the abdomen give poor vesiculation when compared with unpigmented calves, has been amply confirmed.

F.—COLLECTION AND PREPARATION OF THE PULP.

The method used in the collection of the pulp, has been that given in the 1921 report. The total quantity of pulp collected was 1106.92 grammes, of which 1027.97 grammes were glycerinated, and the remainder, 78.95 grammes, lanolinated. The method of glycerination has not been altered.

The lanolinated lymph was prepared in the following way :—

(1) The pulp was weighed.

(2) The pulp was ground as finely as possible in a sterile mortar.

(3) Anhydrous lanolin in amount equal to five times the weight of pulp, was added to the ground mass.

(4) The lanolin was mixed with the pulp on a sterile glass slab with a sterile spatula, until the mixture was homogeneous.

(5) The lymph was put up in small sterilised collapsible tubes fitted with screw-on caps. Each tube held about two grammes, which was calculated to be equivalent to about 80 doses.

G.—STERILISATION OF THE LYMPH.

The sterilisation has been carried out by the chloroforming process in use last year. The results have been very satisfactory, and indicate that the activity of the lymph has not been appreciably affected by this method.

H.—STORAGE OF LYMPH.

The lymph has been stored in an ice chest (average temperature 9° O.C.) in the main Laboratory Building as in previous years. The cold storage chamber has been erected, but was not in working order till the end of 1922.

I.—BACTERIOLOGY OF THE LYMPH.

After chloroforming, the number of colonies on agar per loopful of lymph varied between 20 and 60. A large proportion of the glycerinated lymph became sterile, the average time being 37 days, but lymph batches containing B. subtilis did not, as a rule, do so, though the number of bacteria present was always reduced below 10 colonies per loopful in one or two months. These lymph numbers have been issued, although not sterile, and no bad results have followed their use. Anaerobic cultures in glucose agar were made from all lymph batches before they were issued. B. tetani has never been found.

The bacteria present in the glycerinated lymph consisted of :—

(1) Staphylococci (usually S. albus).

(2) Gram-negative bacteria.

(3) A spore-bearing gram-positive bacillus (B. subtilis).

They die out in the order given above.

J.—THE DISPATCH OF LYMPH.

A lymph batch was not selected for issue until several conditions had been fulfilled, namely, that—

(1) The number of colonies per loopful of lymph did not exceed ten, the organisms present in these being non-pathogenic.

(2) B. tetanus had been demonstrated to be absent.

(3) The trial vaccinations performed at the Laboratory had proved the lymph to be fully active as shown by the vesicles being of moderate size, the zone of re-action confined to the neighbourhood of the vesicles, and sepsis being completely absent.

Lymph for issue was filled into capillary tubes by the method described in the last report. This year Thermos flasks have not been used for the conveyance of lymph as they were all broken in the post, very few surviving more than one journey. The lymph was packed in wet sawdust in small wooden boxes, and so far as is known, it suffered no loss of activity in transit.

Table 4 shows the number of doses of lymph issued during the year, and the quantities sent to each station. Kisii and Kakamega were supplied weekly from Kisumu, sufficient lymph being sent to the latter station to supply all requirements.

TABLE 4.

NUMBER OF DOSES OF CALF LYMPH ISSUED IN 1922.

Station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Eldama Ravine	...	...	...	...	...	...	...	...	100	...	...	...	100
Eldoret	...	...	...	...	300	...	...	200	...	...	...	...	500
Fort Hall	...	...	300	...	...	...	...	50	60	100	80	80	670
Kakamega	...	...	90	...	...	...	...	...	...	...	...	100	190
Kapsabet	...	...	...	...	...	...	...	...	...	...	300	350	650
Kericho	1,155	1,110	350	50	50	50	50	100	100	100	15	100	3,230
Kijabe Mission	...	...	...	...	...	...	...	...	...	18	...	...	18
Kisii	...	...	90	...	...	...	...	...	...	...	...	...	90
Kismayu	...	...	...	...	200	180	...	...	...	...	...	100	480
Kisumu	3,600	3,840	6,000	5,600	6,950	6,000	4,800	4,820	4,760	6,040	4,800	4,590	61,800
Kitale	...	...	...	...	300	...	...	...	...	...	...	...	300
Kitui	...	...	...	...	...	...	...	100	90	150	30	...	370
Kyambu	400	400	...	..	100	400	...	100	...	100	...	...	1,500
Lamu	500	200	190	300	200	200	200	400	400	400	...	400	3,390
Machakos	...	...	390	...	...	...	...	...	150	250	200	200	1,190
Malindi	...	...	...	...	...	...	...	...	150	150	...	100	400
Meru	...	...	...	...	...	...	...	...	...	100	100	150	350
Mombasa	1,200	1,200	1,500	1,200	1,200	1,500	1,200	1,460	1,200	1,880	1,200	1,200	15,940
Nairobi, K.A.R.	1,100	3	...	...	...	1,180	...	...	...	...	...	...	2,283
,, Laboratory	40	16	19	3	...	62	16	...	30	125	38	55	404
,, M.O.H.	1	3	...	...	...	...	...	8	6	...	...	...	18
,, Nat. Hospital	6	27	...	...	...	...	...	8	...	...	...	...	41
,, Prison	150	80	90	80	30	96	70	60	30	...	...	...	680
Naivasha	...	...	100	100	100	150	100	150	150	150	...	...	1,000
Nakuru	62	48	360	66	48	60	48	48	48	60	48	48	944
Narok	...	...	180	...	300	...	310	600	300	...	...	...	1,690
Nyeri	...	...	...	...	...	...	50	...	...	...	...	...	50
Trans-Nzoia	...	...	...	...	...	...	12	...	...	12	...	...	24
Voi	...	50	200	590	400	500	400	480	400	500	...	...	3,520
Various	...	...	...	...	...	...	...	...	...	...	...	...	173
Total	8,214	6,977	9,859	7,989	10,178	10,372	7,256	8,584	7,974	10,135	6,811	7,473	101,995

K.—VACCINATION RETURNS.

The number of persons returned as having been vaccinated during the year is 57,246. The number seen on the eighth day was 6,303. This leaves a total of 48,943 persons who were not seen again, and unfortunately there does not appear to be any solution of this difficulty at present, as the Medical Staff has been considerably reduced, and the great majority of persons vaccinated have been labour recruits, who by the eighth day were scattered all over the country. Many of those vaccinated in the first six or seven months of the year, were porters for the new Uasin Gishu railway who were vaccinated in their own districts before leaving. Had there been a larger Medical Staff, they might have been inspected on arrival at their final destinations, but Officers at that time were already overworked, so that this was impossible to arrange. The remaining Africans who were vaccinated but not seen, proceeded to shambas all over the country, and in most cases to places where there was no Medical Officer in the vicinity. Even with a large Staff, it would be impossible to arrange for the inspection of these people on or about the eighth day.

The station in which the greatest number of vaccinations were performed, was Kisumu, as a large proportion of the Colony's labour comes from the Nyanza Province, and passes through the hands of the Medical Officer of Health, Kisumu, before proceeding to its destination. Out of a total of 34,126 persons vaccinated, 33,259 were not seen again. As a partial control, each lymph number received there, was used to vaccinate a small number of people in the prison and in the township. The results have been excellent, 740 cases being successful out of a total of 867 people vaccinated. The previous vaccinal condition was not ascertained, but probably a considerable number of these persons had been protected at some earlier period.

Some stations showed a low percentage of successful results in their primary vaccinations. One reason for this is probably that a number shown as primary, were in reality re-vaccinations. It is difficult to ascertain with any accuracy the vaccinal condition of a native, unless time is no object. Other stations again had a surprisingly high success rate in re-vaccination. Plague inoculations are frequently confused with vaccination by the native, and this may partly explain some of the figures. Also during the war, many natives were vaccinated in the field with inactive lymph and failed to take, and these should really be classed as primary vaccinations.

The stations showing the lowest percentage success rates in primary vaccinations were :—

Kakamega	67·6	per cent.
Mombasa Prison	70·7	,,
Meru	77·6	,,
Kismayu	77·5	,,

In Kakamega and Mombasa Prison, the results are difficult to understand. The lymph supplied to Kakamega was the same as that supplied to Kisumu, and took only one day more to reach Kakamega. If there was a day's delay, the lymph was stored on ice in Kisumu. Yet the Kisumu results for their vaccinations (primary and re-vaccinations shown together), was 85·3 per cent. In Mombasa the Medical Officer of Health had a success rate of 100 per cent. in his primary vaccinations, while in the prison with the same lymph used on approximately the sames dates, the success rate was only 70·7 per cent. These results may have been due to some error in technique, and an enquiry is being made into this possibility. The Kismayu return may be explained by the length of time it took the lymph to reach that station.

TABLE 5.

RETURN OF VACCINATIONS, 1922.

District or Station.	Population.		Total vaccns. done.	A. Primary Vaccinations.				B. Re-vaccinations.				C Previous vaccinal condition unstated.				Percentage success rate of known results.		
	Total.	per square mile.		T.	S.	F.	U.	T.	S.	F.	U.	T.	S.	F.	U.	A.	B.	C.
Eldama Ravine	19,465	56	30	24	20	4	...	6	...	6	...	...	...	...	...	83·3	0·0	...
Eldoret ...	...	...	165	133	91	10	32	32	29	2	1	...	...	...	...	90·1	93·5	...
Fort Hall ...	150,000	259	247	39	31	8	...	208	148	57	3	...	...	...	...	79·5	72·2	...
Kacheliba ...	16,392	5	98	75	75	...	...	23	23	...	...	...	...	...	...	100·0	100·0	...
Kakamaga ...	289,945	114	1,523	1,353	144	69	1,140	41	13	12	16	129	11	11	107	67·6	52·0	50·0
Kapsabet ...	...	...	587	587	237	33	317	...	...	...	...	...	...	...	...	87·7	...	...
Kericho ...	61,809	71	2,821	2,735	52	5	2,678	36	18	11	7	50	13	7	30	91·2	62·0	65·5
Kisii	231,202	82	6,131	5,969	...	...	5,969	162	...	...	162	...	...	...	...	...	...	...
Kismayu ...	61,647	...	208	150	86	25	39	58	17	29	12	...	...	...	...	77·5	36·9	...
Kisumu ...	266,914	144	34,126	...	...	...	...	...	...	...	...	34,126	740	127	33,259	...	...	85·3
Kitui	104,745	21	230	3	3	...	...	100	67	...	33	127	68	24	35	100·0	100·0	73·9
Kyambu ...	103,867	271	1,767	189	...	...	189	1,578	...	...	1,578	...	...	...	..	...	...	...
Lamu	20,936	...	1,738	...	...	...	...	...	...	...	...	1,738	974	371	393	...	...	72·4
Mackakos ...	185,659	92	364	125	3	...	122	42	...	2	40	197	18	11	168	100·0	0·0	62·0
Malindi ...	28,147	...	174	44	44	...	...	7	1	6	...	123	89	10	24	100·0	14·3	89·9
Meru	115,794	35	257	206	128	37	41	51	24	27	...	...	...	...	...	77·6	46·9	...
Mombasa, M.O.H.	...	...	718	28	23	...	5	4	...	3	1	686	108	13	565	100·0	0·0	89·2
Mombasa, Prison	...	...	908	87	58	24	5	821	360	407	54	...	...	...	...	70·7	46·8	...
Nairobi, K.A.R.	...	...	1,145	210	204	6	...	935	56	879	...	...	...	...	...	97·1	5·9	...
„ Laby....	...	...	435	132	108	8	16	283	174	88	21	...	...	...	...	93·1	66·4	...
„ M.C.H.	...	...	84	1	1	...	...	1	1	..	...	82	...	...	82	100·0	100·0	...
„ Prison	...	...	1,086	...	...	...	...	...	...	...	...	1,086	310	634	142	...	...	67·2
Naivasha ...	...	...	305	193	192	1	...	112	110	2	...	...	...	...	...	99.5	98·2	...
Nakuru ...	...	...	475	1	...	...	1	474	218	45	211	...	...	...	...	...	82·8	...
Narok	45,988	3	1,063	1,059	101	8	950	4	...	3	1	...	...	...	...	92·6	0·0	...
Voi	33,650	...	581	99	53	2	44	...	...	...	...	482	24	8	450	96·3	...	75·0
TOTAL ...	...	...	57,246	13,442	1,654	240	11,548	4,978	1,259	1,579	2,140	40,826	2,355	1,216	35,255	87·3	44·3	51·5

NOTE:—T. Total. S. Successful. F. Failed. U. Result unknown.

L.—GENERALISED VACCINIA.

One case of generalised vaccinia was reported during the year. The patient was an Indian girl, sixteen months old, vaccinated in Nairobi by the Health Office Sister. The parents were both healthy. The father had lived in East Africa for 22 years.

(*a*) HISTORY OF THE CASE.

When teething, the infant developed enlarged glands in the neck, which suppurated. Two months before being vaccinated, the child had a fall, and on the 28th June, an attack of cerebral malaria began, during which she ran a high temperature, was dull and apathetic, with stiffness of the neck, and a squint. Kernig's sign was absent. The temperature continued for seven days, and recovery was slow, the appetite remaining poor, and the child listless.

On August 14th, she was vaccinated with glycerinated lymph No. 281, not having been vaccinated previously. Three insertions were made. The vesicles appeared on the fourth day. On the sixth day the child was feverish and three teeth appeared. She ran a low temperature for four days and only slept intermittently. The vesicles on the eighth day were good, no appreciable inflammation or sepsia being present. The father stated that the child scratched her arm on the eleventh or twelfth day.

The eruption of generalised vaccinia first appeared on the fourteenth day after vaccination, in the following order :—

(1) Two pocks on the chin.

(2) One pock on the upper lip.

(3) Two pocks on the scalp.

(4) Three pocks on the left calf.

(5) One pock on the back, in the lumbar region.

On the sixteenth and seventeenth days, one pock appeared on the abdomen, two on the left thigh, one on the right thigh, one on the right calf, and a minute vesicle on the wrist.

These pocks became vesicular by the eighteenth day, varying in size from that of a sixpence to that of a shilling. They closely resembled the vesicles of ordinary vaccination, except that they were less marked, and rather flatter. They disappeared by the twenty-fifth day after vaccination, leaving practically no scar. The vaccination vesicles cleared up uneventfully.

(*b*) HISTORY OF LYMPH No. 281 Z.

The history of the Z Strain is set out graphically in Table 2, and the results of vaccination of the calves before No. 281 can be seen therein. Table 6 gives the complete history of this lymph number, and also shows the type of lymph record kept in the Laboratory.

TABLE 6.

RECORD OF LYMPH No. 281 Z.

I.—Details of Preparation.

Colour of Calf	White.
Age of Calf...	14 months.
Date of Vaccination of Calf	20-4-22.
Date of Collection of Pulp	25-4-22.
Seed Lymph used for Vaccination ...	271 Z.
Character of Vesiculation...	+++/++++
Weight of Pulp collected	22·9 Grammes.
Mode of Sterilisation	Chloroform Vapour.

II.—Results of Sterility Tests on Agar.

Date.	Number of Colonies per loopful.	Types of Bacteria present.
9-5-22	4	Grand-positive bacilli and Staphylococci.
16-5-22	3	" " " " "
23-5-22	4	" " " " "
29-5-22	4	" " " " "
6-6-22	7	" " " " "
19-6-22	0	... ...
27-6-22	0	... ...

III.—Results of Vaccinations.

Date.	Station.	Primary Vaccinations.				Re-Vaccinations.			
		T.	S.	F.	U.	T.	S.	F.	U.
24-7-22	Nairobi, Prison ...	7	7	...	...	3	...	...	3
25-7-22	Nairobi, Prison ...	...	...	...	...	3	1	1	1
28-7-22	Mombasa, Prison ...	...	...	...	...	8	...	8	...
1-8-22	Nairobi, Prison ...	1	...	1	...	1	...	1	...
3-8-22	Nairobi, Prison ...	...	...	...	...	5	2	3	...
3-8-22	Dr. Anderson, Nairobi	1	1	...	...	...	...	...	...
14-8-22	Nairobi, M.O.H. ...	1*	1	...	...	...	...	...	...
15-8-22	Nairobi, M.O.H. ...	1	1	...	...	...	...	...	...
19-8-22	Nakuru	...	...	...	...	3	3	...	...
22-8-22	Nairobi, Prison ...	4	3	...	1	...	...	...	...
24-8-22	Mombasa, M.O.H. ...	3	3	...	...	...	...	...	...
7-9-22	Eldoret	21	17	2	2	...	...	...	...
8-9-22	Eldoret	23	18	2	3	5	3	2	...
	Totals	62	51	5	6	28	9	15	4

Note.—T. Total. S. Successful. F. Failed. U. Unknown.

* Case of Generalised Vaccinia.

(c) RESULTS OF VACCINATION.

Enquiries were made as to the results of vaccination with this lymph in other parts of the country. All the reports received stated that no bad results and no case of generalised vaccinia were seen or heard of.

Two cases of vaccination may be described in detail, as they were infants.

(1) Dr. Anderson vaccinated one child on 3-8-22 with lymph No. 281 Z. The following are the particulars in this case :—

Age	Two months.
Sex	Male.
Race	European.
Previous Vaccinations	None.
General Condition	Good.
Number of Insertions	Two.
Number of days between vaccination and the first appearance of vesicles	Four.
Number of days between vaccination and recovery therefrom	Eighteen.
Number of Insertions successful	Two.

Remarks.—The child was somewhat restless on the eighth day, but did not lose his appetite. The vesicles were healthy, with a faint red areola surrounding them. The area between the vesicles was slightly oedematous.

(2) The Health Office Sister vaccinated a second child, the following being the particulars :—

Age	Sixteen months.
Sex	Male.
Nationality	Indian.
Previous Vaccinations	None.
General Condition	Good.
Date of Vaccination	15-8-22.
Number of Insertions	Three.
Number of times seen after vaccination ...	Fourth, seventh, twelfth and sixteenth days.
Number of days between vaccination and the first appearance of vesicles	Four.
Number of days between vaccination and recovery therefrom	Seventeen.

Remarks.—No sepsis, no temperature, and no loss of appetite or sleep were observed.

(*d*) DISCUSSION.

There are several points of interest in the case. In the first place, the child did not develop generalised vaccinia until the fourteenth day after vaccination. This is unusal. Allbutt's "System of Medicine," Vol. 2, Part 1, states that it is most commonly the seventh day on which the eruption appears. Secondly, the lymph used was sterile. Thirdly, all the other vaccinations followed a normal course, and showed typical and excellent results, while even in this case the child did not exhibit a reaction to vaccination which could in any way be considered severe. It is noteworthy, however, that the child in question was recovering from a serious illness.

M. LANOLINATED LYMPH.

Lanolinated lymph was prepared on a small scale during the year. The pulp selected for lanolination was above the average. It was issued to several stations and the Medical Officers were invited to report on its use. These reports varied enormously, the following being some extracts :—

(*a*) *Report from the Medical Officer of Health, Kisumu.*—The lanolinated lymph was received on the 8th March, 1922. On the 11th March, 1922, 11 prisoners were vaccinated in Kisumu gaol, four insertions being made on each. On the 18th March, 1922, nine of these were seen again, and seven were found not to have taken at all. In the eighth man, three insertions were in the pustular stage, while in the ninth, two insertions were showing signs of taking, and when seen again on the 25th March, 1922, were in the pustular stage. The seven men who had not taken, were re-vaccinated with glycerinated lymph on the 18th March, 1922. Five of these were seen again on the 25th March, 1922, three had taken well in all insertions, one had aborted, and one had failed.

On the 15th March, nine persons were vaccinated with lanolinated lymph, and five with glycerinated lymph. These people were inspected on the 22nd, and all those vaccinated with lanolinated lymph had failed. Three of the five vaccinated with glycerinated lymph had taken well, while the remaining two had aborted. In conclusion, this Medical Officer states that the lanolinated lymph does not compare at all favourably with the glycerinated lymph ordinarily used.

(b) The Medical Officer, Kisii, stated that in his opinion the vesicles with lanolinated lymph were healthier than those obtained with glycerinated lymph. His vaccination results however showed a very low percentage success rate.

(*c*) *The Medical Officer of Health, Mombasa,* reported that the lanolinated lymph was excellent, giving typical vesicles with no sepsis, and a success rate of 100 per cent.

(d) The Medical Officer, Machakos, reported very favourably on the lanolinated lymph supplied.

All these reports were based on vaccination with the same lymph batch. The following table shows the results of vaccinations performed by the Assistant Bacteriologist in Nairobi Prison. A lymph batch was divided into two parts, one part being glycerinated, and the other lanolinated. While the number of vaccinations is too small for conclusions to be drawn, the lanolinated lymph did not appear to give such good results as the glycerinated.

TABLE 7.

COMPARISON OF THE RESULTS OF VACCINATION WITH GLYCERINATED AND LANOLINATED LYMPH.

Lymph Number.	Date of Collection.	Date of Vaccination.	Vaccinations.																		Insertions.								
				Glycerinated Lymph.								Lanolinated Lymph.									Glycerinated Lymph.					Lanolinated Lymph.			
				Primary Vaccns.			Re-vaccinations.					Primary Vaccns.				Re-vaccinations.					Primary Vaccns.		Re-vaccinations.			Primary Vaccns.		Re-vaccinations.		
			T.	T.	S.	F.	T.	S.	A.	F.	U.	T.	S.	F.	U.	T.	S.	A.	F.	U.	T.	S.	T.	S.	A.	T.	S.	T.	S.	A.
296	27-6-22	1-10-22	25	5	5	0	6	0	4	1	1	4	1	3	0	10	2	1	6	1	20	20	20	0	16	16	1	36	8	4
317 B.	11-10-22	15-10-22	38	3	3	0	15	9	3	1	2	2	2	0	0	18	1	7	7	3	12	12	52	36	12	8	8	60	4	28
,,	,,	22-10-22	21	2	1	1	12	0	10	2	0	3	2	0	1	4	1	1	1	1	8	4	48	0	40	4	4	12	4	4
,,	,,	29-10-22	18	1	1	0	9	2	5	1	1	1	1	0	0	7	1	1	3	2	4	4	32	8	20	4	4	20	4	4
,,	,,	5-11-22	12	...	...	...	6	1	2	3	0	...	...	...	...	6	1	1	3	1	...	...	24	4	8	...	...	20	4	4
,,	,,	12-11-22	17	1	1	0	8	4	2	2	0	1	1	0	0	8	2	0	5	1	4	4	32	15	8	4	2	28	7	0
,,	,,	19-11-22	8	...	...	...	4	1	2	1	0	...	...	...	...	4	3	1	0	0	...	...	16	4	8	...	...	16	12	2
,,	,,	3-12-22	8	...	...	...	4	0	0	3	1	...	...	...	...	4	2	0	2	0	...	...	12	0	0	...	...	16	5	0
,,	,,	10-12-22	8	...	...	...	5	1	1	2	1	...	...	...	...	3	1	1	1	0	...	...	16	4	4	...	...	12	4	4
,,	,,	17-12-22	38	...	...	...	...	...	...	...	...	30	20	3	7	8	2	2	2	2	..	...	...	...	...	92	72	24	2	8
			193	12	11	1	69	18	29	16	6	41	27	6	8	72	16	15	30	11	48	44	252	71	116	128	91	244	54	58

NOTE.—**T.** Total. **S.** Successful. **A.** Aborted result. (Successful on the third day, nil on the eighth day). **F.** Failed. **U.** Unknown.

The disadvantages of lanolinated lymph are many, some being as follows :—

(1) There is no method by which the pulp can be sterilised before the lanolin is added.

(2) There is no tendency for extraneous organisms to die out as in glycerinated lymph ; indeed the reverse is rather the case, as lanolin appears to be an excellent culture medium for some of these contaminating organisms, which increase rapidly in it.

(3) The lymph has perforce to be put up in bulk, and vaccinating from the portion of lymph extruded by pressure from a collapsible tube is highly objectionable, though apparently unavoidable.

TABLE 8.

SYNOPSIS OF RESULTS OF LYMPH PRODUCTION IN 1922 AS COMPARED WITH 1921.

		1922.	1921.
Number of calves vaccinated		94	226
Number of calves vaccinated successfully		68	91
Average yield of pulp per calf—			
(*a*) All calves		11·9 gms.	4·3 gms.
(*b*) Successfully vaccinated calves		16·3 gms.	12·8 gms.
Number of doses manufactured.	Total	224,542	223,300
	Glycerinated	205,594	206,000
	Lanolinated	18,948	—
	Dessicated	—	17,300
Number of doses issued.	Total	101,595	83,271
	Glycerinated	94,915	65,971
	Lanolinated	6,680	—
	Dessicated	—	17,300
Total expenditure on lymph production		£493 16 4	£1,515 13 7
Cost per dose. Manufactured		0·53d.	1·63d.
Issued		1·16d.	4·36d.

SECTION 4.—REPORT ON ROUTINE EXAMINATIONS.

A complete table showing the results of all examinations during the year will be found in Appendix 1.

A.—DIFFERENTIAL LEUCOCYTE COUNTS.

It has been possible this year to obtain the eventual diagnosis of a very considerable proportion of cases in which differential leucocyte counts were done in the Laboratory. The results will be found in Appendix 2. Unfortunately counts were only made in a very few cases in which malarial parasites were found, either owing to lack of time on the part of the Laboratory Staff,

or to the unsuitability of the blood films. The making of these counts led to questions arising as to their dependence on certain factors, thus, for example, workers differed in some cases in their methods of enumeration. One man would count only the centre of the blood film, another across the film including the edges, a third the length of the film. All these methods led to differing results. It seemed then that the only way of obtaining a satisfactory count was to make a very small film of blood about 1 cm. square, and to count every leucocyte in it. This is excellent if good films can be obtained, but these, as a rule, can only be secured from members of the Laboratory Staff, the technique being too recent to be generally adopted by the general practitioner who as regards laboratory methods is essentially conservative. The problem of the best method of counting the ordinary long film then arose, and it was found that the method recommended by Napier in his article in the Indian Medical Gazette, Vol. 57, page 176, was the best, namely, to count the whole length of the film about the centre line including both extremities of it. For this the end of the film should be as square as possible, and should not be drawn out into tags. As regards the numbers of leucocytes to be enumerated, it was found that a count of 200 leucocytes gave substantially the same results as one of 300, and therefore a large number of the results recorded in Appendix 2 are the average percentage derived from a count of 200 white blood corpuscles. One feature of blood cell enumeration obtruded itself unpleasantly, for it was found that films from the same case taken at three or four hours intervals, gave markedly different results, especially in the content of large mononuclear cells. It was also noted that blood taken from the ear gave a different count to blood taken from the finger at the same moment. These problems are still under investigation at the time of writing.

As regards the conclusions to be drawn from the results of differential leucocyte counts made during the year, the numbers were insufficient to form the grounds of any deduction, and it must suffice to draw attention to the fact that a large mononuclear leucocyte increase was seen in all of the cases in which malarial parasites were found, while in blood films from healthy cases the large mononuclear leucocyte content was low in almost every instance. In cases where diseases were diagnosed by the practitioners in charge, on clinical grounds, little weight need be attached to the label of malaria, as this name was often used to designate cases of pyrexia in which the fall of temperature coincided fairly closely with the exhibition of quinine. On the other hand true cases of malaria may frequently have been diagnosed as influenza or simply as pyrexia, when the temperature fell in response to the administration of aspirin. We are therefore thrown back for our conclusions on two classes of cases, those in whom malarial parasites were found, and those who were apparently healthy, and even then in the latter class it is difficult to exclude a chronic malarial infection, the symptoms of which did not rise into consciousness. It may be said therefore that in spite of the trouble taken over blood counts this year, the results accomplished have borne little relation to the actual labour expended. It is hoped during the coming year to show figures of greater value than during the year under review, and to determine definitely the value of blood counts, when hourly or daily variations are taken into consideration. Possibly the use of a panoptic stain and a further differentiation of the white blood corpuscles, may assist in the diagnosis of the tropical diseases met with in this country.

B.—MALARIA.

The figures for malaria for this year show only a slight increase on those for last year in spite of the rainfall having been normal or even perhaps supernormal, and do not approach those of any previous year. The question of malaria in certain parts of the Colony is of great economic importance, and

an entomological survey of these districts, with an investigation of the types of mosquito carrying malaria, is urgently required in the interests of public health. There is hardly a disease in tropical climates, if one excepts amoebiasis, which is the cause of so much indisposition as malaria, and its elimination would lead to the saving of man-power and money. The association of the Plasmodium tenue type of parasite with the very severe form of malaria found in the Thika district, noted in last year's report, has not yet been made the subject of investigation, but it has been observed that it has also been frequently seen in cases of malaria from the district round Masongoleni where blackwater fever is common. It is worthy of note that both these districts are largely engaged in sisal production.

C.—TRYPANOSOMIASIS.

An extensive survey of the shores of Lake Nyanza was made during the year by Dr. Bevan. He sent to this Laboratory a number of blood slides from cases in which he made a clinical diagnosis of sleeping sickness, but in spite of the most rigorous examination of the films submitted, no trypanosomes were found. In a blood slide submitted this year from a native working at Makindu, T. gambiensi was observed, but no history could be obtained and the source of the infection was never discovered. The monkeys and guinea pigs inoculated from a suspected case of trypanosomiasis in a European at the close of 1921 showed no evidence of infection during the year under review.

D.—TYPHOID FEVER AND ALLIED DISEASES.

Typhoid fever, or its allies, seems to be present with us as an endemic disease. Cases occur at such irregular intervals, and in so sparse numbers, that the tracing of the source of infection is extremely difficult if not impossible. The few which were observed during this year were examples of this statement. Four of them occurred at the same time in January, yet of these only two could be shown to be connected in any way, these patients being inhabitants of the same house. It was certain that in these cases the milk supply could not be incriminated, and the water supply could, with almost as much certainty, be freed from blame, as it is unthinkable that if the water were the source of the disease many other persons amongst the general population of Nairobi would not have been attacked.

The diagnosis of typhoid fever and its allies by agglutination tests still remains as troublesome as ever, owing to the late stage at which agglutinins appear in the blood, but it is difficult to persuade local practitioners to take blood for cultures sufficiently early although they realise that the Widal reaction is very unreliable in this country. The value of blood culture is shown by the fact that three out of the four cases which occurred in January of the year under review gave positive results by this procedure. In connection with one case of typhoid fever, it is interesting to note that the patient suffered from a very mild attack, but died from toxæmia in a relapse. Agglutination tests and blood culture were negative during the actual attack, but the Widal reaction became positive for B. typhosus during the relapse.

E.—DYSENTERY.

Remarks have been made in previous reports on the change of type that occurred in dysentery in this country during the war. Prior to 1914, amoebic dysentery was the only form recognised, whereas the type prevalent during the period of the campaign, particularly amongst the native troops and porters, was the bacillary one. Last year's report contained no note on the subject of dysentery as 1921 was a year singularly free from the disease, and no case of

infection with Entamoeba histolytica, or with the dysentery group of organisms, was observed during the period then under review. With the return of a normal rainfall, 1922 showed a rise in the incidence of dysentery, and this is reflected in the Laboratory results. Entamoeba histolytica was observed on thirty-four separate occasions, and this number would doubtless have been increased had it been possible to obtain the stools of other suspected cases sufficiently soon after they had been passed to have seen the living protozoa. Time and again further specimens have been asked for in suspicious cases, but the request either received no attention or only elicited another sample taken several hours after defaecation. That there may be a certain amount of unrecognised amoebiasis among the general population is suggested by several cases of sickness seen during the year. In all these the diagnosis was in dispute, the various symptoms displayed being more or less anomalous, though all consistent with an old amoebic infection. In some there was a definite history of previous dysentery. These patients all responded miraculously to a course of injections of emetine. In several instances the only symptom seen was pyrexia, which did not respond to any drug until emetine was tried as a remedy of despair, with the result that the temperature immediately fell to normal.

The mode of infection in amoebic dysentery is extremely obscure. It seems almost impossible to distinguish the source. In cases where an attempt has been made to trace the origin of the disease, no carrier of Entamoeba histolytica cysts has been found amongst those in contact with the person or the food of the patient, and in the case of one child at least the parents had always taken the most extravagant precautions to safeguard the infant from any possible source of infection, and yet he succumbed to amoebic dysentery. The difficulty of tracing the origin of the disease in dysentery, as in typhoid fever, is probably to be accounted for by its relative infrequency, so that no special feature of the previous history of the case is sufficiently emphasised by its recurrence in several patients to give a hint as to the manner in which the infection was probably contracted.

Towards the close of the year dysentery in almost epidemic form broke out in the Native Hospital, Nairobi. Clinically the picture was that so often seen in the Carrier Corps Hospitals in East Africa during the war, and was typical of bacillary dysentery. Repeated microscopic examination of the stools of the patients failed to reveal any evidence of the presence of Entamoeba histolytica, but cultural examination in several cases lead to the isolation of an organism closely resembling Bacillus dysenteriae (Shiga). None of the recognised methods of treating bacillary dysentery had any effect until the polyvalent vaccine, prepared according to the method used in this Laboratory during the war, was issued. In many cases this had an immediate beneficial influence and the disease was well in hand at the close of the year. It is interesting to note that epidemic bacillary dysentery seems to be particularly amenable to vaccine treatment in this country, contrary to the observations recorded in other parts of the world. Unfortunately, there has been no opportunity to produce anti-sera for the local strains of organisms, the Laboratory not being a suitable building for this purpose. Now that the ice plant has been erected, it is intended that an order should be placed in England for a supply of stock anti-dysenteric serum and when this arrives it is hoped that it will prove as effective in combating the disease here as it has done in other hands elsewhere.

F.—DIARRHŒA.

Two cases of diarrhœa occurred during the year in which microscopical examination demonstrated the presence of two protozoa infrequently observed here. One case showed a large number of the cysts of Giardia intestinalis in the fæces; the other patient was the host of a considerable number of Iodamœba

bütschlii cysts. There is no record of the occurrence of Trichomonas intestinalis in any stool examined this year, though whether this indicates the true state of the case, or is due to omission on the part of the observer, is unknown.

G.—VETERINARY WORK.

It will be noted that a considerable number of animal specimens have been examined during the year. Some of these were met with in the ordinary course of observation of experimental laboratory animals, but the majority have been sent in by the Veterinary Officer, Nairobi, as a matter of convenience, since the Veterinary Laboratory is some considerable distance from the centre of the town.

H.—UNDULANT FEVER.

For the first time in the medical history of the country, so far as our records show, the presence of undulant fever in our midst has been discovered. The first case occurred in the Northern Frontier District, and was diagnosed on clinical grounds by the Medical Officer in charge there. The blood serum was sent for examination to the Laboratory, when it was found that it agglutinated M. melitensis in a titre of 1 in 1,600. A second case was diagnosed by the agglutination reaction in a patient at Kitui in the Wakamba reserve, the titre of the serum for M. melitensis being as high as 1 in 3,000. Evidence volunteered by an Administrative Officer at this station, indicates that the disease may be common in that place, while he states that nearly every one, both Europeans and natives, drinks goat's milk. Two other cases occurred at Fort Hall, one being an infection with M. para melitensis, while a fifth case was seen at the hospital of the King's African Rifles, Nairobi. It is possible that the disease has been present in the country for a long time, but it is strange that it has not been seen and diagnosed earlier, as all sera sent in for Widal reactions have been tested against M. melitensis and M. paramelitensis as a routine procedure for some considerable period.

I.—HISTOLOGICAL EXAMINATIONS.

Difficulty has been found this year in getting a paraffin suitable for an embedding material, which will give good results under all climatic conditions. It has been noted that a paraffin which gives good results in the morning, may give hopeless ones in the afternoon, owing to the change of temperature. The difficulty has been solved by adding one part by weight of beeswax to five parts by weight of a mixture of hard and soft paraffin melting at 50° C., fusing together and filtering. The resulting medium has a melting point of 51° to 53° C. and remains of a firm, tough consistency at all temperatures. This formula was seen in one of the issues of the *British Medical Journal* under Notes and Queries, but as it is some considerable time ago, the exact reference and the discoverer's name have been lost. It is, however, a most valuable suggestion, as it enables one with great ease to cut sections, one micron in thickness, of the most friable tissue.

J.—SCHISTOSOMIASIS.

As has been noted in the previous reports this disease is existent in many parts of the Colony. When seen in Nairobi, it usually affects the rectum, though cases of urinary bilharziasis do occur. Advantage was taken of the attachment of Dr. Mitchell to the Laboratory for temporary duty, to attempt an investigation of the snails found in the irrigation canal, which runs parallel to the Nairobi river, as this would seem a very probable place for these

molluscs to become affected, owing to the number of public native latrines on its banks and to its course close to the crowded Indian Bazaar. At the time the investigation was begun, the weather was dry, and the snails were readily discovered on the muddy banks close to the water. As soon as the rains began, however, they seemed to disappear from the canal altogether, and it is surmised, though not actually known, that they departed to the damper vegetable shambas irrigated by the canal. The snails collected were of many varieties, but many could be definitely identified as belonging to the genus Planorbis. Dissection of these molluscs showed that the livers of many of them contained fork-tailed cercariæ. In only one instance, however, were cercariæ found which showed the characteristics of those of S. mansoni, namely, the absence of pharynx, the absence of eye spots, the presence of a forked tail, and the presence of glands on both sides of the posterior end of the body, which communicated with the mouth. The liver of this snail was teased out in water to allow of the escape of the cercariæ, and the shaved leg of a guinea pig was held in the water for some time. Unfortunately no infection of this animal took place, and before any more cercariæ were found, the rains began and field work was perforce abandoned for a time, while after the rains ceased, Dr. Mitchell was transferred to Fort Hall. It is hoped to continue these experiments during 1923.

K.—HELMINTHIC INFECTION.

The very large number of native stools coming into the Laboratory still show a high percentage of infection with helminths. The commonest intestinal worm from which ova have been found in the fæces, is a member of the family of Ancylostomidæ, but its definite identification has not yet been made, as in spite of requests for samples of the worms, after anti-helminthic treatment, none so far have been forthcoming. Infections with T. saginata are the next most common, closely followed by those with T. trichiura.

As regards the actual findings in the Laboratory this year, the following were the results :—

Of 605 stools examined.

Ova of Ancylostomidae were found in 70 cases	11·6	per cent.
Ova of Taenia saginata were found in 59 cases	9·8	,,
Ova of Trichiuris trichiura were found in 45 cases	7·4	,,
Ova of Ascaris lumbricoides were found in 33 cases	5·5	,,
Ova of Schistosoma mansoni were found in 10 cases	1·7	,,
Larvæ of Strongyloides stercoralis were found in 9 cases	1·5	,,
Ova of Hymenolepis (Sp. ?) were found in 1 case	0·2	,,

Double infections occured in 41 cases = 6·8 per cent., and were as follows :—

Ova of Ancylostomidae and T. saginata ...	... 7 cases.
Ova of Ancylostomidae and T. trichiura ...	... 7 cases.
Ova of Ancylostomidae and A. lumbricoides	... 6 cases.
Ova of A. lumbricoides and T. trichiura ...	... 6 cases.
Ova of T. saginata and T. trichiura ...	... 5 cases.
Larvæ of S. stercoralis and ova of T. trichiura	... 3 cases.
Ova of S. mansoni and Ancylostomidae ...	... 2 cases.
Ova of S. mansoni and T. saginata ...	... 2 cases.
Ova of S. mansoni and T. trichiura ...	... 1 case.
Ova of T. saginata and A. lumbricoides ...	... 1 case.
Ova of T. saginata and Hymenolepis (Sp. ?)	... 1 case.

Triple infections occurred in 3 cases = 0·5% and were as follows:—

Ova of Ancylostomidae, T. saginata and T. trichiura	2 cases.
Ova of Ancylostomidae, A. lumbricoides and T. trichiura	1 case.

In the early part of the year an investigation was made into the amount of helminthic infection present among the inmates of the Kabete Reformatory. Altogether 156 boys were examined, a few on two occasions, but the majority on one occasion only. The following were the results obtained:—

Ova of Ancylostomidae were foundi n 39 cases	= 25·0 per cent.
Ova of T. saginata were found in 17 cases	= 10·9 ,,
Ova of A. lumbricoides were found in 17 cases	= 10·9 ,,
Ova of T. trichiura were found in 16 cases	= 10·3 ,,
Larvæ of S. stercoralis were found in 6 cases	= 3·8 ,,
Ova of S. mansoni were found in 1 case	= 0·6 ,,
No ova or larvæ were found in 77 cases	= 49·3 ,,

Single infections occurred in 63 cases (= 40·4 per cent.). The helminths found were as follows:—

Ova of Ancylostomidae	29 cases.
Ova of A. lumbricoides	11 cases.
Ova of T. saginata	10 cases.
Ova of T. trichiura	9 cases.
Larvæ of S. stercoralis	4 cases.

Double infections were found in 15 cases (= 9.6 per cent.) and were as follows:—

Ova of Ancylostomidae and T. saginata ...	5 cases.
Ova of Ancylostomidae and A. lumbricoides ...	3 cases.
Ova of A. lumbricoides and T. trichiura	2 cases.
Larvæ of S. stercoralis and ova of T. trichiura ...	2 cases.
Ova of Ancylostomidae and T. trichiura	1 case.
Ova of T. saginata and T. trichiura	1 case.
Ova of T. saginata and S. mansoni	1 case.

A triple infection was found in one case (= 0·6 per cent.) which showed ova of Ancylostomidae, A. lumbricoides, and T. trichiura.

It will be seen that almost twice as many stools were examined for helminths and other parasites during the past year as in 1921.

It is interesting to note in connection with these examinations, that the order of frequency in which the helminths were found, is the same in both years, with the exception of S. mansoni and S. stercoralis, which have changed places. It will also be observed that the per centage of infection with helminths is considerably higher among the inmates of the Reformatory than in the general population as represented by the stools received in the Laboratory, though in this connection it must be remembered that the latter include many sent in for re-examination after treatment for worms, and a large proportion of them are then negative.

One specimen of fæces was received, in which were found ova which corresponded in all respects with those of Hymenolepis. A request was made to the Medical Officer in charge of the case, that he would send specimens of any worms passed after anti-helminthic treatment. Unfortunately these were not forthcoming, so that the species of this parasite could not be determined. Its occurrence is of interest, as it is the first time it has been reported in the Colony.

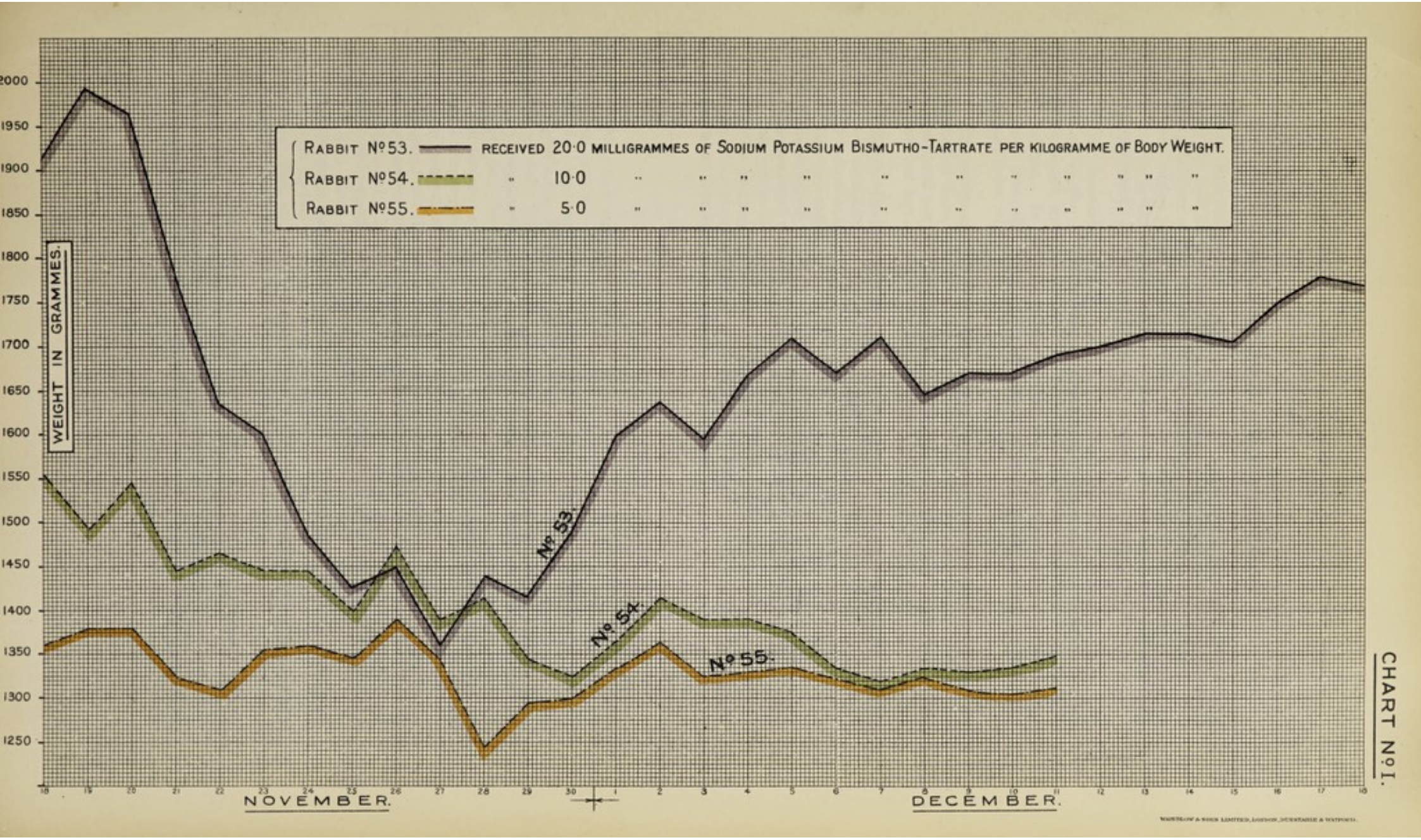
By an oversight, mention was omitted in last year's Report of a case of infection with Sparganum mansoni. The patient was a Masai who sought treatment at the Native Hospital for a large abscess of the thigh. When this was opened, the worm was found in the puss, and was brought to the Laboratory, when the diagnosis of Sparganum mansoni was made. It is worthy of note that the only other case from East Africa mentioned in Manson's "Tropical Diseases" was also a Masai.

L.—SYPHILIS AND YAWS.

From the laboratory point of view, the question of diagnosis of these diseases reduces itself to the possibility of the differentiation of yaws and syphilis by bacteriological or immunological tests. Hopes are placed in the Sigma test, as it is stated that it gives one much more definite imformation than the Wassermann test. So far only twenty-nine cases have been subjected to both reactions. For the Sigma test we have used an antigen prepared by ourselves in accordance with Dreyer's directions, but it is hoped at an early date to obtain some standard antigen direct from his laboratory, so that our own antigen can then be given a factor such as will make our findings comparable with those obtained in England. Of these twenty-nine cases, thirteen sera gave a negative and fifteen a positive result by both methods, while one gave a negative result with the Sigma test and a very weak positive reaction with the Wassermann test. Sufficient cases have not yet been done to j ustify any conclusions being drawn.

A real advance which has been made this year, has been in the substitution of sodium potassium bismuth tartrate for neosalvarsan, or one of its allies, in the treatment of yaws. Attention was first drawn to the use of this drug owing to its employment by the Medical Department in Tanganyika Territory. The method used there in its preparation has been modified and simplified by the workers in the Chemical Research Department of this Colony. In Appendix 3 will be found a description by the Director of Chemical Research of the present method of its manufacture.

When the drug was first prepared, little was known about its chemical composition. Some of the papers in French medical journals were available, but all dealt with the use of the drug in treatment, and in one only was there a footnote giving a clue to its chemistry, and even this merely stated that the preparation used in the experiments described contained 50 to 54% of bismuth. With only this slender evidence to go on, when a salt containing this amount of bismuth was finally prepared, it was considered advisable to test its toxicity. The paper above mentioned stated that in a rabbit a dose of 5 milligrammes of the sodium potassium bismuth tartrate per kilogramme of body weight, given intravenously, caused progressive emaciation and death in seven to eight days, while 10 milligrammes killed rabbits in three days, and 20 milligrammes in two days. It was therefore considered that should the toxicity for rabbits of our preparation be no greater than this, it might be considered safe to employ in the treatment of man. Three rabbits were used for the test. Chart No. 1 shows the change in weight after intravenous injection in Rabbit 53 of 20·0 milligrammes of the drug per kilogramme, in Rabbit 54 of 10·0 milligrammes per kilogramme, and in Rabbit 55 of 5·0 milligrammes per kilogramme. From this it will be seen that, although a loss of weight occurred in the first instance, this in every rabbit was almost completely regained within the period of observation. At no time did the animals appear to be really ill, although there was a slight falling-of in condition coincident with the alteration in weight. The results of this experiment therefore show that the drug prepared by the method devised here in less toxic than that used by Sazerac and Levaditi in France.


RABBIT Nº53. RECEIVED 20·0 MILLIGRAMMES OF SODIUM POTASSIUM BISMUTHO-TARTRATE PER KILOGRAMME OF BODY WEIGHT.
RABBIT Nº54. " 10·0 " " " " " " " " " " " "
RABBIT Nº55. " 5·0 " " " " " " " " " " " "
WEIGHT IN GRAMMES.
2000
1950
1900
1850
1800
1750
1700
1650
1600
1550
1500
1450
1400
1350
1300
1250
Nº 53.
Nº 54.
Nº 55.
NOVEMBER.
DECEMBER.
CHART Nº I.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M.—VACCINE PRODUCTION.

The manufacture of stock vaccines for the Colony, has been carried out during the year on the usual lines, but owing to the necessity for economy in the expenditure of the Medical Department, the preparation of plague vaccine has been added to the other activities of the Laboratory. The only change in the routine methods described in previous reports has been the addition of B. paratyphosus C. to the stock T. A. B. vaccine.

The demand for autogenous vaccines has increased during the year. In addition to the B. coli vaccines, which will be discussed in another section of this report, marked success has been obtained with vaccines for pyorrhœa and asthma. In the case of the former, the vaccine is prepared from cultures obtained from the gums, or from extracted teeth. The asthma vaccines are obtained from cultures of the washed sputum.

The question as to whether the preparation of residual vaccines should be undertaken here, has been discussed, but with the present small staff it has been decided not to proceed with this innovation, particularly in view of the success that has attended vaccines prepared in the ordinary way.

Standardisation of the vaccines has given a certain amount of trouble. There is no doubt that the most accurate method consists in weighing the dried bacilli before emulsifying, but in practise this is tedious. It has been found that Brown's method of comparing the emulsion with a standard suspension of barium sulphate, answers very well, the only difficulty being that it introduces a large personal equation, some observers differing by as much as 10 per cent. As this error is multiplied when diluting the bulk vaccine from which the sample is drawn, the final error is often considerable, so that it has been our practice to restandardise the emulsion after dilution. This has largely reduced what must formerly have been a considerable error.

N.—WATER SUPPLIES.

Fifty-five samples of water were examined during the year, excluding mineral waters. Of these, forty-nine were taken from various points on the Nairobi water supply, the remaining six coming from other parts of the country. As regards the Nairobi samples, an attempt was made this year to carry out the last of the investigations suggested in the Annual Report for 1921, namely, a daily examination of the Nairobi water supply, the accessible springs at Kikuyu, and the two sections of the reservoir, over a period which included part of the dry and part of the wet season. This was the more important in that it was suggested by the Chief Sanitation Officer, that the variation of the B. coli content of the water with the rainfall was due to rain washing bird-droppings from the rocks exposed in the reservoir, into the water. This was a possible source of the organisms indicative of fascal contamination, and had to be eliminated. If the B. coli in the water were derived from bird-droppings, one would expect a sudden and rapid increase of the B. coli count after heavy rain, and then a gradual diminution as the coliform organisms died out. Examinations, however, in previous years have tended to show that the increase of B. coli in the water occurs some fifteen to twenty-five days after the onset of heavy rain, and that the count remains high until the rains have ceased, when it slowly regains its normal dry weather level.

The period during which tests were carried out, was from February 10th to March 11th. In Table 9 are given the results of all water supply and mineral water examinations made during the year. Of these the samples, numbered 157 to 191, were examined during the period under review. Some of these were taken

TABLE 9.

WATER EXAMINATIONS, 1922.

Serial No.	Source.	Colonies on Gelatine per c.c. 3 days.	Colonies on Agar per c.c. 2 days.	Colonies on L.B.A. per c.c. 2 days.	Bacillus Coli per litre.	Streptococci per litre.	Bacillus enteritidis sporogenes per litre.
153	Soda water	...	...	15	> 1000	...	...
154	Soda water	...	...	0	0	...	...
155	Soda water	∞	∞	26	100–1000	< 40	< 40
156	Soda water	...	...	1	< 20	...	...
157	Nairobi main ...	...	...	22	100–1000	...	...
158	Nairobi main ...	...	...	107	1000–10000	...	...
159	Nairobi main ...	...	...	188	1000–10000	...	...
160	Nairobi main ...	...	...	433	> 10000	...	...
161	Nairobi main ...	36	46	12	< 100	< 100	...
162a	Spring I, Kikuyu ...	...	...	11	< 1000	...	...
162b	Spring II, Kikuyu ...	...	...	5	< 1000	...	...
162c	Spring III, Kikuyu ...	...	...	9	< 1000	...	...
162d	Spring IV, Kikuyu ...	...	...	29	> 2000	...	...
162e	Spring V, Kikuyu ...	...	...	2	< 1000	...	...
162f	Spring VI, Kikuyu ...	...	...	9	< 1000	...	...
162g	Spring VII, Kikuyu...	...	...	4	< 1000	...	...
162h	Spring VIII, Kikuyu	...	...	15	1000–2000	...	...
162i	Spring IX, Kikuyu ...	...	...	5	< 1000	...	...
162j	Spring X, Kikuyu ...	...	...	7	< 1000	...	...
162k	Spring XI, Kikuyu ...	...	...	5	< 1000	...	...
162l	Spring XII, Kikuyu...	...	...	3	1000–2000	...	...
162m	Spring, Waddell's ...	...	...	1	< 1000	...	...
163	Nairobi main ...	275	617	145	> 10000	100–1000	...
164	Nairobi main ...	140	804	100	100–1000	100–1000	...
165	Nairobi main ...	301	529	86	100–1000	100–1000	...
166	Nairobi main ...	6000	1287	213	100–1000	50–100	...
167	Nairobi main ...	∞	4950	424	1000–10000	100–1000	...
168	Nairobi main ...	2100	2790	250	1000–10000	100–1000	...
169	Nairobi main ...	?	4050	167	> 10000	100–1000	...
170	Upper reservoir ...	?	2700	95	100–1000	20–100	...
171	Lower reservoir ...	?	1470	98	100–1000	20–100	...
172	Spring A, Kikuyu ...	...	...	17	100–1000	...	...
173	Spring I, Kikuyu ...	...	...	11	40–100	...	...
174	Spring II, Kikuyu ...	...	...	9	40–100	...	...
175	Spring III, Kikuyu ...	...	...	3	40–100	...	...
176	Spring IV, Kikuyu ...	...	...	54	1000–10000	...	...
177	Spring V, Kikuyu ...	...	...	5	100–1000	...	...
178	Spring VI, Kikuyu ...	...	...	6	100–1000	...	...
179	Spring VII, Kikuyu...	...	...	1	100–1000	...	...
180	Spring VIII, Kikuyu	...	...	7	1000–10000	...	...
181	Spring IX, Kikuyu ...	...	...	4	100–1000	...	...
182	Spring X, Kikuyu ...	...	...	6	100–1000	...	...
183	Spring XI, Kikuyu ...	...	...	10	100–1000	...	...
184	Spring XII, Kikuyu...	...	...	26	1000–10000	...	...
185	Spring, Waddell's ...	...	...	1	40–100	...	...
186	Swamp, Kikuyu ...	...	...	66	1000–10000	...	...
187	Nairobi main ...	?	2410	256	1000–10000	100–1000	...
188	Nairobi main ...	53	770	37	20–100	20–100	...
189	Nairobi main ...	533	368	30	20–100	< 20	...
190	Nairobi main ...	?	3850	231	> 10000	20–100	...
191	Nairobi main ...	?	2430	130	1000–10000	20–100	...
192	Well, Nairobi ...	...	...	366	> 10000	100–1000	...
193	Reservoir, Magadi ...	574	∞	18	1000–10000	1000–10000	> 100
194	Pond, Ngong ...	...	...	39	1000–10000	< 20	> 100
195	Mombasa main ...	5	34	0	< 20	100–1000	> 100
196	Drain, Kikuyu ...	...	487	4	100–1000	1000–10000	> 100
197	Reservoir, Kikuyu ...	...	1750	35	1000–10000	> 10000	> 100
198	Well, Mombasa ...	?	∞	∞	> 10000	> 10000	> 100
199	Soda water	...	...	39	100–1000	...	...
200	Ginger ale	...	...	2	< 20	...	...
201	Filtered water ...	...	...	14	< 20	...	...
202	Soda water	...	...	15	< 20	...	...

from the springs at Kikuyu, but the remainder were taken from the Laboratory tap. Extreme precautions were observed in obtaining the sample, *e.g.*, in cleaning the tap, and letting the water run for twenty minutes before collecting it. In Table 10 will be found a comparison of the results of the bacteriological examination of Nairobi water as taken from the Laboratory tap, with the rainfall at Kikuyu during the period under observation. In Table 11 will be found a comparison of the results of investigation on two separate occasions of the various springs supplying the reservoir at Kikuyu.

TABLE 10.

RESULTS OF A SERIES OF DAILY EXAMINATIONS OF WATER FROM NAIROBI MAINS.

Date.	Colonies on Gelatine per c.c. 3 days.	Colonies on Agar per c.c. 2 days.	Colonies on L.B.A. per c.c. 2 days.	B. coli per litre.	Rainfall at Kikuyu Station. inches.
10-2-22	...	...	22	100–1000	0·50
11-2-22	...	...	107	1000–10000	0·10
12-2-22	...	...	...	...	0·00
13-2-22	...	...	188	1000–10000	0·00
14-2-22	...	...	433	> 10000	0·00
15-2-22	...	...	...	...	0·20
16-2-22	...	...	...	...	0·00
17-2-22	...	...	...	...	0·00
18-2-22	...	...	...	...	0·00
19-2-22	...	...	...	...	0·00
20-2-22	...	...	...	...	0·00
21-2-22	...	...	...	...	0·00
22-2-22	36	46	12	< 100	1·20
23-2-22	...	...	...	...	0·60
24-2-22	...	...	...	...	0 00
25-2-22	...	...	...	...	0·00
26-2-22	...	...	...	...	0·00
27-2-22	275	617	145	> 10000	0·00
28-2-22	140	804	100	100–1000	0·00
1-3-22	301	529	86	100–1000	0·00
2-3-22	6000	1287	213	100–1000	0·00
3-3-22	∞	4950	424	1000–10000	0·00
4-3-22	2100	2790	250	1000–10000	0·00
5-3-22	...	...	...	...	0·00
6-3-22	?	4050	167	> 10000	0·00
7-3-22	?	2410	256	1000–10000	0·00
8-3-22	53	770	37	20–100	0·00
9-3-22	533	368	30	20–100	0·00
10-3-22	?	3850	231	> 10000	0·00
11-3-22	?	2430	130	1000–10000	0·00

NOTE:—L.B.A.: Lactose bile-salt neutral red agar.

?: Plates liquefied.

> : More than. < : Less than.

TABLE 11.

RESULTS OF THE EXAMINATION OF THE SPRINGS AT KIKUYU RESERVOIR.

Origin of Sample.	Examination 17-2-22.		Examination 6-3-22.	
	Colonies on L.B.A. per c.c. 2 days.	B. coli per litre.	Colonies on L.B.A. per c.c. 2 days.	B. Coli per litre.
Upper Reservoir	...	...	95	100–1000
Lower Reservoir	...	...	98	100–1000
Spring A	...	...	17	100–1000
Spring I	11	< 1000	11	40–100
Spring II	5	< 1000	9	40–100
Spring III	9	< 1000	3	40–100
Spring IV	29	> 2000	54	1000–10000
Spring V	2	< 1000	5	100–1000
Spring VI	9	< 1000	6	100–1000
Spring VII	4	< 1000	1	100–1000
Spring VIII	15	1000–2000	7	1000–10000
Spring IX	5	< 1000	4	100–1000
Spring X	7	< 1000	6	100–1000
Spring XI	5	< 1000	10	100–1000
Spring XII	3	1000–2000	26	1000–10000
Waddell's Spring	1	< 1000	1	40–100
Swamp...	...	...	66	1000–10000
Laboratory tap	...	...	107	> 10000

NOTE:—L.B.A.: Lactose bile-salt neutral red agar.
> : More than. < : Less than.

It will be seen from the consideration of these two tables that only one conclusion can be drawn, namely, that the bacterial count and the B. coli content change very greatly from day to day, and that the bacterial count on agar and bile salt media, and the B. coli content will vary in more or less the same manner. If then the bacteriological examinations show such wide differences from day to day, it naturally follows that it is unwise to draw any definite conclusions from such examinations as to factors affecting the water supply. To anyone acquainted with the possibilities of contamination existent in the reservoir, this condition of affairs is explicable, but it invalidates many of the deductions we have drawn previously from weekly examinations of the Nairobi water, inasmuch as the results on which such conclusions were based, were probably vitiated by errors due to sampling. It is possible also that variations in the time of chlorinating the reservoir may have played a part in the changes shown from day to day in this year's findings. One result only stands out clearly in the figures here presented, namely, that it is only on rare occasions that the Nairobi water can be considered fit for human consumption if judged by the standards obtaining in England.

It will be noted that the results of the daily examination do not bear out the contention of the Chief Sanitation Officer, as there is no sudden increase of B. coli in the water after heavy rain. Although indeed there must be a possibility of B. coli entering the water from bird-droppings on the rocks in the reservoir, the exposure of such droppings to a tropical sun on a surface which becomes very hot in the middle of the day, must suffice to render them almost, if not quite, sterile.

When one comes to review this year's work in a subject like this, one feels how inadequately one has touched the problems presented. It was, however, only as the result of the loan of Dr. Hunter from the Sanitation Division of the Medical Department that even these results could be obtained, and he had

to be taken off this work in a comparatively short time so as to enable more urgent research on rat poisons to be dealt with. The numbers of the Laboratory Staff are too small to deal with the work required by a series of water examinations.

O.—MILK SUPPLIES.

In Table 12 are shown the results of the examination of twenty-seven milk samples investigated during the year at the request of the Veterinary Officer, Nairobi, who was instituting a campaign to obtain a purer milk supply in the town. As no information was given, in the majority of cases, regarding the identity of the producer of the milk, few conclusions can be drawn from the results, since many of the samples were known to have been taken from native milk vendors.

P.—VEGETABLE SUPPLIES.

A lettuce was obtained from the local market in order to find out the bacterial condition of the common constituent of salads at the time of purchase. The result was as indicated in Table 12. It goes to show what risks of disease are run through the use of lettuce in salads.

TABLE 12.

MILK AND VEGETABLE EXAMINATIONS, 1922.

Serial Number.	Source.	Colonies on Agar per c.c. 2 days.	Colonies on L.B.A. per c.c. 2 days.	Greatest dilution giving B. coli in 1.0 c.c.	Greatest dilution giving Streptococci in 1.0 c.c.
5	Milk ...	55,000,000	5,000,000	1/10,000	1/10,000
6	Milk ...	1,600,000,000	5,000,000	1/10,000	1/1,000,000
7	Milk ...	14,720,000,000	8,000,000	1/10,000	1/100
8	Milk ...	9,200,000,000	570,000,000	1/10,000	1/100
9	Milk ...	40,000	<100	1/100	1/100
10	Milk ...	§	440,000,000	1/1,000,000	1/100
11	Milk ...	20,360,000,000	70,000,000	1/10,000,000	1/100
12	Milk ...	11,080,000,000	2,400	1/100	1/10,000
13	Milk ...	316,000,000	2,800	1/100	1/100
14	Milk ...	310,000,000	21,000	1/100	1/100
15	Milk ...	§	§	1/10,000,000	1/1,000,000
16	Milk ...	1,400,000	400	1/100	1/100
17	Milk ...	20,000,000	150,000	1/100	1/100
18	Milk ...	4,000,000	25,000	1/100	1/100
19	Milk ...	47,000,000	31,000	1/100	1/100
20	Milk ...	2,000,000	1,500	1/100	1/100
21	Milk ...	17,000,000	1,000,000	1/100	1/100
22	Milk ...	54,000,000	5,000,000	1/100	1/100
23	Milk ...	§	10,000,000	1/1,000,000	1/100
24	Milk ...	3,000,000	2,100	1/100	1/100
25	Milk ...	25,000,000	2,000,000	1/100	1/100
26	Milk ...	49,000,000	5,000,000	1/10,000	1/100
27	Milk ...	72,000,000	31,000	1/100	1/100
28	Milk ...	68,000,000	67,000	1/100	1/100
29	Milk ...	§	2,000,000	1/1,000,000	1/10,000
1	Lettuce	42,000,000	9,000,000	1/1,000,000	1/100

NOTE.—§: Uncountable. <: Less than. L.B.A.: Lactose bile-salt neutral red agar.

SECTION 5.—COLI-TYPHOID GROUP VACCINES.

In addition to the cases detailed in the last Annual Report, fifteen new patients have been treated with autogenous vaccines made from coli-typhoid group organisms isolated from their stools, while eleven further batches of vaccine were made up for some of those previously treated.

The cases of which the results are known, are sumarised in Table 13.

TABLE 13.

LIST OF CASES TREATED BY COLI-TYPHOID GROUP VACCINES.

Case Number.	Date of commencement of treatment.	Conditions for which vaccine given.	Results up to December, 1922.
237	August, 1919 ...	Rheumatoid arthritis	Greatly improved.
321	April, 1920 ...	Rheumatoid arthritis	Greatly improved.
345	May, 1920... ...	Rheumatoid arthritis	Greatly improved.
356	June, 1920 ...	Rheumatoid arthritis	Greatly improved.
373	July, 1920... ...	Chronic rheumatism	Cured.
394	July, 1920... ...	Chronic rheumatism	Cured.
S.	November, 1920 ...	Rheumatoid arthritis	Greatly improved.
W.	November, 1920 ...	Chronic rheumatism	Cured.
453	November, 1920 ...	Acute rheumatism	Slightly improved
460	November, 1920 ...	Chronic rheumatism	Cured.
471	December, 1920 ...	Osteo-arthritis	Not improved.
490	January, 1921 ...	Chronic rheumatism	Cured.
553	July, 1921... ...	Chronic rheumatism	Cured.
569	August, 1921 ...	Chronic rheumatism	Cured.
577	August, 1921 ...	Chronic rheumatism and sciatica	Cured.
580	September, 1921 ...	Chronic rheumatism	Cured.
586	October, 1921 ...	Rheumatoid arthritis	Not improved.
609	October, 1921 ...	G.S. Wound of leg	Cured.
615	November, 1921 ...	Chronic rheumatism	Cured.
628	December, 1921 ...	Chronic rheumatism and sciatica	Greatly improved.
634	December, 1921 ...	Arthritis	Not improved.
644	December, 1921 ...	Chronic rheumatism	Cured.
668	January, 1922 ...	Chronic dyspepsia	Cured.
681	February, 1922 ...	Chronic rheumatism ...	Greatly improved.
683	March, 1922 ...	Chronic rheumatism	Greatly improved.
689	March, 1922 ...	Chronic rheumatism	Greatly improved.
694	April, 1922 ...	Membranous colitis	Cured.
711	May, 1922... ...	Coluria	Cured.
740	July, 1922... ...	Coluria	Cured.
774	September, 1922 ...	Chronic rheumatism	Greatly improved.

SUMMARY.

Disease.	Total cases.	Cured.	Greatly improved.	Slightly improved.	Not improved.
Chronic rheumatism	16	11	5	...	...
Rheumatoid arthritis...	6	...	5	...	1
Coluria	2	2	...	...	...
Osteo-arthritis	1	...	...	...	1
Acute rheumatism	1	...	...	1	...
Arthritis	1	...	...	. .	1
Chronic dyspepsia	1	1	...	..	...
G.S. Wound of leg	1	1	...	...	...
Membranous colitis	1	1	...	...	...
TOTAL	30	16	10	1	3

NOTE.—Cases still under treatment, insufficiently treated, or as yet untraced, are excluded from the above table.

Before describing the clinical details of the new cases, the more strictly laboratory side of the question will be discussed.

A.—METHODS.

Some modifications of the methods described in last year's report have been made during 1922. In the first place using the microscopical method, only when agglutination has taken place at a dilution of 1 in 90 of the patient's serum, has it been regarded as significant. This change has been made, as it has been found that the lowest titre in any case showing clinical symptoms, has always been at least 1 in 90, and the adoption of this standard eliminates, to a large extent, the possibility of normal agglutinins for B. coli group organisms being mistaken for pathological ones. The microscopical method of testing agglutination has again been largely used, but in some cases Neisser's method has been employed either alone, or in conjunction with the microscopical one.

Another change which has been made in procedure during this year, has been in the dosage of the vaccine. Last year it was our custom to make the strength of each dose double that of the preceding one, and though such increase has given good results in our own hands, it has proved unsatisfactory in those of general practitioners, who cannot be persuaded that more is involved in vaccine therapy than the injection of a dose of vaccine at weekly intervals. Consequently the strength of each dose of vaccine has now been made 15% greater than that of the preceding one. This, together with the new policy of administering most of the vaccines in the Laboratory, should enable every case to be dealt with satisfactorily, according to the reaction each individual shows to each dose of vaccine.

It is of great interest to note that, in a few instances, the organism isolated from the faeces and found to agglutinate with the patient's serum, has also been discovered in and isolated from the urine.

There is one observation which seems to be significant in regard to these infections. The faeces of patients in whom agglutinable coli-typhoid group organisms are found usually present several varieties of colonies when plated out, whereas normal persons without agglutinable organisms, only show, at most, one or two different types.

B.—AGGLUTINATION REACTIONS OF NORMAL PERSONS TO AUTOGENOUS COLI-TYPHOID GROUP ORGANISMS.

These have been investigated more extensively during the year under report. In 1921, attention was drawn to two cases of gonorrhœal arthritis whose faeces were examined for coli-typhoid group organisms several times, but never yielded any bacilli agglutinating with the homologous serum. Investigation of two of the cases reported in last year's Annual Report as untraceable, has resulted in the discovery that no agglutinable organisms were found in these patients' faeces, so that no vaccines were prepared for them.

It was also noted that Dudgeon, Wordley and Bawtree (1) had stated that out of sixty-six normal individuals examined for agglutinins for B. coli, only five showee any in a serum dilution of 1 in 50 by Dreyer's method. In a later paper (2), the same authors have demonstrated that in a further one hundred and four "normal" cases believed free from a coli infection, sera from only twenty-two persons gave a positive reaction at a dilution of 1 in 50, and two of these had on further investigation a probable coli infection. During this year an opportunity has been taken of examining the faeces from fifty-four cases who were under treatment in hospital for non-intestinal diseases, and clinically free from a coli infection. These patients were subjected to exactly the same routine tests as those suspected of coli-typhoid group infection, and in only two cases was positive agglutination at a titre of 1 in 90 obtained with an organism isolated from the faeces. It may be observed here that the serum of one of these cases gave very poor agglutination, so much so that, in dealing with a patient suspected of a coli infection, it would probably have been registered as negative. Unfortunately there was no opportunity of examining these two cases further, to discover if some latent coli infection were present or not. In four cases of arthritis sent in this year by local practitioners as suspected infections with coli-typhoid group organisms, no coliform bacilli agglutinating with the patient's serum were discovered. Further investigations showed that one of these cases was suffering from gonococcal arthritis and one from tubercular arthritis.

C.—AGGLUTINATION REACTIONS OF PATIENTS SUFFERING FROM COLI-TYPHOID GROUP INFECTIONS.

Two questions should be considered in this section, namely, the titre to which agglutinins rise in the blood of patients suffering from a coli infection, and the existence of cross-agglutination between sera and organisms from different cases.

To take the question of titre first, it is not unusual to find agglutinins in a patient's blood acting in high dilutions on organisms isolated from the stool of that person. The highest titre met with has been 1 in 800, bnt agglutination at dilutions of 1 in 160 or 1 in 320 is fairly common. It is also not unusual to find that two different organisms isolated from the same sample of faeces, are agglutinated by the patient's serum, and in such a case, the titre for one is often much lower than that for the other. We are then faced with the problem as to whether the agglutinins in such cases are a mixture of primary and secondary varieties, or whether the two types present are both primary. If the former is the case, absorption tests should demonstrate the fact. Experiments are in progress to test this at present. Weight, however, is lent to the latter view in that organisms of the B. Coli group are notorious for producing agglutinins which are practically specific for the homologous organism. If then, two separate agglutinins are present, we must conclude that two separate infections have occurred, possibly at different times. It thus follows that more than one organism of the B. coli group can act as a pathogenic agent. If this is so, since a vaccine in these coli-typhoid group infections only raises the resistance of the body against the organism from

(1) Dudgeon, Wordley and Bawtree, Journal of Hygiene. Vol. 20, p. 158.
(2) Dudgeon, Wordley and Bawtree, Journal of Hygiene. Vol. 21, p. 178.

which it is made, and not against that group represented by that organism, there is no guarantee that a recurrence of the symptoms will not take place, seeing that another member of the same group may develop pathogenic properties for the individual under treatment. Indeed this does seem to take place frequently, as we have had several requests for further courses of vaccine, and in one case, at least, we have some proof of its occurrence, for when the patient ("S" in last year's report) came in for a second course of vaccine therapy, no trace of the organism which had caused the first infection, could be found in the stool, but a second bacillus with quite distinct and different sugar reactions, was isolated, and was agglutinated by the patient's serum. Either then this was a new infection, or else the second organism had escaped isolation when the first vaccine was made, an unlikely occurrence seeing that in every case examined several plates are made from the faeces, and every colony showing distinct characteristics is isolated and tested. If then there is a possibility of multiple infections with different coliform organisms occurring, are we justified in assuming that low titre agglutinins can be rejected? Should we not rather consider them as evidence that a fresh infection is in progress? Is it not possible, indeed, that titres as low as 1 in 30 should be taken as significant? This is a question which may never be solved, but having seen the relief that follows the administration of vaccines made from these organisms, even when the symptoms are somewhat indefinite, it is difficult to feel justified in withholding vaccine therapy whatever the symptoms may be, if such a definite indication as an agglutination titre of 1 in 90 for coli-typhoid group organisms isolated from the faeces, is present in the patient's serum.

As regards cross-agglutination between the sera of, and the organisms isolated from, patients suffering from coli-typhoid group infections, no work that is worth recording has been done as yet, owing mainly to lack of time to examine the strains of coliform bacilli while the sera were fresh. It is hoped to make more of these tests during the coming year.

D. IDENTIFICATION OF THE COLI-TYPHOID GROUP ORGANISMS ISOLATED.

The sugar and other reactions of some of the organisms isolated from patients, are given in table 14. It has, unfortunately, been impossible so far to test all the organisms, as in many cases there have been ten or twelve separate bacteria from the same individual to identify, and it has only been after the sugar reactions have been completed, that one has been certain that many of these were the same. In some cases, when bacteria from the one case have only differed as regards reactions on a single sugar, it has necessitated the re-testing of the cultures, and in one or two instances it has been found that the latter have not been quite pure. However, during the year, ninety-two bacteria have been examined in regard to their reactions with some selected sugars, and also for certain other properties, *e.g.* indol formation, carbinol reaction, etc. These bacteria were isolated from twenty-two samples of faeces from seventeen patients. After investigation, it was found that the actual bacteria causing the infections, could be reduced to forty-three, several from the same patient being identical. On further comparing the organisms from different patients, it was discovered that the actual varieties distinguishable by the reactions employed, numbered nineteen, as can be seen from Table 14.

TABLE 14.

CULTURAL REACTIONS OF CERTAIN COLIFORM ORGANISMS.

Culture number.	Lactose.	Mannite.	Glucose.	Saccharose.	Dulcite.	Salicin.	Adonite.	Sorbite.	Inosite.	Litmus Milk.	Indol.	Voges—Proskauer Reaction	Gelatin.	Bouillon.	Motility.
620 C.	AG	AG	AG	O	AG	AG	O	AC	O	AC	+	O	O	T	+ + +
634 G.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
641 A.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
652 D.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
681 L.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
704 A.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
738 A.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
740 A.	...	...	...	..	...	...	...	...	...	...	...	...	...	...	..
801 E.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
620 D.	AG	AG	AG	AG	AG	AG	O	AC	O	AC	+	O	O	TP	+
634 F.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
660 X.	...	.	...	...	...	...	...	...	...	..	...	...	...	...	...
682 K.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
683 C.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
693 A.	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...
735 C.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
638 A.	AG	AG	AG	AG	AG	O	O	AG	O	AC	+	O	O	TP	+ + +
668 C.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
755 K.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
774 D.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
631 G.	AG	AG	AG	O	O	AG	O	AG	O	AC	+	O	O	TP	+ + +
644 H.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
801 G.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
631 O.	AG	AG	AG	AG	O	AG	O	AG	O	AC	+	O	O	TP	+ + +
634 C.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
704 D.	AG	AG	AG	O	AG	AG	O	O	?	AC	+	O	O	T	+
738 H.	...	...	...	...	...	...	...	...	..	...	...	...	...	.	...
681 N.	AG	AG	AG	AG	O	O	O	AG	O	AC	O	O	O	TP	+
735 H.	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...
735 T.	AG	AG	AG	O	O	O	AG	AG	O	AC	+	O	O	T	+ + +
788 A.		...	...	...	...	...	...	...	...	...	...	...	...	..	...
615 A.	AG	AG	AG	AG	AG	AG	O	AG	AG	AC	O	+	O	TP	+
615 B.	AG	AG	AG	O	AG	O	O	AG	O	AC	+	O	O	T	+ + +
738 F.	AG	AG	AG	sAG	AG	AG	O	O	?	AC	+	O	O	T	+
652 E.	AG	AG	AG	O	AG	AG	AG	AG	O	AC	+	O	O	TP	+
660 R.	AG	AG	AG	AG	AG	AG	O	AG	AG	AC	+	O	O	TP	+
668 B.	AG	AG	AG	AG	O	AG	O	AG	AG	AC	O	+	O	TP	+
668 F.	AG	AG	AG	AG	AG	O	O	AG	O	AC	O	O	O	TP	+ + +
683 B.	AG	AG	AG	AG	AG	AG	O	AG	O	AC	+	+	O	T	+
683 D.	AG	AG	AG	AG	O	AG	A	AG	AG	AC	+	+	O	T	+
755 B.	AG	AG	AG	AG	O	O	O	AG	O	AC	+	O	O	T	+ +
801 B.	AsG	AG	AG	AG	O	AG	O	AG	A	AsC	O	O	O	T	+

NOTE.—**A.**—Acid. **G.**—Gas. **C.**—Clot. **s.**—Slight. **T.**—Turbidity. **P.**—Pellicle.
?—Untested. **+**—Present, or indicates the degree of motility. **O.**—Absent, or no change.

Comparison of the reactions of these varieties with the list given by Castellani and Chalmers in their Manual of Tropical Medicine, has only enabled us to identify eight with previously known and named bacteria. The common infecting organism was apparently a true B. Coli communis (nine cases), but B. pseudo-coli (Castellani) ran it a close second, occuring in seven instances. The other types were found much less frequently. However, until more of the cases, and more of the chemical and serological relationships of these bacteria, have been investigated, it will not be possible to come to a definite conclusion as to whether a particular group of coliform organisms is responsible for the affections we have treated, or whether any member of the coli group can take on pathological properties when it gains access to the bowel.

In concluding this section, attention must be drawn to the value of a combination of china blue and rosolic acid as an indicator. The changes from an alkaline to an acid reaction are clearly marked, and one is rarely puzzled by indifferent colours.

E. PATHOGENICITY OF MEMBERS OF THE COLI-TYPHOID GROUP FOR RABBITS.

Two of the organisms isolated from a case of chronic rheumatism, (namely Bacillus 681, L. and Bacillus 681 N.) were tested for their pathogenic action on rabbits. A live bouillon culture of B. 681, L. was inoculated into the knee joint of Rabbit 51. There was a marked local reaction. Heat and tumefaction of the joint resulted, with loss of function. Besides the synovitis, there was also considerable swelling of the periarticular tissues, although the culture was injected directly into the synovial cavity of the joint. There was practically no alteration in the animal's temperature or weight, while, apart from its obvious disinclination to use the affected limb, the rabbit never appeared indisposed. A control injection of the sterile bouillon was made into the knee joint of the opposite side, but practically no change was seen beyond a very slight synovitis which caused no disability, the animal moving the leg quite freely. It will be noted on reference to Table 14 that culture 681 L. is a true B. coli communis. The same experiment was made on Rabbit 58 with culture 681, N, an unidentified coliform bacillus, with exactly the same results. A living culture of this same bacillus, 681, N, was also injected intravenously into Rabbit 60 without causing any indisposition, or any change in weight or temperature. Rabbit 29 was used as a control throughout.

These experiments on pathogenicity were only commenced a short time before the close of the year, and will be continued during 1923, when it is hoped that not only the immediate effects of inoculation, but also the remote ones, as evidenced by histological changes, will be investigated. The experiments reported this year are too few in number to enable any conclusions to be drawn.

F.—COMPLEMENT FIXATION REACTIONS.

Efforts were made to make use of the complement fixation reaction to obtain a grouping of the organisms isolated in the course of this research. Unfortunately, so far, we have been unable to secure any figures worth reporting here, as only a few sera have been tested, and the technique still requires standardising. Although results up to the present have been disappointing, hope has not been lost in the possibilities of complement fixation as a differentiating group test, though it may be that the precipitin reaction will eventually prove more satisfactory.

G.—CLINICAL REPORTS ON OLD AND NEW CASES.

Case 237. The general condition of this patient has not altered, except that he complained recently of a slight reccurence of pain in some of the affected joints. A new vaccine was made up for him just before the close of the year, and it is hoped that this will remove these symptoms. It is now three and a half years since this patient first came under treatment, so that it may be considered that the improvements wrought by vaccine therapy have been well maintained.

Cases 321, 345, 373, W, 460, 580, 615 and 644. These cases have remained free from symptoms during 1922.

Case 356. This patient had a recurrence of pain during the year, but stated that he was too busy to come for vaccine treatment. As he is carrying on his occupation without any apparent disability, one must conclude that the relapse was only slight.

Case S. After a spell of cold and damp weather in September, this case returned complaining that the stiffness in the hands was recurring. An investigation of the faeces showed that a new organism was apparently responsible for the trouble, and a course of treatment with a vaccine made from it, removed the symptoms complained of.

Cases 453, 490, and 586. No further information is available in regard to these patients.

Case 471. No improvement has taken place in the joint condition despite prolonged vaccine treatment.

Case 553. This patient reported slight recurrence of pain in the cervical spine towards the close of the year. Another course of injections completely removed the trouble.

Case 569. This case has been to England on leave during the year, and in spite of experiencing a very inclement summer, has had no return of rheumatism.

Case 577. There was a slight recurrence of pain in the left leg in June, but this was immediately cured by further vaccine treatment.

Case 394. (July, 1920.). This case was reported as untraceable in the 1921 report. This year, however, his former medical attendant sent in an order for another vaccine, stating that the first one had completely relieved his patient's rheumatism, but that a slight relapse had occurred. Unfortunately he has not responded to a request for clinical notes of the original condition, only stating that the patient suffered from chronic rheumatism, chiefly affecting the legs.

Cases 503 *and* 535. These were reported last year as untraceable, but further enquiry has shown that in neither of them could agglutinable bacilli be found, so that no vaccine was ever made up for them. They should therefore be excluded from the list of cases treated with vaccine.

Case 610. (November, 1921.). This patient only came for two injections of vaccine, and being thus inadequately treated, cannot in equity be included in our figures.

Case 609. (October, 1921.). This case, although treatment was commenced in 1921, was not reported on last year, as results had not then come to hand. The patient does not belong to the ordinary type of case treated by us with B. coli vaccines, but he is of importance as a link in the argument for our views. The man in question had a severe gunshot wound in the right thigh during the war, with comminution of the middle third of the femur. As a result of this, he was in hospital in England for about two years. On arrival in East Africa, he had the misfortune to break the damaged femur again, and it was at this juncture that he came under our observation. The new fracture was not compound, but the original injury became inflamed again, and some of of the old sinuses began to discharge. The inflammation gradually subsided, but later recrudesced, and this alternation of activity and quiescence lasted for some twelve months, till the possibility of the presence of a coli infection presented itself. Cultures from the sinuses only showed staphylococci, and the same organisms were found in the pus from a small abscess which formed near the injured bone, and was opened at an operation. Examination of the faeces, however, resulted in the isolation of an organism of the coli-typhoid group which agglutinated to a titre of 1 in 250 with the patient's serum. A vaccine was made from this bacillus, and after a few injections, there was marked improvement in the patient who had previously been getting worse and was threatened with the development of amyloid disease (a small amount of albumen was indeed found in the urine.) Since this time there has never been a relapse, and the patient is now able to play both golf and tennis, in spite of having an ankylosed knee-joint in the injured limb. Enquiry showed that when the original wound occurred, one of the organisms isolated from it, was a coliform bacillus. It would seem therefore that, although cultures from the sinuses failed to show it, the infection with this organism had never really died out, and that the high agglutination titre of the patient's serum against an organism of the same group found in the faeces, indicated that this was either identical with, or closely allied serologically to, the original coliform bacillus infecting the wound. If this latter assumption is correct, it supports very strongly the view that the presence of agglutinins in a patient's serum for a coli-typhoid group organism isolated from the faeces, indicates that such bacillus is exercising some pathogenic action on the patient.

Case 628. (December, 1921.). This was a case of mucous colitis, associated with very severe sciatica and rheumatoid arthritis. The colitis had followed an attack of amoebic dysentery some years previously, and the sciatica and rheumatoid arthritis were later developments. The patient on examination showed marked tenderness along the course of the sciatica nerve of the right side. The leg could not be flexed at the hip-joint if the knee was in a position of extension, and any attempt to do so caused acute pain. Some of the fingers showed spindle-shaped swelling of the interphalangeal joints, while there was slight ulnar flexion of both hands. No other articulations were apparently involved. The patient's serum agglutinated very strongly two bacilli of the coli-typhoid group isolated from the faeces, and a vaccine was therefore made from them. The patient unfortunately had to leave for Europe soon after treatment began, but the latest report received stated that the vaccine had caused great improvement.

Case 634. (December, 1921.). This is one of the most interesting of cases, although it must be deemed a failure as regards vaccine treatment. The patient was a man of forty or thereabouts, who had led a very active life up to a few years ago. There was a history of gonorrhœa in youth, but no history or evidence of syphilis, congenital, or acquired. The illness for which he came under notice, began with pain in the knees, and as this was thought to be a late result of gonorrhœa, prostatic massage was instituted. This was followed by synovitis of the knee joints, at first only slightly painful, and remaining but a few days, then disappearing to reappear a week

later. These conditions of tumefaction and normality alternated for some time. The patient then went to England where he was treated by many doctors with very little improvement. By the time he returned to East Africa, the swelling of the knees had settled down into a definite periodicity, so that these articulations were swollen and very painful for three days, and were more or less normal for the same period. The swelling of the knees was associated with a definite rise in temperature, while there was also some synovitis of the ankle joints, and some pain was felt in the right shoulder. At the time of the exacerbation of swelling and pain, there was a decided tendency to frequency of micturition. It was at this juncture that the patient first came under observation at the Laboratory. The most striking point in the physical signs was the condition of the knees, which seemed, when they became distended, to be on the point of bursting, while the pain was so great that the patient had to go to bed and remain there until the tumefaction disappeared. There was some thickening of the synovial membrane of the affected joints. Examination of the patient revealed no obvious focus of sepsis, although the fibrile character of the attacks, their periodicity, and their association with the frequency of micturition, pointed to a bacterial affection of some kind. There was no evidence of pyorrhœa, the synovial fluid of the knee-joints was sterile, while the prostatic fluid showed no evidence of bacteria on culture, although the history of onset of the affection was suggestive of a gonococcal arthritis. This was evidently the opinion held in England, as the patient had been given a course of gonococcal vaccine. Examination of the stool led to the isolation of three bacilli agglutinating with the patient's serum, while culture of the urine during one of the attacks of frequency of micturition, yielded a bacillus identical with one of the faecal strains. A vaccine was accordingly prepared from the three vacilli, and great hopes were raised when it was found that the periodicity in the swelling of the joints gradually changed, and the frequency of micturition entirely disappeared. Unfortunately the effect on the knees showed itself in a slight delay in onset of the swelling of the left one, which led eventually to one or other joint being always in a condition of tumefaction. This was probably due to the too frequent administration of the vaccine which resulted in very marked reactions with a high temperature. For a time pain in the knees was diminished, but latter, in spite of the vaccine, it became worse, and finally the patient decided to return to England. Meanwhile another examination of the faeces led to the isolation of two more varieties of coliform bacilli, and the urine, a month after this, showed the presence of one of the organisms originally isolated, another similar to one of the new faecal strains, and a third not to be identified with any previously found. Another vaccine was made from these baccilli, and the patient took it with him to England, At the time of writing no further report has been received.

Case 668. (January, 1922.). The symptoms of this patient were somewhat indefinite, the main complaint being chronic dyspepsia, associated with fleeting pains in various joints of the limbs. The patient took practically no alcohol and did not smoke. There was no evidence of any indiscretions in diet, but there was very obstinate constipation unrelieved by any of the usual treatments. The blood serum agglutinated in high dilution three lactose-fermenting baccilli isolated from the faeces, and a vaccine made from these led to a rapid disappearance of the constipation and of the apparently associated indigestion, and at the close of the course of injections, the patient stated that he had completely recovered, and had not been so well for years.

Case 681. (February, 1922.). The patient in question had suffered for years with a fistula-in-ano, but stated that for some time prior to the onset of that affection he had felt pain and stiffness in the cervical spine and in the hands. When he first came under observation, he was complaining mostly of the pain in the hands and the neck, but there was also associated with this a

very considerable degree of general malaise. A short time after this, the fistula-in-ano gave rise to an ischio-rectal abscess, and it was noted that there was coincidently a distinct improvement in the rheumatic symptoms in the hands. Later on, however, pain and stiffness reappeared, and the patient then requested that vaccine treatment should be tried. On the evidence of the previous history, the probabilities of improvement were considerable, and it was also hoped that the healing of the fistula-in-ano which was not completed, would be promoted by the vaccine. Two lactose-fermenting baccilli were isolated, one of them from the faeces, and one, a true B. coli communis, by sugar reactions, from the discharge from the fistula. A vaccine made from these organisms was followed by a certain degree of improvement, but the results were not as satisfactory as had been expected. Consequently a second examination was made, and two other bacilli isolated which agglutinated with the patient's serum at dilutions of 1 in 200 and 1 in 800 respectively. A second vaccine made with these organisms has led to a complete cure of the fistula, and to entire disappearance of the rheumatic symptoms, though the course of injections is not yet complete.

Case 683. (March, 1922.). This patient had suffered for years with pain in the knees, and in the interphalangeal articulation of the third finger of the right hand, whenever damp weather was approaching. The knees showed a considerable amount of thickening of the periarticular tissues, with distinct grating on movement. No bony changes could be made out. The affected joint in the finger was swollen, a certain amount of the tumefaction being due to synovitis, but the greater part being attributable to inflammation of the surrounding structures. There was also a considerable loss of function, and marked tenderness on palpation No pathological condition other than these lesions could be made out, except for some vague pains in the muscles of the shoulder, and chronic constipation. On examination of the patient's stool, three types of lactose-fermenting bacilli, which agglutinated with the patient's serum, were isolated, and a vaccine containing them, was made up. Shortly after the treatment was started, this patient was transferred to Dar-es-Salaam, but the last report received from him, stated that the finger was quite better, and that the knees caused him no trouble at all, in spite of the fact that, prior to treatment, they had always become much worse in a hot climate. As regards the present clinical condition of the joints, no information can be obtained, so that it is only on the patient's own statement that one can consider this case as improved, but from that one can gather that the original lesions have been cured as regards subjective symptoms.

Case 689. (March, 1922.). This patient sought relief for excruciating pains in the upper extremities. The pain was apparently of a fleeting character, and went from joint to joint, affecting most frequently the hands and shoulders, but also attacking at times the dorsal and cervical portions of the spinal column. The history was one extending over some two or three years. On examination of the patient during a quiescent interval, no pathological changes could be made out in the joints usually affected. Lactose-fermenting bacilli, agglutinating with the patient's serum, were isolated from the faeces, and a vaccine was made therefrom. The latest report from the patient states that the pains have practically disappeared, and that even when they are felt, are so slight as to be no longer a cause for complaint. This case would probably repay a further investigation of the faeces.

Case 692. (March, 1922.). This patient came complaining of pain and disability in the right elbow joint. On examination there was considerable limitation of movement due to thickening of the periarticular tissues, and to bony changes in the form of exostoses. There was a history extending back for eighteen months of chronic constipation associated with gradually increasing pain and disability in the elbow. No other joints appeared to be affected. A lactose-fermenting organism corresponding to B. pseudocoli (Castellani) was

isolated from the faeces and agglutinated with the patient's serum in a dilution of 1 in 640. A vaccine was made therefrom, and after two doses all pain the arm ceased. Unfortunately, the patient neglected to continue the treatment after this, so that the clinical condition of the joint has not improved.

Case 694. (April, 1922.). This was a case of membranous colitis. The patient presented the typical signs of the disease, passing mucus and a slight amount of blood in the stools, with occasionally an incomplete cast of the large bowel. At the time of the attack, acute gnawing pain over the descending colon with nausea and complete anorexia, was complained of. Bismuth carbonate relieved the pain temporarily, but cessation of the exhibition of this drug led to a recurrence of the symptoms. The history of the condition extended over some ten years, but the attacks had ceased for about twelve months prior to the one under consideration. The patient was a neurotic subject. Examination of the faeces led to the isolation of several lactose-fermenting organisms agglutinating with the patient's serum. A vaccine made from these cleared up all the symptoms of the disease immediately, and the patient has been free from all trouble up to the time of writing.

Case 711. (May, 1922.). This patient complained of pain over the right kidney, dysuria, and greatly increased frequency of micturition. The symptoms had been treated with drugs without any relief. Examination of the patient showed slight enlargement with tenderness of the right kidney. The urine was very cloudy, and culture of it resulted in a pure growth of B. coli communis, agglutinating in high dilution with the patient's serum. A vaccine was made from this and the condition was completely cured.

Case 740. (July, 1922.). This was a similar case to No. 711, except that the kidneys gave no pain, nor was tenderness found on palpitation of them. The urine contained a considerable amount of pus. From it a pure culture of B. coli communis agglutinating with the patient's serum was obtained. A vaccine made from this completely cured the complaint, and the patient's general health was very materially benefitted.

Case 774. (September, 1922.). This patient had a history extending back for some years of chronic rheumatism. The disease affected more especially the dorsal portion of the vertebral column and the sterno-chondral articulations. There was also considerable paid in the hands and a slight amount in the knees and feet, and this was at times so acute as to confine the patient to bed and to prevent sleep. Even in the comparatively quiescent intervals pain was constantly present. On examination, it was found that there was a considerable amount of emphysema of the lungs making the chest more or less barrel-shaped. The vertebral column showed a marked degree of limitation of movement in the affected region, while the junctions of the ribs with the sternum were tender on pressure. Some part of the pain complained of must, however, have been muscular in origin, as in the anterior part of the chest pain was referred to regions where it was difficult to believe that anything other than a skelatal muscle could be involved. The hands showed commencing ulnar flexion with spindle-shaped swelling of most of the phalangeal joints. Bony changes in these parts, however, could not be made out. There was a slight thickening of the periarticular tissues of the knees in the quiescent periods, but no obvious pathological change in the ankles or feet. During acute attacks the affected joints showed all the symptoms of acute rheumatism, and became hot, swollen, red and very painful. The patient had tried all manner of treatment recommended by various specialists in England, includiug Spa and drug therapy, but no relief had resulted. Culture of the blood in bouillon and in bile proved sterile. Examination of the faeces resulted in the isolation of a lactose-fermenting bacillus, agglutinating with the patient's serum in a dilution of 1 in 320. A vaccine was made from this bacillus, and its injection in a short time afforded a very considerable degree of relief. When the patient

left hospital at Christmas, the pain had almost completely disappeared and the limitation of movement and other pathological changes in the affected joints were very much improved.

Case 836. (December, 1922.). In this case, as in No. 681, a fistula-in-ano was associated with mild symptoms of rheumatism. For some considerable time the patient had had attacks of pain in various parts of the body, affecting chiefly the skeletal muscles, but so pronounced that it was sometimes impossible to play games or take exercise. At the time advice was sought there were no physical signs of disease present, other than the fistula. This was treated by operation, when a small abscess was found at its extremity, the pus from which proved to be sterile. Culture of the blood also gave a negative result, but after several investigations of the faeces, a lactose-fermenting bacillus was isolated which agglutinated with the patient's serum in a dilution of 1 in 200. A vaccine was made from this bacillus, but up to the present no report has been received from the Medical Officer in charge of the case.

Case 840. (December, 1922). This patient came complaining of rheumatism of several years standing. His main symptoms were frequently recurrent attacks of trigemnal neuralgia, sciatica and acute fleeting pains in most of the joints and muscles of the limbs. These disabilities were so great as almost to incapacitate him from work, and games, such as tennis, were out of the question during the attack. Examination of the patient in a quiescent interval showed very little pathological change. There was considerable tenderness along the course of the sciatic nerve of the right side, and flexion of the right hip joint with the knee in an extended position was impossible. The patient was unable to extend his right arm above his head. Culture of the faeces led to the isolation of lactose-fermenting organisms which agglutinated in a dilution of 1 in 150 with the patient's serum, and a vaccine was made from this. The first two doses led to some amelioration of the symptoms, but sufficient of the course of injections has not yet been completed to judge of the result.

Case 849. (December, 1922.). This was a man who was suffering from a severe attack of pleurodynia. There was also present a slight degree of sciatica. Beyond the physical signs attributable to the latter complaint, no pathological change could be observed, but the pain of the pleurodynia was so great as to prevent the patient sleeping. No drugs relieved the condition. The faeces were examined several times by the routine method described above, but only one lactose-fermenting organism agglutinating slightly at a dilution of 1 in 90 with the patient's serum, was isolated. Although the titre for this bacillus does not promise any great measure of success, a vaccine has been made up to the organism and treatment will shortly be commenced.

H.—DISCUSSION.

In last year's Annual Report in the section on these vaccines, it was surmised that in cases showing symptoms of disease which might be attributed to toxaemia, and from whose faeces an organism belonging to the coli-typhoid group could be isolated which agglutinated with the patient's serum, a vaccine prepared from this organism would usually bring about considerable improvement in, if not cure of, the disease. At the close of 1922 one is in a somewhat better position to judge whether this statement has been justified by results or not. In the first place the evidence given by agglutination tests must be considered. It is usually held that the presence of agglutinins in the blood in any quantity is the result of an attempt on the part of the body to produce immunity to the organism agglutinins, or near ally. It is recognised, however, that agglutinins for certain bacteria may be normally present in the

blood plasma of certain individuals. Are then the agglutinins for the coli-typhoid group of organisms found in the sera of the cases described above, to be taken as normal or pathological ?. In deciding this question let the results of examination of normal cases be first considered. It must be remembered in connection with this investigation that it is extremely difficult to decide whether or no an individual is "normal," for if the contention put forward in this report is correct, an infection with coli-typhoid group organisms may lead to anomalous and often extremely ill-defined symptoms. Altogether fifty-four apparently normal cases have been examined during the year, and of these, only two gave agglutination titre of 1 in 90 for organisms of the coli-typhoid group isolated from their stools. Again eight cases showing symptoms of arthritis, have been examined in the course of this investigation and in none could any organisms be isolated from faeces which would agglutinate with the patient's serum. Further observation and enquiry have led to the diagnosis of gonococcal arthritis in three of these cases, and of tubercular arthritis in a fourth. These results have been borne out by the work of Dudgeon, Wordley and Bawtree who report that in one set of sixty-six "normal" cases, five only agglutinated stock B. coli communis at a titre of 1 in 50 (Dreyer's method), while in another set of one hundred and four cases, twenty-two only gave a titre of 1 in 50 with B. coli, and two of these were later discovered to have a probable infection with that organism. Contrast this fact with what has been found in the thirty-five cases so far treated by us. The majority of these cases have shown agglutination in a serum dilution of at least 1 in 90 for organisms of the coli-typhoid group isolated from their respective faeces, while in some cases the titre has reached a height of 1 in 800, and in most has varied from 1 in 160 to 1 in 640. It is important to note also that whereas Dudgeon, Wordley and Bawtree have only tested their sera for agglutination with typical B. coli communis, an organism always present in the faeces, all our patients, except one, have in addition shown agglutination in much higher dilution for a typical organisms of the coli-typhoid group, a very significant fact taking into consideration the marked specificity of agglutinins for members of this group, and the dictum of Robertson [3] that "Aberrant types of B. colis communis are somewhat common, especially in the intestine, and there are very good grounds for believing that they are in nearly every instance in which they occur exercising a pathogenic action." Further support is lent to the theory that the presence of agglutinins in the titre demanded in our routine method, is evidence of pathological action, but cases such as Numbers 634, 711 and 740 where an organism of the coli-typhoid group isolated from the faeces and found to be agglutinable in high titre by the blood serum, was also isolated from the urine in pure culture. Cases 628 and 694 are also suggestive, in that the history, in the one case of dysentery, and in the other of colitis, indicates the route by which an infection may have occurred. Cases 609 also provides us with evidence that an organism of the coli-typhoid group which is exercising a pathogenic action, leads to the formation of agglutinins in the blood.

Experiments on pathogenicity are not yet sufficiently advanced for any conclusions to be drawn therefrom, but the evidence afforded by the therapeutic use of the vaccine must not be neglected. A record of thirty complete cases with sixteen complete recoveries and ten others showing as great improvement as the permanent pathological changes present would allow, is surely weighty evidence of the value of the vaccine, more especially when one considers that these cases came for relief only when other measures had failed.

It is unfortunate that there have not been more cases on which to test this method of treatment, but in a small community such as that in this Colony, it is not to be expected that a greater percentage of disease should

(3) Robertson. "Therapeutic Immunisation." page 143.

occur than in England. However the numbers will undoubtedly grow as time goes on, and it may be that the results of our work here will persuade other workers with more material at their disposal to test our statements. At least one can say that so far the balance of evidence accruing from our laboratory studies, and our clinical and therapeutic experience is in favour of the statement made in last year's Annual Report, that where organisms of the coli-typhoid group agglutinating with the patient's serum in high dilution, can be isolated from the faeces, a vaccine containing such organisms will probably materially benefit the disease from which the patient seeks relief.

What is the real pathology underlying the various manifestations of disease shown by our patients ? In the majority of them, one must imagine that the original lesion was one of the intestinal mucosa, which then permitted organisms from the faeces, or their toxins, to gain access to the tissues of the body. This is supported by the histories or previous dysentery or chronic constipation in most of our cases. The actual manifestation of disease for which relief is desired, is probably more the result of selective action of bacterial toxins than of invasion by bacteria themselves, though the experimental proof of this statement is being sought for at the present moment. Of one thing there can be little doubt however, that the primary lesion rarely disappears, for in most of our earlier cases, further courses of vaccine have had to be administered, and in several instances the organisms isolated for the second vaccine have proved different to those from which the first one was made, showing that fresh bacilli must have invaded the body tissues, now successfully protected against the original invaders. It would seem also that vaccine treatment must have some influence on organisms present in the intestinal canal, as in one or two cases at least, the bacteria isolated for the first vaccine had completely disappeared from the faeces when the latter were examined for the second one.

At this point the subject must be left for the present. Several lines of thought demand investigation, and it is hoped during the coming year to advance the subject by further experimental work, and to attempt to determine the underlying pathology of infection by coli-typhoid group organisms.

SECTION 6.—SOME EXPERIMENTS ON THE USE OF RAT POISONS AND POISON BAITS.

Kunhardt and Chitre in their paper "Further experiments in plague prevention carried out at Poona" (Indian Journal of Medical Research, Vol. 8, No. 3. page 466), have worked out the comparative value of various rat poisons, and determined the substances which provide the best baits. Their experiments were carried out upon Poona rats, and their conclusions therefore hold good only in so far as these animals are concerned.

It was decided that experiments should be made on similar lines in the Laboratory, Nairobi, with a view to discovering how far the conclusions of these authors apply to the rats of East Africa, in particular the common plague-carrying rat—Rattus rattus kijabius.

The main objects of the experiments were to discover :—

(1) a bait which is readily taken by the rat, and which is cheap, easy to make, and at the same time a suitable vehicle in which to administer the poison.

(2) the most effective, practical poison which rats will eat, and its minimum lethal dose.

(3) the effect of such poison on domestic animals likely to pick up poison baits containing it.

A.—GENERAL CONDITIONS UNDER WHICH THE EXPERIMENTS WERE PERFORMED.

(a) **RATS.** All rats used were caught in traps by the rat gang attached to the Nairobi Health Office. They included both males and females of various sizes. All rats were kept several days before use in order to allow of their becoming accustomed to their new surroundings.

(*b*) **CAGES.** The cages in which the actual experiments were carried out, measured eighteen inches long, twelve inches broad and ten inches high. The floor and sides consisted of galvanised iron wire, the top of galvanised iron sheeting, one half of this being hinged on the other half to act as a door. The cage rested upon a galvanised iron tray twenty-two inches long and fourteen inches broad, with a rim one inch high. The floor being of wire only, waste food, excreta, etc., could fall on the tray, so that the cage could be lifted up and the tray easily cleaned without disturbing the contained rats. Two large cages made on the same principle were used to contain a reserve stock of rats.

(*c*) **HOUSING.** A room was reserved exclusively for these experiments, the window being darkened, and the rats disturbed as little as possible. Tow was placed in the large cages, and the rats used this to make nests for themselves. The mortality among the animals other than that due to poison, was very low (less than 3 per cent.)

(*d*) **FEEDING.** Food and water were given daily. The diet was varied and included grain, meat, fish, vegetables, etc.

B.—COMPARATIVE VALUE OF SUBSTANCES USED FOR BAITS.

Preliminary tests were carried out in order to determine the number of rats which should be placed in each cage, the most suitable method of offering the bait and its size, and the period of observation required for the experiments.

It was found that, whereas an individual rat in a cage, often refused to take the baits and always ate them slowly, five rats in a cage together consumed them within a reasonably short time. This number was therefore used throughout these experiments.

In the ordinary daily feeding it was noticed that grain was preferred to meat, fish, or vegetables. This, together with the fact that it is always obtainable, indicated that some variety of grain would furnish the most suitable vehicle for poison.

Experiments showed that the bait could most conveniently be offered in the form of a dough pill, made by the addition of water to the flour of some particular grain. The more complete the grinding and sifting of the flour, the easier it was to make the pill. One pill made to contain 2·0 grammes (30 grains) of flour was found to be the most convenient in size. Smaller pills were consumed too quickly, larger ones required a prolonged period of observation before they were eaten.

The experiments to compare the value of various baits were carried out as follows:—

Batches of twenty rats were placed five in a cage, and left for twenty-four hours before commencing the test, food and water being given as usual. One hour before the experiment began, all food was removed, and the floors of the cages, and the trays cleaned. Two varieties of grain were selected for comparison. Pill baits were prepared from the dough of the selected flours and placed side by side in the cages. Each pill contained 2·0 grammes of flour, and five pills of each variety were placed in each cage. Each rat was thus able to take whichever variety it pleased. The total weight of each kind of bait offered was noted, and, after a period of twenty minutes, the remaining bait was removed and weighed, the amount of bait eaten being recorded. All quantities were made to refer to substances in the dry state. The weight of water added to make the dough was noted and in calculating the weight of bait remaining, the contained percentage of water was deducted.

Other methods of determining comparative values of foods, such as those in which baits were tabulated as wholly eaten, partly eaten, untouched, etc., were found to contain many fallacies, and were abandoned in favour of the method described.

It having been decided that dough provided the best basis for the bait, experiments were carried out to discover which of the common grains in this country was preferred by the rat. Maize, mtama and bajri were taken for comparison. Wheat, on account of its cost, was not considered a suitable vehicle for practical purposes. The results of these experiments are shown in Tables 15 and 16.

TABLE 15.

COMPARATIVE VALUE OF MAIZE AND MTAMA WHEN USED AS DOUGH BAITS.

(Each bait contained 2 grms. dry flour.)

Number of Rats used.	Maize.			Mtama.		
	Number of baits offered.	Total weight offered.	Total weight consumed.	Number of baits offered.	Total weight offered.	Total weight consumed.
20	20	40 gms.	24·4 gms.	20	40 gms.	8·1 gms.
20	20	40 ,,	26·0 ,,	20	40 ,,	6·9 ,,
20	20	40 ,,	23·1 ,,	20	40 ,,	4·6 ,,
20	20	40 ,,	31·2 ,,	20	40 ,,	9·4 ,,
20	20	40 ,,	30 8 ,,	20	40 ,,	8·2 ,,
100	100	200 gms.	125·5 gms.	100	200 gms.	37·2 gms.
	Percentage of Maize consumed = 62·75 per cent.			Percentage of Mtama consumed = 18·60 per cent.		

TABLE 16.

COMPARATIVE VALUE OF MAIZE AND BAJRI WHEN USED AS DOUGH BAITS.

(Each bait contained 2 grms. dry flour.)

Number of Rats used.	Maize.			Bajri.		
	Number of baits offered.	Total weight offered.	Total weight consumed.	Number of baits offered.	Total weight offered.	Total weight consumed.
20	20	40 grms.	23·7 grms.	20	40 grms.	19·8 grms.
20	20	40 ,,	21·4 ,,	20	40 ,,	25·0 ,,
20	20	40 ,,	36·6 ,,	20	40 ,,	24·6 ,,
20	20	40 ,,	28·0 ,,	20	40 ,,	25·4 ,,
20	20	40 ,,	26·9 ,,	20	40 ,,	16·1 ,,
100	100	200 grms.	136·6 grms.	100	200 grms.	110·9 grms.
	Percentage of Maize consumed = 68·3 per cent.			Percentage of Bajri consumed = 55·45 per cent.		

RELATIVE VALUES:—

Maize 100.
Bajri 81·2.
Mtama 29·6.

These experiments show that the rats preferred maize to either bajri or mtama, although the degree of preference is not so marked with the former as with the latter.

Maize was therefore selected as the best grain to use as a basis for baits, and further experiments were made to discover if any substance, in the form of a condiment, could improve the plain maize dough bait in regard to taste or smell. Tables 17 to 22 show the results of these experiments.

TABLE 17.

COMPARATIVE VALUE OF MAIZE BAITS CONTAINING 10 PER CENT. JAGOREE AND PLAIN MAIZE BAITS.

Number of Rats used.	Maize containing Jagoree 10 per cent.			Plain Maize.		
	Number of baits offered.	Total weight offered.	Total weight consumed.	Number of baits offered.	Total weight offered.	Total weight consumed.
20	20	40 grms.	11·6 grms.	20	40 grms.	36·4 grms.
20	20	40 ,,	16·5 ,,	20	40 ,,	38·1 ,,
20	20	40 ,,	11·1 ,,	20	40 ,,	35·0 ,,
20	20	40 ,,	10·4 ,,	20	40 ,,	28·3 ,,
20	20	40 ,,	10·2 ,,	20	40 ,,	31·5 ,,
100	100	200 grms.	59·8 grms.	100	200 grms.	169·3 grms.
	Percentage of Maize with 10 per cent. Jagoree consumed = 29·9 per cent.			Percentage of plain Maize consumed = 84·65 per cent.		

TABLE 18.

COMPARATIVE VALUE OF MAIZE BAITS CONTAINING 10 PER CENT. GHEE AND PLAIN MAIZE BAITS.

Number of Rats used.	Maize containing 10 per cent. Ghee.			Plain Maize.		
	Number of baits offered.	Total weight offered.	Total weight consumed.	Number of baits offered.	Total weight offered.	Total weight consumed.
20	20	40 gms.	4·5 gms.	20	40 gms.	28·8 gms.
20	20	40 „	3·3 „	20	40 „	33·2 „
20	20	40 „	7·6 „	20	40 „	27·2 „
20	20	40 „	8·4 „	20	40 „	26·9 „
20	20	40 „	4·6 „	20	40 „	29·5 „
100	100	200 gms.	28·4 gms.	100	200 gms.	145·6 gms.
	Percentage of Maize with 10 per cent. Ghee consumed = 14·2 per cent.			Percentage of plain Maize consumed = 72·8 per cent.		

TABLE 19.

COMPARATIVE VALUE OF MAIZE BAITS CONTAINING 2 PER CENT. GHEE AND PLAIN MAIZE BAITS.

Number of Rats used.	Maize containing 2 per cent. Ghee.			Plain Maize.		
	Number of baits offered.	Total weight offered.	Total weight consumed.	Number of baits offered.	Total weight offered.	Total weight consumed.
20	20	40 gms.	9·1 gms.	20	40 gms.	34·7 gms.
20	20	40 „	12·5 „	20	40 „	26·3 „
20	20	40 „	16·1 „	20	40 „	30·8 „
20	20	40 „	10·6 „	20	40 „	26·7 „
20	20	40 „	12·2 „	20	40 „	22·1 „
100	100	200 gms.	60·5 gms.	100	200 gms.	140·6 gms.
	Percentage of Maize with 2 per cent. Ghee consumed = 30·25 per cent.			Percentage of plain Maize consumed = 70·3 per cent.		

TABLE 20.

COMPARATIVE VALUE OF MAIZE BAITS CONTAINING 10 PER CENT. CHEESE AND PLAIN MAIZE BAITS.

Number of Rats issued.	Maize with 10 per cent. Cheese.			Plain Maize.		
	Number of baits offered.	Total weight offered.	Total weight consumed.	Number of baits offered.	Total weight offered.	Total weight consumed.
100	100	200 gms.	104·4 gms.	100	200 gms.	156·6 gms.
	Percentage of Maize with 10 per cent. Cheese consumed = 52·2 per cent.			Percentage of plain Maize consumed = 78·3 per cent.		

TABLE 21.

COMPARATIVE VALUE OF MAIZE BAITS, MADE UP WITH WATER IN WHICH FISH HAD BEEN BOILED, AND PLAIN MAIZE BAITS.

Number of Rats used.	Maize with Fish Water.			Plain Maize.		
	Number of baits offered.	Total weight offered.	Total weight consumed.	Number of baits offered.	Total weight offered.	Total weight consumed.
100	100	200 gms.	95·5 gms.	100	200 gms.	162·4 gms.
	Percentage of Maize with Fish Water consumed = 48·25 per cent.			Percentage of plain Maize consumed = 81·2 per cent.		

TABLE 22.

COMPARATIVE VALUE OF MAIZE BAITS, CONTAINING 2·5 PER CENT. OF A SOLUTION OF EQUAL PARTS OF OX BILE AND AMBER OIL, AND PLAIN MAIZE BAITS.

Number of Rats used.	Maize with Ox Bile and Amber Oil.			Plain Maize.		
	Number of baits offered.	Total weight offered.	Total weight consumed.	Number of baits offered.	Total weight offered.	Total weight consumed.
100	100	200 gms.	30·9 gms.	100	200 gms.	180·3 gms.
	Percentage of Maize with Ox Bile and Amber Oil consumed = 15·45 per cent.			Percentage of plain Maize consumed = 90·15 per cent.		

It will be seen that the addition of jagoree, ghee and the other condiments used, not only failed to increase the value of maize dough as a bait, but definitely served to render it less attractive. Hence it was concluded that plain maize-flour is the best bait to use, provided that the added poison does not of itself markedly detract from its value, a factor investigated later in these experiments.

C. DETERMINATION OF THE MINIMUM LETHAL DOSE OF VARIOUS POISONS.

In these experiments individual rats were placed in the cages. The poison was mixed with 1·0 gramme (15 grains) of maize flour, and the whole made into a dough pill. Thus the latter was approximately half the size of those used in the previous feeding experiments. It was found advantageous to make the pill as small as possible (provided that there was sufficient bait substance to mask the taste of the poison), as the rats then ate more readily the whole bait and thus took the full dose of poison offered. Each bait and dose of poison were weighed separately in order to ensure accuracy.

As in the previous experiments all food was removed one hour before the poison baits were offered, but after the latter had been consumed, food and water were given in order to reproduce natural conditions as far as possible, as it was presumed that the recently poisoned rat in the wild state had access to both. The period intervening between the consumption of the poison and the occurrence of death, was noted in each case.

Rats of every size were used, and in all experiments controls in separate cages were fed on baits without poison in order that any mortality among them due to any other cause than poison, would be noticed.

It was observed that there was no direct relation between the size of the rat, the time taken to kill, or the dose required to bring about death. In many cases the first rats to die were the large ones, and with the smaller doses of poison, large animals frequently died where small ones survived.

(*a*) *Barium Carbonate.*—Both crude and pure barium carbonate were used. There appeared to be no appreciable difference in the toxicity of the two forms, but this is not surprising as chemical analysis showed the crude salt to contain 95·28 per cent. of pure barium carbonate.

The time required for any given dose of the poison to kill, varied within wide limits, even in the case of rats of the same size. The symptoms of poisoning observed were thirst, lassitude, diarrhœa, increased frequency of respiration, and paralysis, which began in the hind legs and spread throughout the body, finally resulting in death when the respiratory muscles became involved. No difficulty was experienced in getting the rats to eat the baits.

TABLE 23.

RESULTS OF VARIOUS DOSES OF BARIUM CARBONATE GIVEN IN 1.0 GM. MAIZE DOUGH BAITS.

Dose of Barium Carbonate.	Number of Rats used.	Number of Rats which died.	Percentage of deaths.	Minimum time in which death took place.	Maximum time in which death took place.
½ grain	10	4	40 %	4 hours	30 hours
1 „	20	17	85 %	2½ „	36 „
1½ „	100	100	100 %	2 „	30 „
2 „	10	10	100 %	2 „	24 „

One and a half grains of crude barium carbonate would thus appear to be sufficient to kill the Rattus rattus kijabius, as met with in Nairobi district, within thirty hours.

(*b*) *Common Sense Rat Exterminator.*—This is a patent preparation of the phosphorus paste type. It has a very strong pungent smell, and is luminous in the dark. Unless disguised, it was not readily taken by rats and it was difficult to mix homogeneously into a pill bait.

TABLE 24.

RESULT OF VARIOUS DOSES OF COMMON SENSE RAT EXTERMINATOR.

Dose of Poison.	Number of Rats used.	Number of Rats dying.	Percentage of deaths.	Minimum time in which death took place.	Maximum time in which death took place.
½ grain	10	1	10 %	24 hours	24 hours
1 „	10	4	40 %	18 „	48 „
2 „	10	7	70 %	18 „	36 „
3 „	20	20	100 %	12 „	36 „

The minimum lethal dose of this poison was thus three grains.

(*c*) *Squill Powder.*—This drug was tried in doses varying from 2·0 to 7·5 grains. Small doses had no toxic effect, while five grains killed less than 25 per cent. of the rats and it was only with difficulty that the rodents could be made to eat the poisoned dough. When the amount was increased to 7·5 grains, baits remained in the cages for more than twenty-four hours, in spite of the fact that food was withheld.

(*d*) *Ratinol.*—A bottle of this poison was supplied for laboratory use by the courtesy of the Chief Sanitation Officer. It is difficult to get rats to take this poison in maize or bread baits, unless it is in very small amount, and it is left alone when other food is available.

TABLE 25.

RESULT OF VARIOUS DOSES OF RATINOL GIVEN IN 1.0 G.M. MAIZE DOUGH BAITS.

Dose of Poison in drops.	Number of Rats used.	Number of Rats dying.	Percentage of deaths.	Minimum time in which death took place.	Maximum time in which death took place.
5	5	0	0 %	...	...
10	5	2	40 %	22 hours	22 hours
15	5	2	40 %	20 ,,	48 ,,
20	5	1*	20 %	24 ,,	24 ,,
30	8†	5	62·5 %	20 ,,	48 ,,

* Only the rat which died, ate the whole of the bait.

† These rats were kept together in one cage, so that their natural voracity might be stimulated by selfishness and jealousy. The whole of the baits were eaten, but it is possible that the rodents which survived, did not get their fair share of the bait. When they were placed in separate cages, it was practically impossible to get them to consume baits containing thirty drops of Ratinol.

From these experiments we may conclude that the minimum lethal dose of Ratinol is at least twenty drops, and more probably thirty, and that this quantity is very difficult to diguise in a bait sufficiently well for a rat to consume a lethal dose.

D. THE EFFECT OF VARIOUS POISONS ON THE PALATABILITY OF MAIZE DOUGH BAITS.

These experiments aimed at deciding the relative values as regards attractiveness of baits containing barium carbonate and those incorporating Common Sense Rat Exterminator, and further to compare these baits with others of plain maize dough. These tests were carried out in the manner described in subsection B except that the pill bait weighed 1·0 gramme only.

TABLE 26.

COMPARISON BETWEEN MAIZE BAITS CONTAINING 1·5 GRAINS OF BARIUM CARBONATE, AND MAIZE BAITS CONTAINING 3·0 GRAINS OF COMMON SENSE RAT EXTERMINATOR.

	Baits containing Barium Carbonate.			Baits containing Rat Exterminator.		
Number of Rats used.	Number of baits offered.	Total weight offered.	Total weight consumed.	Number of baits offered.	Total weight offered.	Total weight consumed.
50	50	50 gms.	37·6 gms.	50	50 gms.	5·6 gms.
	Percentage of Barium Carbonate bait consumed = 75·2 %.			Percentage of Rat Exterminator bait consumed = 11·2 %.		

TABLE 27.

COMPARISON BETWEEN BARIUM CARBONATE BAITS AND PLAIN MAIZE BAITS.

Number of Rats used.	Barium Carbonate Baits.			Plain Maize Baits.		
	Number of baits offered.	Total weight offered.	Total weight consumed.	Number of baits offered.	Total weight offered.	Total weight consumed.
50	50	50 gms.	42·4 gms.	50	50 gms.	43·2 gms.
	Percentage of Barium Carbonate baits consumed = 84·8 %.			Percentage of Maize baits consumed = 86·4 %.		

Thus baits containing barium carbonate were much more readily eaten than those incorporating Common Sense Rat Exterminator. Further, the addition of barium carbonate to maize does not appreciably lower the value of the latter as a bait, the poisoned dough being almost as readily taken as unpoisoned.

E.—EFFECT OF VARIOUS POISONS ON DOMESTIC ANIMALS.

Inasmuch as the only poisons examined which appeared to be both practical and effective for rats, were Barium Carbonate and Ratinol, these were the only ones tested on domestic animals. Dogs were obtained from the Nairobi Municipality, cats were supplied by the courtesy of the Chief Sanitation Officer, and chickens were purchased locally.

(a) *Ratinol.*

Thirty drops and sixty drops of Ratinol were poured down the throats of two fowls. No ill effects were seen.

(b) *Barium Carbonate.*

(1) *Effect on Dogs.*

Dog A. (Weighed 29 lbs.) He was given 25 grains of barium carbonate in milk. He vomited an hour later, and then had slight diarrhœa. He had completely recovered in twenty-four hours.

Dog B. (Weighed 25½ lbs.) He was given 50 grains of barium carbonate in milk on an empty stomach. He vomited within half an hour, and later suffered from diarrhœa. Within seven hours he was dead.

Dog C. (Weighed 27 lbs.) He was given a 100 grains of barium carbonate in milk. He vomited within two hours and then was seized with diarrhœa. In seven hours he was very ill, being completely paralysed, and died at the end of twelve hours.

Dog D. (Weighed 30 lbs.) He was given 150 grains of barium carbonate in milk, and vomited in half an hour. Ten hours later he was still unwell, but managed to escape during the night, and although search was made in the neighbourhood of the Laboratory, no dead dog was found.

(2) *Effect on Cats.*

Cats A and B. (Weighed ¾ lb. each.) They were given 0·5 grain of barium carbonate in milk. Both remained quite well.

Cat C. (Weighed ¾ lb.) She was given 5 grains of barium carbonate in milk, but only took less than half (equivalent approximately to 2 grains of barium carbonate). She died within five hours.

Cat D. (Weighed ⅞ lb.) She was given 5 grains of barium carbonate in milk. She did not vomit, and died three hours later.

Cat E. (Weighed 4 lbs.) She was given 2 grains of barium carbonate in milk. She was quite well within an hour, though somewhat indisposed soon after the meal.

Cat F. (Weighed 4 lbs.) She was given five grains of barium carbonate in milk. She vomited after a few hours, but remained otherwise quite well.

Cat G. (Weighed 4 lbs.) She was given 10 grains of barium carbonate in milk. She vomited an hour and a half after the meal, and died at the end of three and a half hours.

A shortage of cats prevented any further experiments being made.

(3) *Effect on Fowls.*

The fowls used were all full-grown birds of approximately the same weight.

Fowl A. Was given 1 grain of barium carbonate in a pill of maize flour. No ill effects were noted.

Fowl B. Was given 2 grains of barium carbonate in a pill of maize flour, and remained quite well.

Fowl C. Was given 3 grains of barium carbonate in a bait composed of maize flour, and suffered no ill effects.

Fowls D and E. Were each given 6 grains of barium carbonate in maize flour pills. Both became very ill with diarrhœa, but recovered within forty-eight hours.

Fowl F. Was given 7·5 grains of barium carbonate in a maize flour bait. It became very ill, but eventually recovered.

Fowl G. Was given 8 grains of barium carbonate in a maize flour pill. It became very ill, and had severe diarrhœa. After twenty-four hours it could no longer move about, and died within thirty-six hours.

Fowl H. Was given 10 grains of barium carbonate in a maize flour pill. In a few hours it had acute diarrhœa and after twenty hours the bird was completely paralysed. Death took place in forty-eight hours.

From these experiments one may conclude that :—

1. Ratinol is harmless to fowls in doses up to 60 drops.

2. Barium carbonate is lethal to dogs, the minimum lethal dose being 2 grains per pound of body weight.

3. The minimum lethal dose of barium carbonate for cats is between 1 and 2 grains per pound of body weight.

4. The minimum lethal dose of barium carbonate for full grown fowls of average size is about 8 grains.

It will thus be seen that barium carbonate is not so harmless to domestic animals as has been stated, and this is particularly true of small dogs which, more greedy than cats, may easily swallow enough of the ordinary poison baits containing 1½ to 3 grains of barium carbonate to obtain the lethal dose.

F.—SUMMARY OF RESULTS OF EXPERIMENTS ON RAT POISONS.

1. Maize flour forms a more attractive basis for rat poison baits than either bajri or mtama.

2. The attractiveness of a bait made of maize flour is not increased by the addition of jagoree, ghee, cheese, water in which fish has been boiled, or a mixture of equal parts of ox bile and amber oil.

3. Barium carbonate (crude) will kill Rattus rattus kijabius in 1½ grain doses in thirty hours.

4. The minimum lethal dose for rats of Common Sense Rat Exterminator is 3 grains.

5. Squill and Ratinol are too distasteful to rats to be taken in lethal doses.

6. Maize flour baits containing barium carbonate are only slightly less attractive to rats than plain maize flour, whereas those containing Common Sense Rat Exterminator are very much more distasteful.

7. Ratinol is harmless to fowls in doses of 60 drops.

8. The minimum lethal dose of barium carbonate for dogs is probably 2 grains per pound of body weight, for cats between 1 and 2 grains per pound of body weight, and for full grown fowls of average weight about 8 grains.

G.—ADDENDUM TO THE REPORT ON RAT POISONS.

After the completion of the work on rat poisons, the Chief Sanitation Officer asked us to make some experiments as to the attractiveness of cotton seed for rats as compared with maize. As the experiments were conducted on the same lines as those in Sub-section B of the Rat Poison Report, it has been thought best to include these later experiments in an addendum.

Experiments 1 *and* 2.

Two groups, A and B, each consisting of three rats were used for these experiments. In experiment 1 Lot A was given three ounces of crushed maize, and Lot B three ounces of cotton seed. In experiment 2, the food was reversed. The following table shows the results.

TABLE 28.

Group of Rats.	Amount of Food eaten in Experiment 1.		Amount of Food eaten in Experiment 2.	
	Maize.	Cotton Seed.	Maize.	Cotton Seed.
Group A	1·4 oz.	—	—	0·3 oz.
,, B	—	0·2 oz.	2·5 oz.	—

It was noted that the rats began to feed on the maize soon after its introduction into the cage, whereas the cotton seed was left until the rats became very hungry.

EXPERIMENT 3. In this experiment eight rats in a single cage were used. They were deprived of all food an hour before the test commenced. Two ounces of crushed maize and two ounces of cotton seed were then placed in the cage, and water was supplied as usual. After twenty-four hours, the food remaining was collected and weighed, when it was found that 1·75 ounces of maize had been eaten, but only 0·5 ounce of cotton seed.

EXPERIMENT 4. This was a repetition of Experiment 3, using, however, sixteen rats, and giving them four ounces of crushed maize and four ounces of cotton seed. In twenty-four hours, 3·0 ounces of the maize had been eaten, but only 1·1 ounces of the cotton seed. The same delay in eating the cotton seed, as noted in Experiment 3, was observed.

We therefore conclude that when rats have access to maize as well as cotton seed, the former will be their chief food supply.

In closing this report of experiments on rat poisons, tribute must be paid to Dr. Hunter, who so ably planned and executed the experiments detailed in subsections A to D, and to Assistant Surgeon Nair who assisted Dr. Hunter in the earlier experiments, and carried out under supervision those detailed in the later sections.

SECTION 7. RAT VIRUSES. Dr. P. H. Ross, formerly Director of Laboratories in this Colony, found that rat viruses imported from England for the purpose of destroying rats, apparently lost all virulence in transit, so that they became non-pathogenic for the animals they were intended to kill. During this year two dealers in Nairobi imported varieties of rat virus and advertised them for the eradication of rats. At the request of the Chief Sanitation Officer, these viruses were examined, with results entirely confirming Dr. Ross's statement.

A.—LIVERPOOL VIRUS. The first specimen tested was a sample of Liverpool Virus. This was supplied in two forms, namely, firstly in a tin containing the virus incorporated in a meat bait, and secondly as a liquid in a bottle for application to bread or other baits. The first experiment was made with the tin of virus. The contents were given to twenty-three healthy rats, no other food being supplied at the same time. All the bait was eaten. These rats were observed over a period of one month. None died, or showed any signs of illness.

The second experiment was carried out with the liquid Liverpool Virus. Prior to its application to baits, cultures were made from it, and a bacillus was isolated. This subculture proved that the virus was still variable, and was used in a fourth experiment detailed later. In the second test, a bait of maize flour, mixed into a paste with the liquid virus, was given to each of eight rats, the amount administered per head being 0·2 c.c. The whole bait was eaten in each case. No rat showed any sign of illness, although the period of observation was extended for three weeks.

The third experiment was also made with the liquid used in the second test. 0·5 c.c. of this culture was injected intraperitoneally into a healthy rat. No signs of illness were observed, other than slight malaise the day after the injection.

The fourth experiment was carried out in the same way as the third, but using 0.5 c.c. of a thick saline emulsion of an agar slope subculture in place of the 0·5 c.c. of liquid virus. The rat used for this test showed slight evidence of illness on the day following the injection. It was killed forty-eight hours after the inoculation, but no signs of gastro-intestinal irritation was seen, and the peritoneal fluid and the abdominal organs were sterile.

B.—DANYSZ VIRUS. The second specimen tested was one of Danysz Virus. This consisted of a slope culture of an organism on a solid medium. A subculture was made from one of the tubes and an organism grown, so that the virus was shown to be variable.

In the first experiment, three tubes of the virus, made up according to directions with eight ounces of bread, were given to eighteen rats in a large cage. All other food was witheld until the whole of the bait was eaten, which event took place within ten minutes. Food and water were then given as usual. One rat died on the eighth day and was partially eaten by the other rats, and another rat died on the seventeenth day. No evidence of disease was found post-mortem, and no bacillus was recovered from the abdominal organs, so that it is doubtful if the deaths could be attributed to the virus. The other rats all remained quite healthy up to the close of the period of observation of four weeks.

In the second experiment the same amount of virus was made up into baits with eight ounces of maize flour. These baits were given to twenty rats in one large cage, and all were eaten within fifteen minutes. Three rats died during the first week, but showed no evidence of gastro-intestinal irritation post-mortem, nor were any organisms recovered from the abdominal organs. Two other rats died during the third week of the experiment, none of them showing any evidence of death from scepticaemia. The surviving rats remained quite healthy till the close of the four weeks during which they were kept under observation.

From the results of these experiments, and in view of the fact that cases of human disease have been attributed to the indiscriminate use of such viruses, it was suggested to the Chief Sanitation Officer that it would be advisable to prohibit their import. The question of the value of rat viruses would seem to be a moot one, even when they are effective, for plague, which is probably one of the most fatal of rat diseases, does not seem to reduce permanently the rat population of the country.

SECTION 8.—EXPERIMENTS ON THE USE OF FUMIGATION IN A CAMPAIGN AGAINST RATS.

The matter on which a decision was required, arose in the course of anti-plague measures which necessitated the freeing from rats and their fleas, of a large quantity of flax tow stored in a grass-thatched barn. It was desirable that the tow should be de-ratted *in situ*, a condition necessitating the use of some gaseous poison, and the difficulties in the way of this, which faced the Officer controlling the operations, lay in two directions. Firstly, he must use some chemical which would not harm the tow, and secondly he must apply his measures in a building which, owing to the numerous cracks and crannies communicating with the outside air, existent in the wall, was very unsuited to measures involving fumigation. It was originally intended to use sulphur dioxide from a Clayton apparatus, but it was objected that it might alter the colour or quality of the tow, and so reduce its commercial value. Formaldehyde vapour was then suggested, but a question was raised as to whether it would be equally efficacious for rats and fleas. The matter was referred to the Laboratory for a decision.

Two experiments were carried out in a chamber having a cubic capacity of 780 cubic feet. This room was in a wood and iron building, and had numerous small apertures communicating with the external air or other rooms, or with the space intervening between the roof and the ceiling. The largest openings were plastered up with paper, but sufficient crannies were left to reproduce, more or less adequately, the conditions pertaining in the barn, in connection with which the problem first arose.

The chamber was denuded of furniture, and in the centre was placed a large cage containing thirty rats, which was surrounded by a wide strip of tanglefoot to prevent the escape of fleas. The rats were fed and watered as usual. In the evening, eight ounces of finely ground potassium permanganate and sixteen ounces of commercial formalin were thoroughly mixed in a bucket in the room, the door closed and sealed, and the rats exposed to the action of the formaldehyde gas for a period of eighteen hours, when the room was opened again. No rats or fleas were found dead, nor was there any evidence that the rodents had been incommoded in any way by the formaldehyde.

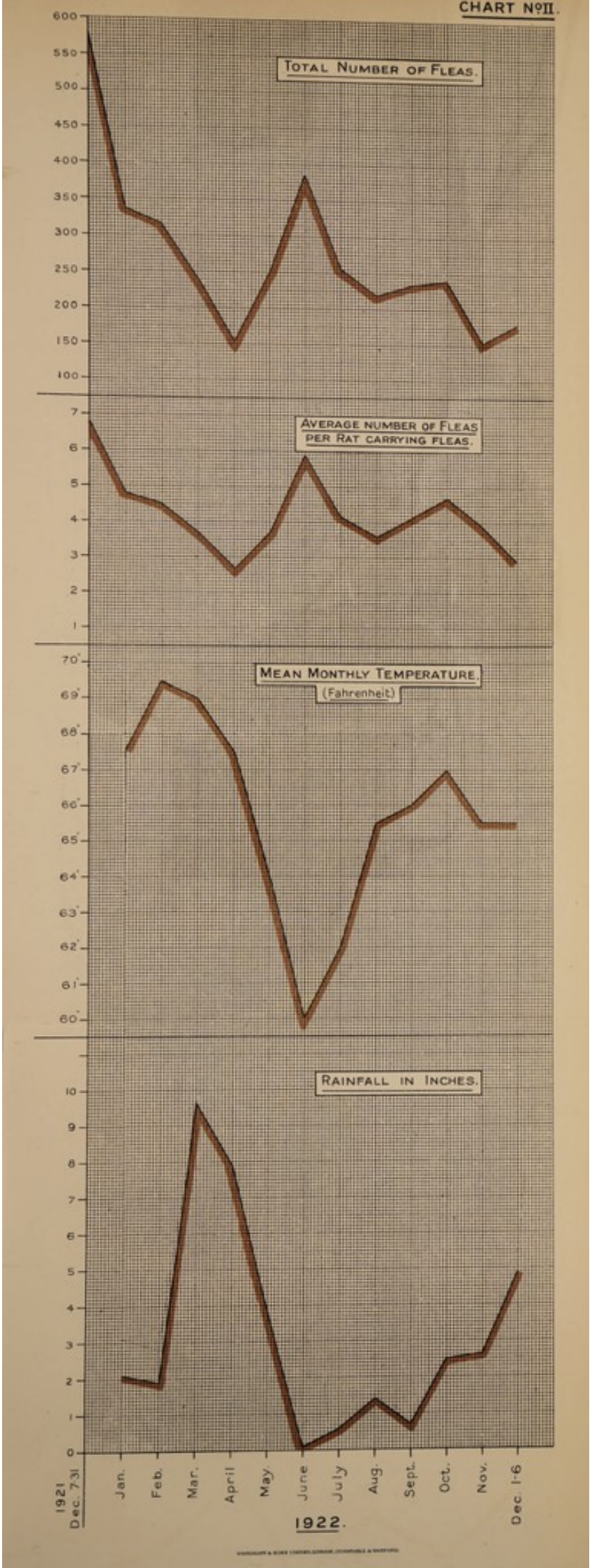
The second experiment was a repetition of the first, save that two pounds of burning sulphur replaced the permanganate and formalin. At the close of the period of eighteen hours, all the rats and the fleas they harboured, were dead.

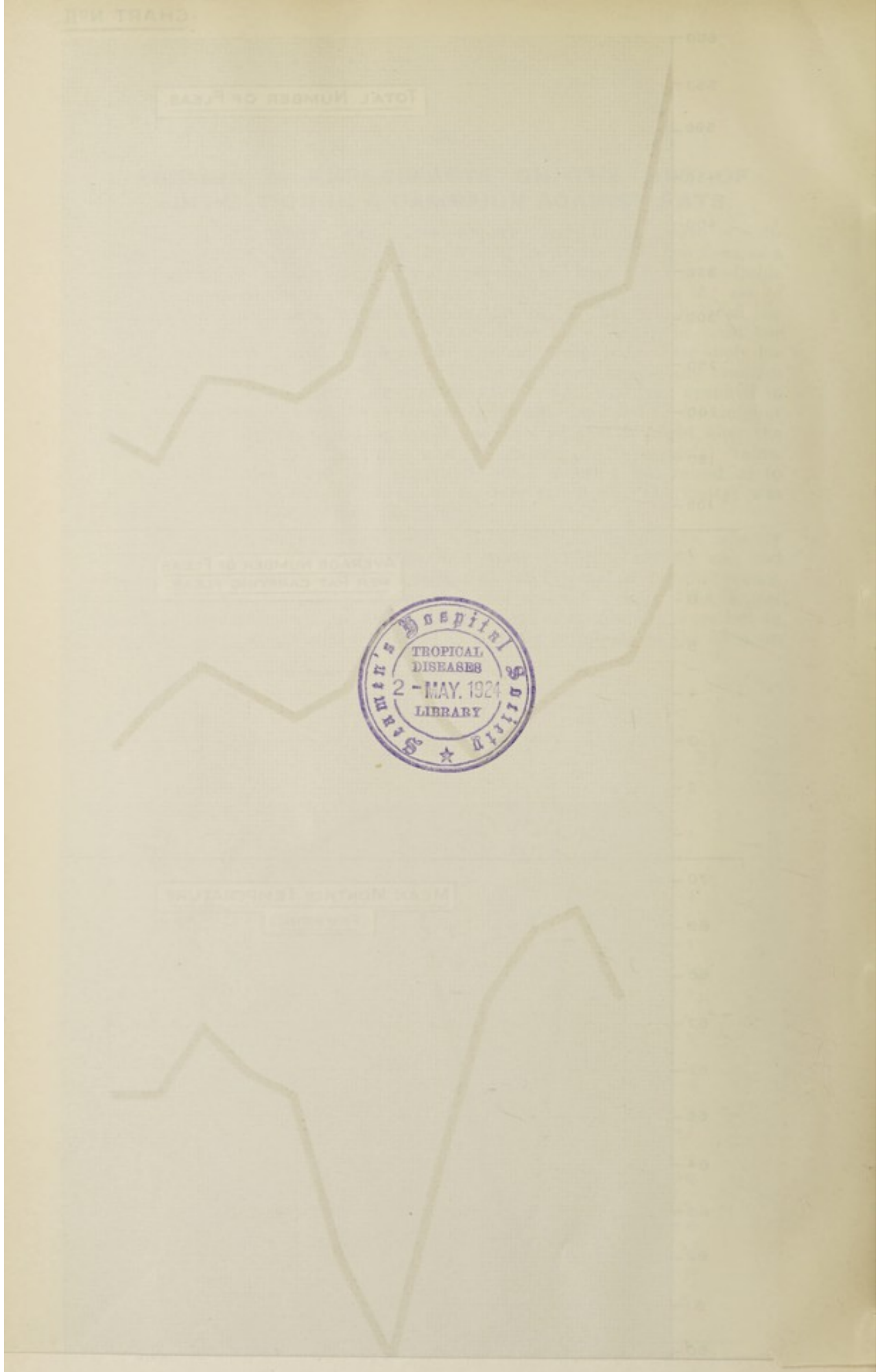
These experiments demonstrate the relative inefficiency of formaldehyde in the strength used as compared wtth sulphur dioxide. As it was improbable that in the interstices of the tow, a concentration of formalin vapour could be obtained approaching that used in the experiment, it was advised that sulphur dioxide should be relied on rather than formaldehyde for the elimination of the rats and their fleas, but that enquiries should be made from the Chemical Research Department as to the action of the former gas on the material requiring fumigation.

SECTION 9.—RAT FLEAS.

In December, 1921, it was decided to determine the flea index for Nairobi rats throughout the year. The work was commenced on December 7th, 1921, when Mr. Anderson, Entomologist to the Agricultural Department, instructed Assistant Surgeon Nair and an African assistant in the method of mounting fleas for identification purposes. It was arranged that three rats should be taken daily from those trapped in Nairobi the previous night, killed and examined for fleas. To collect these ectoparisites, each rat was taken separately and placed in a linen bag, which was put into a metal box. Some chloroform was then poured into the latter, which was closed and kept so for

CHART No II.


TOTAL NUMBER OF FLEAS.
600
550
500
450
400
350
300
250
200
150
100
AVERAGE NUMBER OF FLEAS PER RAT CARRYING FLEAS.
7
6
5
4
3
2
1
MEAN MONTHLY TEMPERATURE. (Fahrenheit)
70°
69°
68°
67°
66°
65°
64°
63°
62°
61°
60°
RAINFALL IN INCHES.
10
9
8
7
6
5
4
3
2
1
0
1921 Dec. 31
Jan.
Feb.
Mar.
April
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec. 1-6
1922.



twenty minutes. At the end of this time, the bag was taken out, the dead rat removed and placed on a large glass plate, and the bag turned inside out and searched for fleas. When these were all collected, the rat's fur was combed through with a fine-toothed comb, and any fleas removed in this way were added to those found in the bag. The parasites were dehydrated and cleared and those from each rat were mounted together on a single slide, so that there was one of these for each rat. The slides were then examined by Mr. Anderson, who identified the fleas and drew up Table 29. It will be seen that 3,105 fleas were taken from a total of 1,146 rats, giving an average of 2·7 fleas per rat. X. sheopis numbered 1,862, X. brasilensis 974, and other varieties of fleas 269.

TABLE 29.

FLEAS ON RATS TRAPPED IN NAIROBI, 1922.

Month.	Number of rats.	Without fleas.	Xenopsylla cheopis.		Xenopsylla brasiliensis.		Others.
			Males.	Females.	Males.	Females.	
December 7–31, 1921 ...	76	11	133	133	64	85	25
January, 1922	95	28	65	67	78	70	45
February, ,, ...	73	21	58	38	61	59	23
March, ,, ...	99	35	56	49	63	42	31
April, ,, ...	95	40	36	62	28	16	5
May, ,, ...	88	29	49	89	38	31	9
June, ,, ...	92	32	92	92	65	41	63
July, ,, ...	99	39	91	88	37	30	2
August, ,, ...	105	42	84	87	17	17	19
September, ,, ...	104	44	81	100	25	20	19
October, ,, ...	98	49	85	75	30	21	23
November, ,, ...	104	63	61	64	17	13	5
December 1–6, 1922... ...	20	8	13	14	2	5	0
Total	1,146	441	904	958	525	449	269

From this table another (Table 30) has been prepared in which the figures are shown as they would have been proportionately, had one hundred rats been examined each month in Nairobi. The rainfall and the mean monthly temperature have also been recorded, and are plotted out in Chart No. 2.

TABLE 30.

FLEAS ON RATS TRAPPED IN NAIROBI, 1922.

(Calculated on a basis of 100 rats caught per month.)

Month.	Rats without fleas.	Xenopsylla cheopis.		Xenopsylla brasiliensis.		Other fleas.	Average fleas per rat carrying them.	Mean monthly temperature.	Rainfall, inches.
		Males.	Females.	Males.	Females.				
December 7–31, 1921	14·5	175·0	175·0	84·2	111·8	32·9	6·77	...	...
January, 1922 ...	29·5	68·4	70·5	82·1	73·7	47·4	4·85	67·5 F.	2·08
February, ,, ...	28·8	79·5	52·1	83·6	80·8	31·5	4·60	69·5 F.	1·81
March, ,, ...	35·4	56·6	49·5	63·6	42·4	31·3	3·77	69·0 F.	9·72
April, ,, ...	42·1	37·9	65·3	29·5	16·8	5·3	2·67	67·5 F.	7·88
May, ,, ...	32·9	55·7	101·1	43·2	35·2	10·2	3·66	64·0 F.	5·92
June, ,, ...	34·8	100·0	100·0	70·7	44·6	68·5	5·89	60·0 F.	0.06
July, ,, ...	39·4	91·9	88·9	37·4	30·3	2·0	4·13	62·0 F.	0·61
August, ,, ...	40·0	80·0	82·9	16·2	16·2	18·1	3·56	65·5 F.	1·46
September, ,, ...	42·3	77·9	96·2	24·0	19·2	18·3	4·08	66·0 F.	0·68
October, ,, ...	50·0	86·7	76·5	30·6	21·4	23·5	4·77	67·0 F.	2·50
November, ,, ...	60·6	58·7	61·5	16·3	12·5	4·8	3·90	65·5 F.	2·57
December 1–6, 1922...	40·0	65·0	70·0	10·0	25·0	0·0	2·83	65·5 F.	4·99

No great deductions can be made from the figures or the chart, the only significant fact being the occurrence of flea minima in April and November, which were wet months in Nairobi, and of flea maxima in January and June, which were dry.

In conclusion we must express our great indebtedness to Mr. Anderson for all the work he has done in connection with the examination of these fleas.

SECTION 10.—EXPERIMENTS ON THE COMPLEMENT CONTENT OF THE BLOOD OF GUINEA-PIGS.

"The Journal of Immunology," Vol. VII., No. 5, 1922, contained a paper by L. F. Morrison on "The Origin and Nature of Alexin in Guinea-pig Blood." This article showed, as the result of the experiment, that "there is a gross initial difference between the alexin content of the clotted blood serum, and the defibrinated blood serum—the former giving a titre of 1 to 10, and the latter a titre of 1 to 64. Following the respective curves one finds that the clotted blood serum rapidly increases in alexin content for the first twenty-four hours, and then decreases, at first rapidly, and then less so as time goes on, until at the end of one hundred and forty hours it ceases to be demonstrable. The defibrinated blood serum retains its potency for the first six hours, and then rapidly decreases."

Further on in the article it is stated that—"Several repetitions of the above experiment were performed and in no case were gross deviations from the incorporated curves encountered. In a number of instances the titre of the defibrinated blood sera was found to be much higher—in a few instances giving a titre of 1 in 80—and often the initial titre of the clotted blood serum was as low as 1 to 2." In these experiments the blood from at least four guinea-pigs was pooled.

Experiments were made in this Laboratory on somewhat similar lines, the differences being that the blood, except in one experiment, was taken from one guinea-pig only; and that secondly, titrations were made once only in each experiment, namely, two hours after the blood was drawn, the idea being rather to compare the initial titres than to ascertain the actual duration of potency.

The blood was obtained for three of the experiments by heart puncture and for the fourth by killing and bleeding the guinea-pig. The animals used were young and fully grown.

As soon as the blood was drawn, it was divided into two equal parts; one part was defibrinated by agitation, after which it was centrifuged in an electric centrifuge at 2,000 revolutions per minute; the second part was left to clot, and the serum allowed to remain in contact with the fibrin and cells.

The technique employed in all the titrations was that given in the Medical Research Committee's "Special Report Series, No. 14"—"The Wassermann Test," page 39, the complement being titrated alone, and also in the presence of antigen. The M. H. D. of the hæmolytic serum used was 1 in 1,000. The antigen used was prepared according to the directions given by Dreyer and Ward in their description of the Sigma test. The readings were taken in each case at the end of half an hour in the water bath.

SYMBOLS USED IN THE TABLES.

+ + + +	=	Complete hæmolysis.
+ + +	=	Almost complete hæmolysis.
+ +	=	Partial hæmolysis.
+	=	Very slight hæmolysis.
o	=	No hæmolysis.

Titration No. 1.—The blood used was withdrawn by heart puncture from two guinea-pigs at 7.30 a.m., and pooled.

RESULTS OF TITRATION No. 1.

Dilutions of Complement.	Clotted Complement.		Defibrinated Complement.	
	Saline row	Antigen row.	Saline row.	Antigen row.
1 in 20	+ + + +	+ + + +	+ + + +	+ + + +
1 in 25	+ + + +	+ + +	+ + + +	+ + +
1 in 30	+ + +	+ +	+ + +	+ + +
1 in 35	+ + +	+ + +	+ + +	+ +
1 in 40	+ +	o	+ + +	+ +
1 in 45	...	...	+ +	+
1 in 50	...	...	+ +	o
1 in 55	...	...	+	o

Titration No. 2.—The blood used was withdrawn by heart puncture from one guinea-pig.

RESULT OF TITRATION No. 2.

Dilutions of Complement.	Clotted Complement.		Defibrinated Complement.	
	Saline row.	Antigen row.	Saline row.	Antigen row.
1 in 20	+ + + +	+ + + +	+ + + +	+ + + +
1 in 25	+ + + +	+ + +	+ + + +	+ + +
1 in 30	+ + + +	+ + +	+ + +	+ +
1 in 35	+ + +	+ +	+ +	o
1 in 40	+ +	+	+	o
1 in 45	o	o	o	o
1 in 50	...	...	o	o

Titration No. 3.—The guinea-pig was killed and bled.

RESULT OF TITRATION No. 3.

Dilutions of Complement.	Clotted Serum.		Defibrinated Serum.	
	Saline row.	Antigen row.	Saline row.	Antigen row.
1 in 20	+ + + +	+ + + +	+ + + +	+ + + +
1 in 25	+ + + +	+ + + +	+ + + +	+ + + +
1 in 30	+ + + +	+ + + +	+ + + +	+ + + +
1 in 35	+ + + +	+ + + +	+ + + +	+ + + +
1 in 40	+ + + +	+ + + +	+ + + +	+ + + +
1 in 45	+ + + +	+ + + +	+ + + +	+ + + +
1 in 50	+ + + +	+ + +	+ + + +	+ + + +
1 in 55	+ + +	+ + +	+ + + +	+ + + +
1 in 60	+ + +	+ + +	+ + + +	+ + + +
1 in 65	+ + +	+ +	+ + + +	+ + + +
1 in 70	...	...	+ + + +	+ + + +
1 in 75	...	...	+ + + +	+ + +
1 in 80	...	...	+ + +	+ +

Titration No. 4.—Blood was withdrawn by heart puncture from one guinea-pig.

RESULT OF TITRATION No. 4.

Dilutions of Complement.	Clotted Serum.		Defibrinated Serum.	
	Saline row.	Antigen row.	Saline row.	Antigen row.
1 in 20	+ + + +	+ + + +	+ + + +	+ + + +
1 in 25	+ + + +	+ + + +	+ + + +	+ + + +
1 in 30	+ + + +	+ + +	+ + + +	+ + + +
1 in 35	+ + + +	+ + +	+ + + +	+ + +
1 in 40	+ + +	+ +	+ + +	+ +
1 in 45	+ +	+	+ + +	+ +
1 in 50	...	...	+ + +	+
1 in 55	...	...	+ +	o

These experiments are too few in number to yield definite conclusions, but so far the results do not support the statement made by Morrison in the article quoted at the commencement of this section.

SECTION 11.—POST-MORTEM EXAMINATIONS.

Six post-mortem examinations were performed by the Laboratory Staff during the year. A list of the diagnoses with notes on two of the interesting cases is appended.

Case 1. Broncho-pneumonia.

Case 2. Broncho-pneumonia.

Case 3. Ruptured Spleen.

No history could be obtained.

The spleen was friable, with a large tear on the internal surface, which, with the peritoneal cavity on the left side, was full of blood clot. There was also an extensive extravasation of blood into the mesentery of the transverse and the descending colon.

Case 4.—Aortic Incompetence.

Case 5.—Aortic Incompetence,

Case 6.—Acute Hæmorrhagic Pancreatitis.

The body was that of a Mganda cook. He had been a steady, though not a heavy, drinker. The evening on which he died, he had been into Nairobi, but returned to the house apparently perfectly well. A few minutes later he complained of acute abdominal pain and died very shortly afterwards. On port-mortem examination, the thoracic and abdominal organs appeared normal, with the exception of the pancreas, which was the seat of a very acute hæmorrhagic inflammation.

APPENDIX I.

SUMMARY OF RESULTS OF ALL LABORATORY EXAMINATIONS AND PREPARATIONS, 1922.

GRAND TOTAL OF ALL EXAMINATIONS, 5,679.

		MAN.																						CAT.	CATTLE.		DOG.	PIG.	RAT.	OTHER EXAMINATIONS							
		Blood.	Cerebro-Spinal Fluid.	Dental Caries.	Exudate from Conjunctivæ.	Exudate from Knee-Joint.	Exudate from Liver.	Exudate from Lungs.	Exudate from Lymphatic Gland.	Exudate from Pericardium.	Exudate from Pleura.	Exudate from Spleen.	Exudate from Ulcers.	Faeces.	Hair.	Nasal Secretion.	Pharyngeal Secretion.	Pus.	Skin.	Sputum.	Urethral, Vaginal and Prostatic Secretion.	Urine.	Varicose Tissues.	Exudate from Spleen.	Blood.	Exudate from Lymphatic Gland.	Blood.	Blood.	Exudate from Spleen.	Blood Stains.	Helminths.	Milk Supplies.	Mineral Waters	Vaccine.	Viruses.	Vegetables.	Water Supplies.
TOTAL SPECIMENS SUBMITTED	...	1613	9	1	1	1	1	10	10	1	2	21	28	605	6	37	15	33	3	266	191	126	36	1	14	2	53	2	2465	31	1	27	8	1	2	1	55
Differential Leucocyte Counts	...	237	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Enumeration of Erythrocytes and Leucocytes	... ...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Estimation of Haemoglobin	... ...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
PARASITES DETECTED BY MORPHOLOGY OR STAINING REACTIONS. Blastocystis hominis	... ...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Entamœba coli	... ...	...	...	...	...	...	...	...	...	...	...	...	...	8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Entamœba histolytica	... ...	...	...	...	...	...	...	...	...	...	...	...	...	34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Filaria perstans	... ...	8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Giardia intestinalis	... ...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Lodomœba butschlii	... ...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Piroplasma canis	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	33	...	...	...	...	...	...	...	...	...	...
Plasmodium falciparum	...	130	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Plasmodium falciparum and p. vivax	... ...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Plasmodium vivax	... ...	20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Spironema pallidum	... ...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Spironema pertenue	... ...	...	...	...	...	...	...	...	...	...	...	...	...	7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Spironema rossi	... ...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Theileria parva	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...
Trichomonas intestinalis	... ...	...	...	...	...	...	...	...	...	...	...	...	...	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Trypanosoma gambiense	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Trypanosoma vivax	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	...	...	...	...	...	...	...	...	...	...	...	...
Bacillus anthracis	... ...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...
Bacillus lepræ	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bacillus pestis	... ...	4	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	...	...	...	...	...	...	...	...
Bacillus tuberculosis	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	36	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Gonococcus	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Meningococcus	... ...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...
Microsporum audouini	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Pneumococcus	... ...	...	1	...	...	...	2	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Staphylococcus	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Streptococcus	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	12	5	3	221	149	55	...	1	8	2	30	1	2459	...	...	2	...	...	...	...	...
Larvæ strongyloides stercoralis	... ...	...	...	...	...	...	...	...	...	...	...	...	...	9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ova ancylostomidæ	... ...	...	...	...	...	...	...	...	...	...	...	...	...	70	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ova ascaris lumbricoides	... ...	...	...	...	...	...	...	...	...	...	...	...	...	33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ova hymenolepis (? sp.)	... ...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ova schistosoma hæmatobium	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ova schistosoma mansoni	... ...	...	...	...	...	...	...	...	...	...	...	...	...	10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ova taenia saginata	... ...	...	...	...	...	...	...	...	...	...	...	...	...	59	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ova trichiuris trichiura	... ...	...	...	...	...	...	...	...	...	...	...	...	...	45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ova double infections	... ...	...	...	...	...	...	...	...	...	...	...	...	...	41	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ova triple infections	... ...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Taenia saginata	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Negative	... ...	625	7	...	1	1	1	8	7	...	2	21	19	273	2	34	12	5	3	221	149	55	...	1	8	2	30	1	2459	...	1	2	...	...	...	...	...
AGGLUTINATION TESTS. Bacillus paratyphosus A.	...	7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bacillus paratyphosus B.	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bacillus typhosus	... ...	12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Micrococcus melitensis	...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Micrococcus paramelitensis	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Negative	... ...	134	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
CULTURAL EXAMINATIONS. Bacillus coli agglutinating with the patient's serum	... ...	...	...	...	...	...	...	...	...	...	...	...	...	26	...	...	...	...	...	...	...	9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bacillus danysz	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Bacillus dysentariæ Flexner	..	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bacillus dysentariæ shiga	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bacillus enteritidis	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Bacillus typhosus	... ...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Micrococcus catarrhalis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Staphylococcus	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	13	...	...	1	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Streptococcus	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Negative	... ...	19	...	1	...	...	...	...	...	...	...	...	...	81	...	1	3	9	...	3	2	15	1	...	...	...	...	...	1	...	...	...	1	1	...	...	...
General Chemical and Microscopical Examination	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	40	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Precipitin Tests	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	31	...	...	...	...	...	...	...
Complete Bacteriological Examination	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	23	7	...	...	1	55
WASSERMANN REACTION. Positive Result	... ...	242	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Doubtful Positive Result	...	57	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Negative Result	... ...	112	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sigma Reaction	... ...	29	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Histological Examinations	... ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	35	...	...	...	...	...	...	...	...	...	...	...	...	...	...

STOCK VACCINES PREPARED AND ISSUED.

Calf Lymph Lanolinated	18,948 doses
Calf Lymph Glycerinated	205,594 ,,
Bacillus coli vaccine	200 ,,
Bacillus pestis vaccine	15,000 ,,
Polyvalent dysentery vaccine	2,000 ,,
T.A.B.C. vaccine	5,000 ,,

AUTOGENOUS VACCINES PREPARED AND ISSUED.

Of Bacillus coli	28
Of Micrococcus catarrhalis	3
Of Micrococcus catarrhalis and Streptococcus	3
Of Staphylococcus	12
For Asthma	3
For Pyorrhœa	3

APPENDIX II.

DIFFERENTIAL LEUCOCYTE COUNTS. 1922.

Case.	Disease.	Race.	PMN.	L.M.	Ly.	Tr.	Eos.	Mast.
A—Cases in which Plasmodium falciparum was found.								
1	Subtertian Malaria ...	African ...	61	21	18	...	...	...
2	Subtertian Malaria ...	Goan ...	49	24	22	3	2	...
3	Subtertian Malaria ...	Indian ...	55	12	30	...	3	...
4	Subtertian Malaria ...	African ...	38	17	33	...	12	...
5	Subtertian Malaria ...	African ...	48	19	29	...	3	1
B—Cases in which Plasmodium vivax was found.								
6	Benign Tertian Malaria ...	Seychelle ...	41	22	37	...	...	...
C—Cases in which Filaria perstans was found.								
7	Syphilis	African ...	30	6	50	...	14	...
8	Local Injury	African ...	38	11	43	...	8	...
9	Hydrocele	African ...	42	5	45	...	8	...
10	Necrosis thumb	African ...	33	3	56	...	8	...
140	Pleurisy	African ...	44	11	41	...	4	...
D—Cases showing no blood parasites, but clinically Malaria.								
35	? Malaria	European ...	52	22	23	2	1	...
36	? Malaria	European ...	65	17	18	...	...	...
37	? Malaria	European ..	58	14	28	...	...	...
38	? Malaria	European ...	57	15	26	2	...	...
39	? Malaria	European ...	62	20	17	...	1	...
40	? Malaria	European ...	61	14	21	1	3	...
42	? Malaria	European ...	61	16	19	3	1	...
44	? Malaria	European ...	48	11	39	2	...	...
77	? Malaria	European ...	84	7	9	...	...	...
87	? Malaria	European ...	39	33	25	3	...	...
92	? Malaria	European ..	75	7	18	...	...	...
100	? Malaria	European ...	37	21	41	...	...	1
101	? Malaria	European ...	47	17	34	...	1	1
104	? Malaria	African ...	29	5	60	2	4	...
117	? Malaria	African ...	66	10	23	...	1	...
129	? Malaria	European ...	45	20	34	...	1	...
135	? Malaria	African ...	67	8	21	...	4	...
142	? Malaria	Indian ...	72	21	7	...	...	...
162	? Malaria	African ...	86	4	9	...	1	...
176	? Malaria	African ...	44	13	29	4	6	4
188	? Malaria	European ...	69	8	22	...	...	1
189	? Malaria	European ...	69	6	25	...	...	...
210	? Malaria	African ...	33	10	53	...	4	...
E—Cases not clinically or microscopically Malaria.								
13	Carcinoma Liver	Indian ...	44	9	46	...	...	1
16	Poliomyelitis	European ...	38	25	37	...	...	...
18	Hepatitis	European ...	61	14	23	1	1	...
19	Influenza	European ...	66	10	24	...	...	...
20	Influenza	European ...	77	9	14	...	...	...
21	Influenza	European ...	79	11	9	...	1	...
22	Bronchitis	Goan ...	48	20	26	...	6	...
24	Influenza	European ...	75	6	18	..	1	...
26	Influenza	European ...	74	7	17	2	...	...
11	Anaemia	Indian ...	52	2	36	0	10	...
17	Influenza	European ...	65	12	23	...	...	...
25	Erysipelas	European ...	85	7	6	2	...	...
41	Measles	Goan ...	69	12	18	1	...	...
45	Septicaemia	European ...	62	20	14	3	1	...
46	Septicaemia	European ...	70	20	8	1	1	...
47	Influenza	European ...	38	7	52	...	3	...
48	Influenza	European ...	71	7	22	...	...	...
51	Influenza	European ...	52	8	38	1	1	...
52	Plethora	European ...	67	14	18	1	...	...
54	Syphilis	Goan ...	58	12	26	2	2	...
55	Teething	European ...	56	11	31	1	1	...

Note:—PMN.: Polymorphonuclea Leucocyte. L.M.: Large Mononuclear Leucocyte. Ly.: Lymphocyte.
Tr.: Transitional Leucocyte. Eos.: Eosinophile Leucocyte. Mast: Mast Cell.

APPENDIX II.—*continued.*

DIFFERENTIAL LEUCOCYTE COUNTS, 1922.

Case.	Disease.	Race.	P.M.N.	L.M.	Ly.	Tr.	Eos.	Mast.
E—Cases not Clinically or Microscopically Malaria.								
56	Influenza	European ...	69	9	20	2	...	...
57	Influenza	European ...	62	12	23	2	1	...
58	Poliomyelitis	European ...	78	8	12	1	1	...
60	Perinephric Abscess ...	European ...	86	9	5	...	...	...
62	Syphilis	African ...	46	14	34	1	4	1
64	Hepatitis	Indian ...	53	6	31	...	10	...
74	Malaise	European ...	60	13	26	...	1	...
75	Pneumonia	European ...	83	9	6	...	2	...
76	Tuberculosis	European ...	37	22	41	...	...	...
78	Appendicitis	European ...	71	16	12	...	1	...
80	Tonsilitis	European ...	66	14	20	...	...	...
82	Paralysis	African ...	42	22	31	...	3	2
83	Paralysis	African ...	58	9	33	...	...	...
89	Jaundice	European ...	71	9	19	...	1	...
90	Jaundice	European ...	61	21	17	...	1	...
91	Pneumonia	African ...	90	2	8	...	...	...
94	Jaundice	European ...	59	12	27	1	1	...
98	Lymphadenoma	African ...	45	20	35	...	...	...
99	Appendicitis	European ...	67	7	23	...	2	1
102	Appendicitis	European ...	45	10	44	...	1	...
103	Syphilis	African ...	46	5	33	...	15	1
105	Local Injury	African ...	44	8	36	...	12	...
106	Yaws	African ...	46	16	33	...	5	...
107	Cystic Disease of Kidney ...	European ...	67	5	23	...	5	...
108	Yaws	African ...	46	14	32	...	8	...
110	Influenza	African ...	52	8	28	...	12	...
111	Hydrocele	African ...	57	10	31	...	2	...
112	Hernia	African ...	67	7	22	1	3	...
113	Injury	African ...	54	14	27	...	5	...
115	Injury	African ...	54	13	26	1	6	...
116	Influenza	African ...	65	9	24	1	1	...
118	Hæmoglobinuria	European ...	36	24	37	2	1	...
120	Tonsilitis	European ...	73	4	21	...	2	...
121	Abscess	African ...	51	11	33	...	5	...
128	Hæmoglobinuria	European ...	77	5	16	1	1	...
130	Typhoid Fever	European ...	32	14	53	1	...	...
131	Pneumonia	Indian ...	19	3	77	...	1	...
132	Pneumonia	African ...	82	3	13	...	2	...
133	Yaws	African ...	71	4	24	...	1	...
134	Injury	African ...	44	7	45	...	4	...
136	Hydrocele	African ...	45	5	41	...	8	1
137	Hydrocele	African ...	44	5	45	...	6	...
138	Hydrocele	African ...	45	6	39	...	10	...
139	Injury	African ...	56	10	31	...	3	...
141	Epilepsy	European ...	53	25	22	...	...	...
143	Phimosis	African ...	64	9	25	...	2	...
144	Yaws	African ...	59	7	28	3	3	...
145	Syphilis	African ...	53	13	30	...	4	...
146	Syphilis	African ...	51	6	39	...	4	...
147	Yaws	African ...	43	8	42	2	5	...
148	Necrosis	African ...	54	9	33	...	4	...
150	Injury	African ...	46	13	26	...	15	...
151	Gastritis	European ...	66	5	28	...	1	...
153	Injury	African ...	20	11	62	...	7	...
154	Injury	African ...	20	11	62	...	7	...
157	Leucocytosis	European ...	85	4	10	1	...	...
158	Influenza	African ...	42	7	41	...	10	...
159	Influenza	African ...	42	7	41	...	10	...
160	Constipation	European ...	46	6	47	...	1	...
163	Yaws	African ...	45	17	36	...	2	...

Note:—P.M.N.: Polymorphonuclea Leucocyte. L.M.: Large Mononuclear Leucocyte. Ly.: Lymphocyte.
Tr.: Transitional Leucocyte. Eos.: Eosinophile Leucocyte. Mast: Mast Cell.

APPENDIX II.—*continued.*

DIFFERENTIAL LEUCOCYTE COUNTS, 1922.

Case.	Disease.	Race.	P.M.N.	L.M.	Ly.	Tr.	Eos.	Mast.
E—Cases not clinically or microscopically Malaria.								
164	Anæmia	Indian ...	46	4	46	...	4	...
165	Syphilis	African ...	60	4	30	...	6	...
166	Myalgia	African ...	39	10	35	...	16	...
167	Injury	African ...	49	11	28	...	12	...
168	Cysts	African ...	55	7	32	...	6	...
169	Typhoid Fever	European ...	56	6	38	...	...	...
170	Typhoid Fever	European ...	62	9	28	...	1	...
171	Injury	African ...	62	8	24	...	6	...
172	Diarrhœa	European ...	62	8	29	...	1	...
173	Abortion	Indian ...	43	9	45	...	3	...
174	Influenza	European ...	68	3	28	...	1	...
175	Malaise	European ...	78	5	14	3	...	...
177	Hepatitis	African ...	36	12	31	...	20	1
178	Malaise	European ...	66	6	25	...	1	2
181	Typhoid Fever	European ...	43	10	47	...	...	...
182	Pneumonia	African ...	50	10	36	...	4	...
183	Amœbiasis	European ...	57	10	33	...	...	...
184	Dysentery	African ...	86	4	9	...	1	...
185	Addison's Disease	European ...	37	6	57	...	...	...
186	Gastritis	European ...	42	9	29	...	20	...
187	Influenza	European ...	82	5	12	...	1	...
190	Anæmia	Indian ...	28	21	45	1	...	5
191	Addison's Disease	European ...	42	24	31	2	1	...
193	Pneumonia	European ...	83	4	12	...	...	1
194	Malaise	European ...	40	8	48	...	4	...
195	Pneumonia	European ...	83	4	12	...	...	1
196	Injury	African ...	54	17	21	...	8	...
197	Influenza	European ...	59	14	25	...	2	...
198	Injury	European ...	74	12	14	...	...	...
199	Phimosis	African ...	44	5	46	1	4	...
200	Phimosis	African ...	67	7	21	0	5	...
201	Myalgia	African ...	42	6	20	...	32	...
202	Pneumonia	African ...	73	6	20	1	...	...
203	Syphilis	African ...	58	4	34	...	4	...
204	Tumour	African ...	62	9	26	1	2	...
205	Myalgia	African ...	31	5	32	...	32	...
206	Typhoid Fever	European ...	28	28	44	...	...	...
207	Influenza	African ...	52	6	36	...	6	...
208	Fistula-in-ano	African ...	54	6	39	...	1	...
212	Tumour	African ...	55	5	38	...	2	...
213	Typhoid Fever	European ...	23	28	49	...	...	...
214	Malaise	European ...	50	17	32	1	...	...
215	Nephritis	European ...	75	15	10	...	...	...
216	Carcinoma Liver	Indian ...	50	4	37	...	9	...
219	Sprue	European ...	40	6	54	...	...	...
220	Hæmatemesis	Indian ...	42	16	41	1	...	...
221	Dysentery	Indian ...	48	8	42	1	1	...
222	Hodgkin's Disease	African ...	86	2	12	...	...	...
223	Typhoid Fever	European ...	79	9	12	...	...	...
224	Typhoid Fever	European ...	80	9	11	...	...	...
226	Syphilis	Indian ...	96	3	1	...	...	...
227	Typhoid Fever	European ...	15	24	60	...	1	...
228	Poliomyelitis	European ...	68	10	17	...	5	...
229	Amœbiasis	European ...	65	9	25	...	1	...
231	Injury	African ...	49	10	35	...	6	...
232	Abscess	African ...	74	6	15	...	5	...
233	Corneal Ulcer	African ...	44	5	44	...	7	...
234	Scabies	African ...	42	5	20	...	33	...
235	Hydrocele	African ...	46	6	25	...	21	2
236	Hydrocele	African ...	44	7	34	...	15	...
237	Trypanosomiasis	African ...	36	9	33	...	22	...

Note.—P.M.N.: Polymorphonuclear Leucocyte. L.M.: Large Mononuclear Leucocyte. Ly.: Lymphocyte.
Tr.: Transitional Leucocyte. Eos.: Eosinophile Leucocyte. Mast: Mast Cell.

APPENDIX II.—*continued.*

DIFFERENTIAL LEUCOCYTE COUNTS, 1922.

Case.	Disease.	Race.	P.M.N.	L.M.	Ly.	Tr.	Eos.	Mast.
F—Cases Whose Eventual Diagnosis is Unknown.								
14	?	African ...	54	23	22	...	1	...
15	?	European ...	64	16	18	...	2	...
23	?	African ...	60	16	21	1	2	...
27	?	African ...	57	16	22	2	3	...
28	?	African ...	41	20	34	1	4	...
29	?	African ...	66	10	19	1	4	...
30	?	African ...	56	14	26	1	3	...
31	?	African ...	69	11	18	...	2	...
32	?	African ...	66	14	17	1	2	...
33	?	African ...	59	14	24	1	2	...
34	?	African ...	56	14	28	...	2	...
43	?	African ...	55	11	20	2	12	...
50	?	African ...	51	11	36	1	1	...
53	?	European ...	61	19	18	1	1	...
61	?	European ...	28	8	64	...	...	...
63	?	Indian ...	61	4	33	1	1	...
65	?	African ...	68	8	23	1	...	...
66	?	?	53	20	23	4	...	...
67	?	European ...	20	21	57	...	1	1
68	?	European ...	52	3	42	1	1	1
69	?	African ...	69	9	12	...	10	...
70	?	African ...	57	5	38	...	...	...
71	?	African ...	60	2	37	...	1	...
72	?	European ...	23	20	55	...	2	...
73	?	African ...	51	4	45	...	...	...
79	?	European ...	45	4	50	1	...	...
81	?	European ...	62	22	12	4	...	...
84	?	European ...	45	9	41	...	4	1
85	?	European ...	61	17	22	...	...	...
86	?	European ...	36	7	55	1	1	...
93	?	European ...	47	4	48	...	1	...
95	?	Goan ...	50	15	33	...	2	...
96	?	Indian ...	88	2	10	...	...	...
97	?	Goan ...	68	10	22	...	...	...
119	?	African ...	67	14	18	1	...	...
149	?	European ...	36	15	49	...	...	...
180	?	European ...	89	1	9	...	1	...
192	?	Indian ...	69	13	18	...	...	...
217	?	Indian ...	66	5	28	...	1	...
218	?	European ...	48	12	36	...	4	...
225	?	Indian ...	49	25	26	...	...	...
G—Healthy Control Cases.								
12	–	European ...	60	13	27	...	...	...
49	–	European ...	68	5	24	...	3	...
59	–	European ...	79	4	17	...	...	...
88	–	Indian ...	64	7	29	...	...	...
109	–	African ...	51	4	43	...	2	...
114	–	African ...	58	12	22	2	6	...
122	–	African ...	54	7	37	...	1	1
123	–	African ...	49	7	43	...	1	...
124	–	African ...	55	9	35	...	1	...
125	–	African ...	44	7	46	...	3	...
126	–	African ...	51	7	38	...	4	...
127	–	African ...	44	7	34	...	15	...
152	–	African ...	12	12	66	...	10	...
155	–	African ...	63	10	26	...	1	...
156	–	African ...	71	9	19	...	1	...
161	–	African ...	23	3	21	...	53	...
179	–	European ...	48	5	45	...	1	1
209	–	African ...	66	4	24	...	6	...
211	–	African ...	61	5	30	...	3	1
230	–	African ...	52	8	37	...	3	...

Note:—P.M.N.: Polymorphonuclear Leucocyte. L.M.: Large Mononuclear Leucocyte. Ly.: Lymphocyte.
Tr.: Transitional Leucocyte. Eos.: Eosinophile Leucocyte. Mast.: Mast Cell.

APPENDIX III.

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PREPARATION OF A DRUG FOR TREATMENT OF YAWS.

During the year the department was asked by the Principal Medical Officer if it could prepare sodium potassium bismutho-tartarate which he required, in the first place experimentally, for the treatment of yaws.

A brief description of the method of preparation used in Tanganyika was provided, and the matter was taken in hand. Much time was taken up in experimenting along the lines indicated in the information supplied, as it was found that compounds containing sodium, potassium, bismuth and tartaric acid, could be crystallised out containing different proportions of these ingredients, agreeing with medical evidence from Tanganyika that some preparations appeared to be more active than others. The first essay resulted in a beautiful salt which was found on analysis to contain only 26 % bismuth.

Differences in the method of preparation were introduced and eventually a salt containing 54 % bismuth was obtained.

The precise conditions necessary to produce this salt were not established for some time—it was a case of it generally, but not always, coming right. Each batch was analysed, and if the bismuth fell below 50 %, it was rejected.

The officer dealing with this work happened to leave before his procedure was quite stereotyped, and the preparation received a temporary set back until another officer and myself had gone over some of the same ground. It is satisfactory to report that very soon a method of preparation was evolved taking much less time than formerly, and yielding a product of the bismuth content aimed at—approximately 54·5 %.

The success which the bismutho-tartarate of soda and potash has met with in the treatment of Yaws, combined with its low cost compared with the arsenobenzene compounds (I understand from the Principal Medical Officer that it will effect a saving in Kenya of something like £5,000 per annum), will probably bring to other Colonial Chemists the task of preparing this compound. To such the following notes will be a sufficient guide.

Bismuth oxycarbonate is heated in a dish over a bare flame, and stirred until it assumes an orange colour, indicating its conversion into bismuth oxide. Rather more than the theoretical quantity of tartaric acid required to convert this into bismutho-tartaric acid, is added. Sufficient boiling water is then added to bring the mass into the consistency of a batter. It is placed on the water bath and stirred vigorously. In a few minutes the colour will commence to fade, and then quite rapidly it will turn white and almost solidify.

When the reaction is complete the mass is transferred to a Büchner filter and drained at the pump. The excess of tartaric acid is removed by washing with a little hot water—bismutho-tartaric acid being only slightly soluble.

The B. T. acid is then transferred to a dish, and treated with slightly less than the theoretical quantity of sodium hydroxide and potassium hydroxide in molecule proportions. It is most important that the alkalis be in solution of syrupy consistency, otherwise the reaction with the B. T. acid will be delayed. The reaction should be violent and hence the alkali be added piecemeal.

When all has been added, the B. T. acid will almost have entirely disappeared into a syrupy solution with the reaction to litmus slightly acid. Filter off and concentrate the filtrate on the water bath until a persistent film appears on the surface.

Then pour into three volumes of alcohol and stir vigorously. In a few minutes the paste at the bottom will harden and crystallise. After standing for an hour or two the alchohol may be poured off and the crystalline mass broken up in a mortar.

The powdered crystals may be then left under a small quantity of fresh alcohol for a further period, filtered at the pump, pressed, dried on porous tiles and finally in the steam oven.

Simple as it may appear, and is with practice, there are several places where danger lurks. The crux is the amount of water. In no part of the procedure should more water be present than is necessary to bring the bodies into reaction. It does not enter chemically into the reactions required, but if a little too much is present, it appears to upset their course and bodies of lower bismuth content result. Also note that if even a slight excess of alkali be added, the salt will not crystallise out under alcohol, but the syrup remains permanently as such.

It is essential that frequent analysis be made—in this department every batch is assayed.

As Sod. pot. bismutho-tartarate is not decomposed by alkali the bismuth content may be obtained by titration with standard sodium sulphide solution, using sodium nitro-prusside as an outside indicator.