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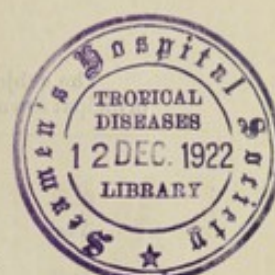
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FEDERATED MALAY STATES.

MEDICAL REPORT FOR THE YEAR 1921.



VITAL STATISTICS.

1. The population of the Federated Malay States as in 1921 census figures, was 1,298,292.

BIRTHS.

2. Thirty-six thousand two hundred and ninety-four births were registered during the year giving a birth-rate of 27.81 per mille population :

Year.	Births.	Birth-rate per mille.
1911	20,310 ..	19.41
1912	25,426 ...	23.50
1913	26,349 ...	23.05
1914	27,978 ...	24.61
1915	29,699 ...	25.33
1916	29,337 ...	24.20
1917	34,763 ...	27.94
1918	33,011 ...	25.70
1919	32,325 ...	24.57
1920	36,556 ...	27.05
1921	36,294 ...	27.81

Although there is a falling off in the actual number of births, due probably to the repatriation of many Tamils, the birth-rate per mille is the second highest on record.

DEATHS.

3. Thirty-eight thousand and seventy-seven deaths were registered giving a death-rate of 29.18 per mille :

Year.	Deaths.	Death-rate.
1911	40,914 ...	39.11
1912	40,901 ...	37.08
1913	38,000 ...	34.00
1914	39,003 ...	34.31
1915	33,899 ...	28.92
1916	36,981 ...	30.06
1917	42,514 ...	34.17
* 1918	67,639 ...	52.85
1919	38,645 ...	29.37
1920	43,705 ...	32.34
1921	38,077 ...	29.18

Death-rate is the lowest recorded for eleven years except that of 1915. It is remarkably lower than that of 1920.

The death-rates of the four principal towns is far too high. It is due largely to infantile mortality and over-crowding of houses due to the financial position.

The sanitation and hygienic conditions of the towns is engaging the attention of the Government and Health Department.

* Influenza Epidemic.

CORRIGENDA.

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CHIEF TOWNS.

The subjoined table sets out the estimated population and death-rate per mille of the principal townships during the past six years:

Year.	Kuala Lumpur.		Ipoh.		Seremban.		Taiping.	
	Population.	Death-rate.	Population.	Death-rate.	Population.	Death-rate.	Population.	Death-rate.
1916	61,443	27.73	29,915	30.15	11,397	52.55	22,237	36.00
1917	63,064	28.45	31,032	32.67	13,620	55.35	22,859	31.00
1918	64,686	38.34	32,150	35.92	14,082	81.66	23,481	41.61
1919	66,308	26.36	33,238	23.56	14,544	45.38	24,721	37.45
1920	67,930	30.00	34,357	22.64	15,006	34.05	25,434	39.90
1921	81,197	27.02	37,194	20.38	17,479	36.16	21,178	50.05

INFANTILE MORTALITY.

4. There were 6,646 deaths of children under one year of age giving an infantile mortality rate of 183 per 1,000 births as compared with a rate of 188 for 1920. The high mortality is chiefly due to the ignorance and carelessness of the native women. Lady Doctors and District Nurses and Midwives might be effective in lowering the rate, but male Doctors and Sanitary Inspectors can do little in a country like this where male teaching or treatment is not accepted.

INFANTILE MORTALITY TABLE.

State.	Death of children under one year of age.		Death-rate per 1,000 births.
Perak ...	...	2,652	160.51
Selangor ...	...	2,095	202.14
Negri Sembilan ...	...	1,010	200.32
Pahang ...	...	889	203.57

The death-rate is still too high, but compares not unfavourably with the children's death-rate of other tropical countries. When an Infantile Welfare Board is established and nursing and educational measures are carried out, it is to be hoped that this death-rate will be greatly reduced.

5. The diseases which caused the greatest number of deaths were malaria, dysentery, diarrhoea, pneumonia and pulmonary tuberculosis.

The following table shows the deaths and death-rates from the principal diseases for the last eleven years:

Year.	Malaria.		Dysentery and diarrhoea.		Pulmonary tuberculosis.		Beri-beri.	
	Deaths.	Rate.	Deaths.	Rate.	Deaths.	Rate.	Deaths.	Rate.
1911 ...	17,440	17.47	7,659	7.31	2,300	2.20		
1912 ...	17,870	16.52	5,885	5.44	1,353	1.25	1,212	1.12
1913 ...	16,414	14.69	5,317	4.75	1,623	1.45	1,190	1.06
1914 ...	13,634	11.99	5,235	4.60	1,655	1.45	1,223	1.07
1915 ...	15,208	12.97	3,148	2.68	1,995	1.70	871	.74
1916 ...	17,627	14.58	3,197	2.64	2,193	1.81	757	.62
1917 ...	18,750	15.07	4,942	3.97	2,446	1.96	1,207	.91
1918 ...	31,515	24.62	4,280	3.34	3,184	2.48	1,277	.98
1919 ...	16,975	12.90	3,712	2.82	2,445	1.86	939	.74
1920 ...	20,595	15.24	3,804	2.81	2,634	1.95	431	.32
1921 ...	17,168	13.16	2,999	2.30	2,255	1.73	422	.32

INFECTIOUS DISEASES.

6. In this report infectious disease means cholera, plague, small-pox and cerebro-spinal meningitis.

Measures against infectious diseases are partly the concern of the Health Branch, partly the concern of the Medical Branch. Until this year, there was some confusion as to which branch should be in charge of an outbreak. It has now been decided that though both branches must do all in their power to stamp out infectious diseases, the Health Branch shall wherever possible direct operations. There were no cases of cholera or plague reported this year. Seventy-six cases of small-pox were reported in Perak. There were no cases in the other three States. The principal infected centres were:—

- a. The Malay kampongs on the Perak river between Teluk Anson and Kuala Kangsar.
- b. In the kampongs about Sungkai.

By the energetic action of the Medical and Health authorities, the disease was stamped out. The epidemics showed that many of the Malays in the districts concerned had managed to avoid vaccination.

Cerebro-spinal meningitis: Altogether there were 16 cases reported. Of these six were from Perak, eight from Selangor and two from Negri Sembilan. All the six cases in Perak, came from Devon Estate. In Selangor, two of the cases came from the Police Dépôt. All the rest were isolated cases.

PRINCIPAL DISEASES IN HOSPITALS.

7. The principal diseases commonly treated at the hospitals were malaria, venereal diseases, ankylostomiasis, pulmonary diseases, dysentery, diarrhoea, beri-beri, pneumonia phthisis and yaws.

The following table shows the number of cases and deaths during the year:—

Diseases.	Perak.						Selangor.					
	1920.			1921.			1920.			1921.		
	No. of cases.	No. of deaths.	Percentage of deaths.	No. of cases.	No. of deaths.	Percentage of deaths.	No. of cases.	No. of deaths.	Percentage of deaths.	No. of cases.	No. of deaths.	Percentage of deaths.
Malaria ...	17,400	1,036	5.95	14,996	860	5.73	12,143	623	5.13	11,203	641	5.72
Venereal diseases ...	3,452	58	1.68	2,885	39	1.35	2,026	20	0.98	2,100	30	1.42
Ankylostomiasis ...	1,990	198	9.92	2,400	224	9.33	752	52	6.91	1,241	104	8.38
Pulmonary diseases ...	510	74	14.51	552	54	9.78	...	...	...	...	...	...
Dysentery ...	1,515	308	20.33	1,558	282	18.10	1,436	378	26.32	1,632	406	24.87
Diarrhoea ...	1,020	142	13.92	1,039	83	7.99	391	35	8.95	261	35	13.41
Beri-beri ...	78	19	19.39	95	22	23.16	260	41	15.96	407	45	11.05
Pneumonia ...	655	309	47.17	613	269	43.88	1,256	577	45.93	611	266	43.53
Phthisis ...	1,080	531	49.16	973	484	49.74	594	243	40.90	678	283	41.74
Yaws ...	105	...	...	115	...	...	9	...	...	223	1	.44

Diseases.	Negri Sembilan.						Pahang.					
	1920.			1921.			1920.			1921.		
	No. of cases.	No. of deaths.	Percentage of deaths.	No. of cases.	No. of deaths.	Percentage of deaths.	No. of cases.	No. of deaths.	Percentage of deaths.	No. of cases.	No. of deaths.	Percentage of deaths.
Malaria ...	5,772	261	4.05	6,091	248	4.07	3,154	86	2.72	2,565	102	3.98
Venereal diseases ...	848	13	1.05	946	8	.84	269	3	1.11	291	3	1.03
Ankylostomiasis ...	611	70	11.04	989	97	9.08	252	15	5.95	527	21	3.98
Pulmonary diseases ...	...	...	...	...	...	...	369	20	5.42	414	23	5.55
Dysentery ...	821	254	30.09	885	273	30.08	274	64	23.35	207	30	14.49
Diarrhoea ...	146	17	11.06	197	17	8.06	112	10	8.92	129	13	10.08
Beri-beri ...	234	49	20.09	231	37	16.01	45	7	15.55	76	10	13.15
Pneumonia ...	438	211	48.01	269	132	49.07	159	75	47.16	126	53	42.07
Phthisis ...	407	185	45.04	394	164	41.06	125	66	52.80	128	70	50.72
Yaws ...	109	...	...	210	...	...	29	...	...	903	...	...

MALARIA.

8. There were 17,168 cases treated in hospital with a death-rate of 13.16 per cent. against 20,595 cases in 1920 and a death-rate of 15.24 per cent., a satisfactory decrease. The activities of the Malaria Advisory Board and Mosquito Destruction Boards are bearing fruit, and the increased accuracy of diagnosis in the hospital have all combined to reduce the mortality figures. The distribution of free quinine has been thoroughly organized.

VENEREAL DISEASES.

9. Fewer patients came to the hospitals for treatment. Novarsenobenzol injections are given in the hospitals but few patients are willing to undergo the full course of treatment as they leave directly they feel better. One or two injections improve their condition and they are satisfied. In spite of warnings, they will not come back for further treatment.

Town dispensaries have been started in various districts with a view to treating patients who do not come to hospital, and have achieved some success. This work will be increased in 1922.

The question of the treatment and prevention of venereal disease will be organized under a special Advisory Board.

ANKYLOSTOMIASIS.

10. The routine examination of faeces shows that ankylostome ova are very common amongst hospital patients. The routine microscope examination of the stools has added an apparent increase to the number of patients 2,400 against 1,998 for 1920.

The American Commission from the Rockefeller Institute report that 95 per cent. of the population are infected. The disease in the Federated Malay States is not a very serious menace to health except in ill-fed persons or where there is inter current disease.

TRAVELLING DISPENSARIES.

11. The motor ambulances which were stationed at various centres in the Federated Malay States were doing good work in visiting the out-lying districts, but they unfortunately had to be stopped in December on grounds of economy.

TUBERCULOSIS PHTHISIS.

12. Practically all the cases admitted into hospitals were in an advanced stage and it is almost impossible to do anything in the way of a cure—it is only possible to relieve them.

The comparative statement of figures are as follow :

				1920.		1921.
Perak ...	...	...	...	1,080	...	973
Selangor ...	...	...	...	572	...	647
Negri Sembilan ...	...	...	...	407	...	394
Pahang ...	...	...	...	122	...	138
Total ...				2,181	...	2,152

Overcrowding, ignorance and dirty habits, with complete disregard of the simplest rules of ventilation, are the main causes of this disease. It is not difficult to design well ventilated houses, but it is impossible to prevent people closing their air entrances.

YAWS.

13. There were the following number of injections given during the year :

Perak ...	...	...	...	...	8,547
Selangor ...	...	...	...	...	578
Negri Sembilan ...	...	...	...	...	2,179
Pahang ...	...	...	...	...	903
Total ...					12,207

A campaign against yaws was organized with great success amongst the Malays. The treatment with the arsenic compounds is very expensive but the results obtained justify the cost. The work had to be curtailed through lack of funds and withdrawal of the motor ambulances.

INFLUENZA.

14. Although there have been a fair number of cases reported it has been of a mild type and only 51 deaths have occurred as shown below :

				Deaths.
Perak ...	...	...	...	8
Selangor ...	...	...	...	11
Negri Sembilan ...	...	...	...	16
Pahang ...	...	...	...	16
Total ...				51

In every district there is now an organized scheme for dealing with an epidemic of this or any other disease.

NOTICE.

Medical Report for the year 1921, page 5. Beri-beri.—The figures omitted under Negri Sembilan for 1921 should read as follows: Cases 231 ... Deaths 37.

F. E. WOOD,
Acting Principal Medical Officer, F.M.S.



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BERI-BERI.

15. It is the opinion of Medical Officers that this disease is on the increase and the admissions during the last few months of the year confirm this impression. Polished rice is being used much more freely as the Chinese undoubtedly prefer this form, and this accounts for the more numerous admissions:

	1920.				1921.			
	Cases.		Deaths.		Cases.		Deaths.	
Perak ...	...	78	...	19	...	95	...	22
Selangor ...	...	260	...	41	...	407	...	45
Negri Sembilan ...	...	233	...	49	...	231	...	37
Pahang ...	...	45	...	7	...	76	...	10

to hospital. As polished rice is more and more used, the figures for beri-beri admissions will rise.

16.

OPERATIONS.

	Major.				Minor.			
	1920.		1921.		1920.		1921.	
Perak ...	...	407	...	362	...	1866	...	1475
Selangor ...	...	273	...	273	...	2859	...	1343
Negri Sembilan ...	...	143	...	62	...	1400	...	1201
Pahang ...	...	31	...	10	...	224	...	210
Total ...	...	854	...	707	...	6349	...	4229

During the year under review operations of all kinds were undertaken by the Chief Surgeons almost always successfully, and the surgery of the Federated Malay States has made considerable advances.

IN-DOOR PATIENTS.

17. During 1921, 116,785 patients were treated as against 120,879 during 1920, a decrease of 4,094. This is accounted for by the departure to India of large number of Tamils.

OUT-DOOR PATIENTS.

18. The figures for 1921, are 321,753 as against 275,783 during 1920. The town dispensaries did good work during the year and as they become better known more may be expected from them.

VACCINATIONS.

19. Sixty-eight thousand two hundred and eighty were performed during the year as compared with 218,320 in 1920. The vast decrease is due to the fact that vaccination done in 1920 was principally in connection with the outbreak of small-pox, etc., and as re-vaccination is not compulsory for adults the 1921 figures are largely those concerning infants and children.

MALAY WOMEN'S HOSPITALS AND WARDS.

20. Lady Medical Officers are stationed at Kuala Kangsar, Kuala Pilah, District and General Hospitals, Kuala Lumpur, Ipoh and Pekan.

WOMEN HOSPITAL, KUALA KANGSAR.

21. This hospital is under the charge of Dr. L. M. Bush. The total number of in-door cases treated during the year was 1,007 as compared with 1,095 during 1920. Forty in-door and 35 out-door maternity cases were attended to in this hospital during the year.

WOMEN HOSPITAL, KUALA PILAH.

22. The Lady Medical Officer Mrs. E. M. M. Cobb is in charge of this hospital. The number of inpatients treated during the year was 710 as against 433 in 1920, including 50 Malay women and children. Twenty-four maternity cases treated as against 12 in 1920. Six thousand four hundred and forty-three out-patients were attended to during the year as against 2,785 in 1920.

One hundred and twelve of yaws treated in hospital. Seven hundred and forty-four injections of N.A.B. were given for yaws. Two hundred and eighty injections of N.A.B. were given for syphilis.

LECTURES.

23. The Lady Medical Officer gives lectures to the elder girls and women at the schools on hygiene and health. The Lady Medical Officer, Kuala Pilah, in submitting her reports remarks as follows:

"I have not as yet finished the course, but I do not consider my efforts have been very successful. The women come to these lectures because I ask them to do so, but it is difficult to hold their attention and to make them understand. This is not altogether due to my lack of knowledge of the language, since each point is emphasized by my travelling Dresser. I consider that my talks in the kampongs are of infinitely more use, when a little practical demonstration can be understood and acted upon. The Malays are exceedingly hospitable, and after I have been invited into a house, it is not long before other women curious to see me also enter soon a little gathering is assembled, and it is on these occasions that I never fail to talk to them about cleanliness and the prevention of disease."

MALAY HOSPITAL, KUALA LUMPUR.

FEMALE WARD.

24. The Lady Medical Officer, Dr. Ahern reports that the majority of the patients treated have been venereal and Gynaecological cases. Great difficulty is experienced in keeping the venereal cases long enough in hospital to carry out tests to satisfy one that anything more than a temporary alleviation was obtained.

GAOL HOSPITALS.

25. The general health of the prisoners has been very satisfactory. The chief diseases prevalent were diarrhoea, malaria and dysentery. The following table gives the total number of cases treated and deaths with percentage of deaths for the past and the current years.

Place.	1920.			1921.		
	Cases.	Deaths.	Percentage.	Cases.	Deaths.	Percentage.
Pudu Gaol, Kuala Lumpur	588	19	3.23	530	7	1.32
Gaol, Taiping	357	21	5.88	672	26	3.86
" Batu Gajah	344	3	.87	559	12	1.93
" Papan	17	1	...	34	1	...
" Lipis	...	...	...	43	...	...
" Seremban	105	2	...	309	7	2.26

The slight increases in Batu Gajah and Seremban are due to the admission of persons of the vagrant class.

INSPECTION OF SCHOOLS.

26. This was undertaken by the Medical Department during the latter half of the year. In the district of Kuala Pilah there is difficulty in visiting all the schools as the distances to be covered are about hundred miles, some miles on foot. On the whole it may be said that the children are fairly healthy but in some districts the spleen rate is rather high. The staff is not sufficient to fully carry out this work and sooner or later it will be necessary to post Medical Officers and Lady Medical Officers whose sole duty will be inspection of schools.

LEPER ASYLUMS.*

LEPER ASYLUM, KUALA LUMPUR.

27. Six hundred and fifty-five were treated during the year and 32 were transferred to Pulau Jerejak. As a rule the patients are only admitted in an advanced stage of the disease—a few cases were selected for treatment and injections of sodium gynocardate and sodium morrhuate were given as well as treatment with oleum chaulmoogra. In some cases there seemed to be slight improvement.

LEPER ASYLUM, PULAU JEREJAK.

Two hundred and thirty-eight lepers were treated in 1921 as compared with 213 in 1920. There were 80 deaths.

LEPER ASYLUM, PULAU PANGKOR LAUT.

This Asylum in the island is for Malays and their co-religionists. It has an accommodation for 57 lepers and the present number is 54, males 32 and females 22. Sixteen new cases were admitted during the year. There were 11 deaths. Treatment with gynocardate of sodium A has been carried out during the last few months and shows somewhat encouraging results.

* It is hoped that in 1922 all the lepers from the Federated Malay States other than Malays will be removed to more suitable locations.

MEDICAL INSTITUTIONS, F.M.S.

States.	Hospitals.	Estate hospitals.	Gaol hospitals.	Lunatic asylums.	Leper asylums.	Dispensaries.	Vagrant and decrepit wards.
Perak ...	23	2	3	1	2	8	2
Selangor ...	11	...	1	...	1	7	2
Negri Sembilan	9	...	1	...	...	3	...
Pahang ...	5	1	2	...	...	6	...

QUARANTINE CAMP, PORT SWETTENHAM.

28. Fifty-one ships with immigrant coolies arrived at Port Swettenham during the year. The total number of immigrants who passed through the quarantine station during the year was 11,238 as compared with 47,561 last year, a decrease of 36,323. The daily average number of immigrants in the camp was 225.77. The largest number on any one day was 1,497. Four thousand one hundred and thirty-eight immigrants received anti-ankylostome treatment. Six hundred and thirty-nine or 5 per cent. of the total number of immigrants were admitted to hospital of these 66 developed lung symptoms. Forty-eight of the lung cases were treated with influenza vaccine and of these 9 or 13.64 per cent. died. There were no cases of infectious diseases except four cases of chicken-pox and one case of measles. Routine treatment was given for ankylostomiasis and malaria.

VETERINARY DEPARTMENT.

RINDERPEST.

29. *Selangor*.—During the year 19 cases of rinderpest with five deaths occurred at Port Swettenham quarantine station amongst cattle newly imported from Siam via Singapore. An outbreak of this disease also occurred at Kuala Kubu in April, there being 17 cases with nine deaths. The origin of these cases was not definitely traced though probably due to buffaloes sent from Port Swettenham to Kuala Kubu for slaughter. During these outbreaks 98 cattle were inoculated with anti-rinderpest serum (three inoculations of 20 cc at intervals of 10 days) out of which eight bullocks contracted the disease but recovered.

30. *Negri Sembilan*.—There were several cases along the boundary near Tampin and Lebok China. Quarantine restrictions were enforced, and 136 cattle in and near Tampin were inoculated. No cases occurred in Negri Sembilan.

FOOT-AND-MOUTH DISEASE.

31. *Selangor*.—Twenty-six cases of foot-and-mouth disease occurred in the Port Swettenham quarantine station amongst newly imported cattle, and 778 cases in Kuala Lumpur and the various outstations, a total of 804 cases. No deaths resulted and animals generally recovered in three weeks or less. The outbreak lasted from July to December.

32. *Perak*.—An outbreak of this disease occurred in Teluk Anson in January. There was a total of 10 cases with no deaths. The outbreak subsided by 24th February.

33. *Negri Sembilan*.—Ninty-nine cases. Outbreaks occurred in Seremban and Ramban districts. There was one death a newly born calf.

34. *Pahang*.—There was an outbreak at Bentong and spread to Raub and Kuala Lipis. The last case was reported on 20th December, 1921. The total number of cases was 165 cattle including 11 buffaloes. There were no deaths. The disease has apparently subsided.

PLEURO-PNEUMONIA.

35. *Perak*.—There were three outbreaks of this disease during the year. The first occurred at Bidor in March. There was a total of 58 cases, of which 56 died and two were destroyed. The last case died on 2nd May. The second outbreak occurred at Batu Gajah in December. Up to end of the year there were 59 cases of which 15 died and 44 were destroyed. The third outbreak occurred at Kampar in December. By the end of the year there were five cases, all of which died.

RABIES.

36. *Selangor*.—Two cases of rabies in dogs were found in Kuala Lumpur, one in January, at Chow Kit Road (which bit a Malay child and a Chinese boy) and one in July at Weld's Hill. At the end of the year muzzling order was rescinded, as no case has then been reported for over six months.

SWINE-FEVER.

37. *Selangor*.—One case was found in a pig imported from Siam. Contacts were slaughtered for food and no further cases occurred.

QUARANTINE STATIONS.

38. *Selangor*.—Port Swettenham—7,449 animals passed through this quarantine station during the year, of which number 2,563 cattle and buffaloes were quarantined for 10 days. At Bukit Sentul, Kuala Lumpur—268 cattle were quarantined and 34 at Kuala Kubu—during the outbreak of rinderpest at that place.

39. *Negri Sembilan*.—Admissions were much reduced.

Tampin	{ Cattle	...	...	...	...	20
	{ Buffaloes	...	...	...	...	6
Seremban	{ Cattle	...	...	...	...	22
	{ Buffaloes	...	...	...	...	74

Buffaloes 23 from Pahang through Sungei Dua station. No cattle arrived by sea.

40. *Pahang*.—There are two regular quarantine stations in Pahang for the prevention of the introduction of disease. The station at the port of Kuantan deals with the introduction of disease by sea. The other station is at Baloh on the line of cattle traffic between Trengganu and Kuantan district.

VETERINARY PRECAUTIONS.

41. One thousand and fifty-nine cases were instituted by the Veterinary Police during the year resulting in 999 convictions. The following table shows the number of cases and convictions for the different States.

				Cases.		Convictions.
Perak	...	...	...	113	...	110
Selangor	...	...	...	650	...	613
Negri Sembilan	...	...	...	218	...	205
Pahang	...	...	...	78	...	71
Total				1,059	...	999

FINANCE.

42. The total revenue collected during the year was as follows:

				1920.		1921.
Perak	...	...	...	\$96,498	...	\$90,964
Selangor	...	...	...	78,356	...	76,921
Negri Sembilan	...	...	...	32,272	...	32,744
Pahang	...	...	...	10,968	...	10,613
Total				\$218,094	...	\$211,242

EXPENDITURE.

The total expenditure under personal emoluments and other charges amounted to \$3,665,438 distributed as follows:

Perak	...	...	...	...	\$1,521,544
Selangor	...	...	...	...	1,212,937
Negri Sembilan	...	...	...	...	623,984
Pahang	...	...	...	...	306,973
					\$3,665,438

STAFF.

43. It is with the deepest regret that the death of Assistant Medical Officers E.R. Keun and S. Manickam is noted.

APPOINTMENTS.

44. The following Officers were appointed during the year: Dr. R. Dowden was appointed Principal Medical Officer, Federated Malay States with effect from 4-11-21; Dr. E. A. O. Travers, Temporary Medical Officer, 1st January, 1921; Dr. Miss Ahern, Lady Medical Officer, 7th May, 1921; Dr. I. W. McBourke, Temporary Medical Officer, 14th June, 1921; Dr. C. T. Darwent, Medical Officer, 5th August, 1921; Dr. W. Young, Medical Officer, 11th November, 1921; Dr. J. P. Fitzpatrick, Medical Officer, 11th November, 1921; Dr. F. V. Jacques, Medical Officer, 25th February, 1921; Dr. J. C. Rowan, Medical Officer, 2nd July, 1921; Dr. R. L. Symes, Medical Officer, 5th November, 1921; Dr. J. G. Catellain, Medical Officer, 3rd December, 1921; Dr. E. B. Jacques, Lady Medical Officer, 25th February, 1921; Dr. L. J. Murphy, Lady Medical Officer, 7th May, 1921; Dr. R. G. Temple, Temporary Medical Officer, 18th April, 1921; Dr. C. B. Pasley, Chief Surgeon, Perak, 1st January, 1921; Dr. P. D. Cilento, Lady Medical Officer, 15th March, 1921; Dr. E. R. Stone, Assistant Medical Superintendent, 15th March, 1921; Dr. R. G. Clements, Health Officer, 4th February, 1921; Dr. O. Pou, Temporary Health Officer, 14th April, 1921.

SISTERS.

Misses C. McCrystal, 15th March, 1921; S. Brown, 15th March, 1921; N. A. Hunter, 29th April, 1921; E. Hammersley, 29th April, 1921; E. A. Haywood, 2nd July, 1921; V. L. Spark, 29th April, 1921; S. A. Taylor, 2nd July, 1921; H. Parsons, 18th June, 1921; M. K. O'Shea, 2nd September, 1921; M. E. M. Couling, 16th September, 1921; E. J. Risdon, 21st September, 1921; C. Borrett, 21st September, 1921; M. A. Abraham, 19th January, 1921.

CHIEF SANITARY INSPECTORS.

W. H. Scott, 4th February, 1921; J. W. Hofflin, 5th March, 1921; O. M. Hale, 25th February, 1921; L. J. Hort, 15th March, 1921; J. Wishart, 15th March, 1921; H. J. Benjafield, 25th February, 1921; E. G. Montford, 23rd March, 1921.

FINANCIAL SECRETARY.

Captain F. Golding was appointed Financial Secretary, Medical Department, Perak, on 1st January, 1921.

TEMPORARY STEWARD AND STOREKEEPERS.

G. Reid, 23rd March, 1921; E. McCutcheon, 12th March, 1921; C. A. Ferguson Davie, 22nd March, 1921.

RESIGNATIONS.

45. Dr. R. G. Clements, 23rd August, 1921; Dr. R. W. Cilento, 25th September, 1921; Dr. P. D. Cilento, 26th September, 1921; Dr. D. F. Brown, service terminated from 2nd April, 1921.

RETIREMENT.

46. Dr. C. L. Sansom, C.M.G., Principal Medical Officer, 3rd November, 1921; Dr. S. P. Peart, Senior Medical Officer, Pahang, 30th June, 1921; Mr. T.A. Ford, Veterinary Surgeon, 26th November, 1921; Dr. A. J. McClosky, Senior Medical Officer, Selangor, 31st December, 1921; Dr. R. Gupta, Assistant Medical Officer, 30th September, 1921.

47. The following reports are attached as appendices:—

- A.—Report of the Malaria Bureau.
- B.— " " Director, Government Laboratories.
- C.— " " Senior Health Officer.
- D.— " " Medical Superintendent, Central Mental Hospital.

KUALA LUMPUR,
4th April, 1922.

R. DOWDEN,
Principal Medical Officer, Federated Malay States.

MALARIA BUREAU ANNUAL REPORT, 1921.

STAFF.

Dr. W. A. Lamborn, who was in charge of the work during the first three months of the year, left on 15th April. Dr. H. P. Hacker returned from leave on 29th March, and is responsible for the rest of the period under review.

The subordinate staff at the beginning of the year consisted of:

Two laboratory assistants, class I;
Four " " " " II;
Eleven collectors;
Two clerks;
Two gardeners;
One peon.

The number of collectors was increased to fourteen in March but it was reduced to nine in October, the latter being the number employed at the end of the year. The senior clerk and librarian, Mr. Sta. Maria, resigned at the end of October and his appointment has not been filled. One of the gardeners was discharged in March, when the Old Museum building was handed over to the Education Department.

EXPENDITURE.

The vote for 1921 was \$28,647, out of which the following was spent:

SALARIES TO SUBORDINATE STAFF	...	...	\$ 9,287
OFFICE EXPENDITURE—			
Sanitary Board bills, light, water, etc.	...	\$ 128.80	
Telephone	...	81.30	
Postage	...	34.20	
Miscellaneous	...	26.50	
			\$ 270
TRAVELLING AND FIELD WORK—			
Fares, etc.	...	\$ 89.63	
Car maintenance	...	1,297.14	
Bicycle allowance	...	1,102.40	
Night allowance	...	66.25	
Clothing and boots	...	734.00	
			\$ 3,289
LABORATORY EQUIPMENT—			
Apparatus	...	\$6,343.43	
Repairs and alterations	...	551.47	
Upkeep of grounds	...	15.44	
			\$ 6,916
LIBRARY	...		648
PUBLICATION OF REPORTS	...		1,583
			\$21,995 *

The expenditure sanctioned for 1922 is \$22,914.

WORK DONE AND SUMMARY OF RESULTS.

Monthly progress reports have been submitted throughout the year and the present report is a review of the subjects mentioned in those reports.

FIGURES RELATING TO FIELD AND LABORATORY WORK.

The monthly figures are recorded separately in Appendix A, and the following are the totals for the year:

Breeding places described	...	797
Larvae identified microscopically	...	95,944
Adults bred out and identified	...	18,340
Adults caught in houses	...	16,668
Adults tested for egg-laying capacity	...	1,458

* The discrepancy in this total is due to the omission of cents.

DR. LAMBOURN'S WORK.

During the first three months much important work was done mainly on the distribution of anophelines and on the seasonal prevalence of species. The results suggested that the distribution of species may depend on the nature of the food material available in the breeding places, that is, on the algae and other microscopic organisms, and that these in their turn possibly depend on differences in the chemical constituents of the water.

A striking example, based on observations extending over four months, is described in the Monthly Report for February. Two breeding places were studied, one a swamp with clean water and the other a fish pond with organically polluted water. In the swamp, 6,318 out of 13,090 larvae were *A. aconitus*, whereas in the fish pond only two out of 7,719 larvae were that species. The algae were found to be different in the two places, and it certainly seems likely that the difference between both the algal flora and the mosquito fauna may depend on differences in the chemical constituents of the waters.

It was also suggested that a periodicity in the development of the algal flora might give rise to a seasonal prevalence of various species of anophelines. Accordingly a large series of routine observations on the species caught at certain definite places was instituted, in order to determine whether there is seasonal prevalence, if so its nature, and whether the various species are capable of breeding all the year round. These observations were made twice a week, the larvae being studied in the swamp and fish pond already mentioned, and adults being caught in huts on the bank of the swamp, in a house on Petaling Hill, and in the Malaria Advisory Board coolie lines, Loke Yew Road.

This work is long and arduous since its value largely depends on the observations being regular and continuous over a period of years, but it is of the utmost importance in relation to the seasonal prevalence of malaria and its cause. It has been continued, therefore, as the main activity of the Bureau.

SEASONAL PREVALENCE OF SPECIES.

Collection of adults and larvae twice a week from the places chosen by Dr. Lamborn has proceeded throughout the year. The results have been analysed and classified in weekly and monthly groups, and studied in relation to the rainfall (G. H. figures). No definite correlation between species and the rainfall could be established, and no very definite seasonal prevalence of any species can be made out, but the rainfall was very uniformly distributed throughout the year, and in a year with more definite dry periods different results may possibly be obtained.

Tables I-V in Appendix B show the proportion of the various species found each month at the five observation stations. In order to render the monthly figures for each species comparable, they have been shown in the tables as percentages of the total monthly catch, but the total number caught on which these percentages are calculated has been also shown in every case. Points of interest in the figures have been commented on in the tables and may be summarised as follows:

1. The figures for swamp and fish pond confirm Dr. Lamborn's observation on the difference between the mosquito faunae, and show that it has been constant throughout the year, thus:

SWAMP.—(vide TABLE IV).—

Total anophelines	...	...	...	30,439
Number of <i>A. aconitus</i>	...	...	...	16,118=53 per cent.

FISH POND.—(vide TABLE V).—

Total anophelines	...	...	...	27,856
Number of <i>A. aconitus</i>	...	...	...	5=0.02 per cent.

2. There is a general slight increase in percentage of the large pool breeders *A. barbirostris* and *A. hyrcanus* in the early part of the year, and of the small pool breeders *A. vagus* and *A. kochi* in the latter part of the year. This is most marked in Tables I and V, but is seen to a varying extent in each of the tables.

3. The increase in frequency of *A. umbrosus* and *A. leucosphyrus* in the first quarter of the year as shown in Tables I and II is interesting.

4. In Table IV, *A. tessellatus* larvae appear in July for the first time and remain throughout the rest of the year, increasing to a maximum in November. Table III shows a great corresponding increase in the number of adults caught in the same neighbourhood during the latter part of the year. On the other hand in Tables I and II, *A. tessellatus* is seen to be more numerous in the early part of the year.

5. The complete absence of the larvae of certain species throughout the year is of interest with regard to the selection of breeding places by anophelines, thus:

- (a) neither *A. maculatus* nor *A. karwari* was ever found in either the swamp (Table IV) or the fish pond (Table V) and
- (b) not one of the shade breeders was found in the open fish pond (Table V).

SEASONAL BREEDING OF ANOPHELINES.

In continuation of Dr. Lamborn's work, adult anophelines caught in houses have been tested each month, to see whether they were capable of laying fertile eggs throughout the year. Of course in this work much depends on the facility with which material, that is, adult females at the egg laying stage, can be obtained; and therefore negative results have no meaning, only positive findings have any value.

The species actually proved to be capable of laying fertile eggs in each month of the year were *A. vagus* and *A. aconitus*. The following species gave positive results during most of the year.—

<i>A. fuliginosus</i>	every month except March
<i>A. tessellatus</i>	„ „ March and April.
<i>A. hyrcanus</i>	„ „ July and August.
<i>A. barbirostris</i>	„ „ October and November.

The converse part of the problem, that is, whether the various species are capable of developing from larvae into adults at all periods of the year, is also important in view of the possibility of a resting period in the larval stage, such as is suggested in the following section of this report. There are no data on this subject for the early part of the year because the routine rearing of adults was abandoned, such entire reliance for identification of species being laid on the examination of larvae that in March no adults were reared from larvae.

During the last eight months the full technique for species identification has been reintroduced and data is available on this subject. *A. barbirostris*, *A. hyrcanus*, *A. aconitus*, *A. fuliginosus*, *A. leucosphyrus*, *A. kochi*, *A. vagus* and *A. maculatus* have been proved to be capable of developing into adults in each of these months, and *A. asiaticus* and *A. aitkeni* in each month except May and October respectively. Here again only positive results are of any value for obvious reasons, thus, *A. ludlowi* might well appear in the above list if suitable material had been available throughout the year.

It is too soon to form any conclusion on this subject, but the general impression obtained in doing this work is that there is no definite breeding season for the different species of anophelines, but that they will breed when and where the natural conditions are suitable. Even if this is the conclusion that will be ultimately reached from this part of the work, there will still remain the problem of the conditions which affect seasonal prevalence of species if this is proved to exist.

ABNORMAL LENGTH OF LARVAL STAGE.

During the year interesting observations were made on the longevity of certain larvae of *A. asiaticus*.

At the time of writing one larva collected on 6th June, 249 days ago, is still alive, and four larvae collected on 8th August are still alive and 186 days old. On 19th January, 1922, four larvae were killed accidentally by workmen in the laboratory. They had been caught in June and July and had lived 205, 191, 187 and 187 days respectively.

That these long-lived larvae do sometimes pupate and develop into adults is shown by the following table:

Date caught.	Date pupated.	Date of emergence.	Sex.	Length of life as larvae.
15-7-21	26-12-21	30-12-21	F	163 days
15-7-21	26-12-21	29-12-21	F	163 „
8-8-21	12-10-21	16-10-21	M	64 „
24-1-19	22-3-19	26-3-19	M	56 „
15-7-21	7-9-21	11-9-21	M	53 „

On the other hand all larvae of *A. asiaticus* do not appear to be so long-lived, for many pupated and hatched within a week of being caught. Both series, "normal" and "long-lived", were kept under exactly the same conditions, in their natural water and with plenty of food material. The only experimental investigation into the cause of this abnormality, done up to the present, has been to keep a batch of the larvae in the dark room; on the supposition that light, which they do not get in their natural habitat, might inhibit their development. Certain of these larvae, however, lived for a long period in the dark: for example, of three larvae placed in the dark on 8th August, 1921, one pupated on 12th October, 1921 and pupated on 16th October, 1921, and two died as larvae on 2nd October, 1921 and 27th October, 1921, respectively.

A possible clue as to the reason for the phenomenon is that the majority of the long-lived larvae were obtained solitary, while the majority of the larvae with a normal larval stage were obtained in batches. It is possibly an example of delayed development of the larval stage in order to overcome some unfavourable natural condition, but much further investigation of this point is required.

TYPE COLLECTION.

An addition was made to the type collection by the discovery of *A. watsoni* in June. Only the adult of this species had been known previously, and its larva and breeding place are now described for the first time. The larvae are extremely like those of *A. leucosphyrus* and cannot be distinguished from them with certainty; in fact, they were identified as *A. leucosphyrus* until the adults were bred out and proved to be *A. watsoni*. The only point of difference that could be made out was that the external occipital hair is simple in *A. watsoni*; whereas in *A. leucosphyrus*, it is branched as described by Stanton (Bull. Entom. Res. Vol. VI, 1915, p. 168). This point was constant in a series of six larval skins of *A. watsoni* with the exception that in one specimen one of the hairs was slightly branched at the tip. The larvae were found in fallen split bamboos at Ulu Gombak together with the larvae of *A. leucosphyrus* and *A. asiaticus*.

Some of the adult females hatching from *A. leucosphyrus* larvae, obtained from these breeding places, showed the relatively short palps and narrow white bands of the form described by Edwards (Bull. Entom. Res. Vol. XII, 1921, p. 70) as *A. leucosphyrus* var. *hackeri*. Moreover the leucosphyrus-like larvae showed a tendency to vary, particularly in the posterior clypeal hair which was often branched; and although this was most marked in the var. *hackeri* and *A. watsoni*, it was also seen in the larvae which hatched out into the usual form of *A. leucosphyrus*. *A. leucosphyrus* usually breeds in pools along the course of jungle streams and it is interesting to note its tendency to vary, both in its larval and adult stage, when it is found in an abnormal breeding place.

The facts just described lend support to a far seeing idea expressed verbally by Dr. Stanton, at a time when *A. watsoni* was only known by two or three sporadic adult specimens, that *A. watsoni* might prove to be some kind of mutation or variation of *A. leucosphyrus*. It seems possible that the unusual character of the breeding place may be the cause of the variation of *A. leucosphyrus* into the two forms var. *hackeri* and *A. watsoni*, but there is no direct proof.

Specimens of male and female, and corresponding larval skins, of *A. watsoni* have been sent to the British Museum and the Central Malaria Bureau, Kasauli.

A new type of aitkeni-like larva which may turn out to be the *A. aitkeni* var. *insulae florum* of Swellengrebel or *A. culiciformis* (Coghill) has also been found recently, but no adult female has been obtained as yet. A difference in distribution of the three known types of *A. aitkeni* larvae was detected on an expedition up Bukit Kutu. All the 51 larvae collected from nine places at the top of the hill showed the "trident" or "pronged" type of internal anterior clypeal hair, whereas from six places at the foot and lower parts of the hill, out of 23 larvae, 15 were "pinnate", six were "forked" and only one was "trident".

Sets of specimens illustrating the larval and adult stages of the commoner species of anophelines have been prepared for distribution. Complete sets have been sent to:

Health Officer, Perak North;

Dr. V. G. Heiser, International Health Board, New York;

Dr. M. O. T. Iyengar, Malaria Research Laboratory, Calcutta;

Dr. J. S. C. Elkington, Quarantine Officer, Brisbane;

and collections of special material have been sent to:

Major S. R. Christophers, Central Research Institute, Kasauli;

Mr. F. W. Edwards, British Museum, London;

Mr. A. Bacot, Lister Institute, London.

ASSOCIATION TABLES.

The data for these tables (M. B. Reports, Vol. II) are steadily increasing but revision of the tables will only be necessary about once in three years. The main alteration arising out of the past year's work is that *A. asiaticus* is no longer a species found solely by itself. In its typical breeding place, bored bamboos which are still growing, no other species has been found up to the present; but as it has been found outside this specialised breeding place, namely, in dead split bamboos, it acquires as associates *A. leucosphyrus* and *A. watsoni*, species also found in these situations.

ARTIFICIAL BREEDING PLACES.

Anopheline larvae have been found twelve times in artificial or domestic collections of water, but the problem remains much as it is stated in M. B. Reports, Vol. II, pp. 25-28. An exception to those results, however, is the finding of large pool breeders in small collections of water, thus *A. barbirostris* and *A. hyrcanus* were found in a broken cooking pot, and *A. barbirostris* and *A. fuliginosus* were found in two latex cups.

A group of four disused buckets all contained *A. leucosphyrus*, a finding very similar to the group of *A. leucosphyrus* described in the Reports.

The small pool breeder *A. kochi* was found twice, once in a latex cup and once in an earthenware jar.

The shade breeder *A. tessellatus* was found in a disused water cart which was covered by decaying palm leaves, the debris from which had contaminated the water. The breeding place was thus very like the natural conditions in which this species breeds.

A. ludlowi was found in the bilge water of one Chinese boat at Port Swettenham, and *A. ludlowi* and *A. vagus* in another boat.

OUT-BREAK OF FLIES.

An out-break of flies at the District Hospital was investigated, on the instruction of the Principal Medical Officer, and a report was issued on 23rd May, 1921. The main interest of the work was that the common house fly, *Musca domestica*, was found breeding freely in cow dung which is rather an unusual breeding place for that species. Capt. H. M. Pendlebury, Entomologist to the F.M.S. Museums, kindly confirmed the identification of this species.

TRAPS FOR MOSQUITOS.

Some work was done on the devising of traps for adult anophelines but the results were very disappointing. A preliminary report on the experiment was issued on 20th July, and the work is held in abeyance until a more convenient time.

WORK ON OILING.

This has been continued and has been combined with visits to estates to study oiling in the field. The main interest has been the determination of the conditions under which when either crude oil or kerosene is placed on water in a petri dish, it sometimes remains as a circular button or blob over 1 mm. thick, and sometimes spreads widely into a thin film. In the early experiments it was found impossible to produce uniform films, anything from the thickest blob to the thinnest film being obtained from the same amount of oil; and the discovery of the cause of these variations in spread is perhaps the most important advance during the year.

Pure paraffin, however, never spreads when placed on water, and an interesting line of work, which is still proceeding, is the study of the substances which when added to pure paraffin enable it to spread. Paraffin is thus being used as the test for estimating the spread producing value of various materials.

It is hoped that the results of these experiments will be ready for publication in 1922.

PUBLICATIONS AND REPORTS.

Volume II of Malaria Bureau Reports arrived in May and 607 copies have been distributed. Thirty-four copies of Vol. I have also been sent out.

Dr. Lamborn published papers on "The Nature and Function of the Caudal Tufts of Malayan Anopheline Larvae" and on "A Protozoon Pathogenic to Mosquito Larvae". From material on which the latter paper was based D. Keilin, Sc.D., has described the protozoon under the name *Lambornella stegomyiae* and a new fungus under the name *Coelomonomyces stegomyiae*.

Appendix C shows details of the publications and reports issued during the year.

VISITS.

During the year forty-eight visits have been registered. A most stimulating visit was received from Major S. R. Christophers, I.M.S., of the Central Malaria Bureau, Kasauli. Most of the mounted specimens were looked through from a critical standpoint and much material was exchanged,—the Bureau gaining a valuable collection of Indian species.

The Bureau was visited by the Chief Secretary, the Director-General of Medical and Sanitary Services, the Principal Medical Officer and the Director of Government Laboratories in connection with a scheme for reorganisation of the work. As a result of their deliberations the Bureau came, at the end of the year, under the supervision of the Director of Government Laboratories as a part of the Institute for Medical Research.

H. P. HACKER,
Malaria Research Officer.

11th February, 1922.

APPENDIX A.

Figures relating to field and laboratory work.

Month.	Breeding places described.	Larvae identified microscopically.	Adults bred out and identified.	Adults caught in houses.	Adults tested for egg laying capacity.
January ...	16	7,774	430	1,727	88
February ...	—	6,594	173	1,532	81
March ...	6	6,384	—	1,536	98
April ...	25	8,233	255	1,560	134
May ...	2	9,055	801	1,187	108
June ...	25	12,196	1,696	597	123
July ...	59	11,619	3,945	971	121
August ...	89	8,259	2,835	1,722	124
September ...	113	8,034	2,364	1,594	138
October ...	216	8,098	3,031	1,745	150
November ...	155	5,885	1,481	1,186	160
December ...	91	3,813	1,329	1,311	133
Totals ...	797	95,944	18,340	16,668	1,458

APPENDIX B.

TABLE I.

Adult anophelines caught at the Malaria Advisory Board cooly lines, Loke Yew Road.

Month of Year 1921.	Total number caught on which the percentage is calculated.	Percentage monthly catch for each species.											
		Large pool or open swamp breeders.					Shade Breeders.			Small pool breeders.			
		<i>A. bachirostris.</i>	<i>A. hyrcanus.</i>	<i>A. crucians.</i>	<i>A. fuliginosus.</i>	<i>A. subpictus</i> var. <i>malayensis.</i>	<i>A. leucosphyrus.</i>	<i>A. umbrosus.</i>	<i>A. tessellatus.</i>	<i>A. vagus.</i>	<i>A. kochi.</i>	<i>A. maculatus.</i>	<i>A. koraneri.</i>
January ...	459	.2	1.3	19.6	.2	1.1	.2	...	2.6	71.5	2.8	.4	
February ...	372	.5	.6	15.9	...	.3	...	.3	1.3	81.2			
March ...	441	.5	5.4	2.7	...	1.4	...	.2	.2	89.6			
April ...	836	.9	1.7	5.5	...	.6	...	...	.4	89.9	.6	...	.4
May ...	523	.2	1.0	2.6	.2	1.3	...	...	.4	93.3	.8	.2	
June ...	209	...	3.3	2.4	.5	2.4	...	...	...	90.9	...	.5	
July ...	603	...	.2	1.7	...	.3	...	...	...	97.8			
August ...	1,213	...	.1	.1	...	.2	...	...	...	99.4	.2		
September ...	1,096	...	.2	.1	...	.2	...	...	...	99.4	.1		
October ...	1,034	...	...	...	...	...	...	...	...	100.0			
November ...	692	...	.3	1.9	...	...	...	...	.6	96.7	.4	.1	
December ...	645	.2	.2	1.2	...	...	...	...	...	98.1	.2	.2	
Total Specimens ...	8,123	15	65	259	3	36	1	2	27	7,677	29	6	3
Percentage for the year	...	.2	.7	3.2	.04	.4	.01	.02	.3	94.5	.4	.07	.04

REMARKS.

- (1) The large pool breeders are slightly more prevalent in the first part of the year than in the second.
- (2) The small pool breeders increase in the second half of the year, reaching a maximum in October when all of 1,034 caught were *A. vagus*.
- (3) The jungle breeders *A. leucosphyrus* and *A. umbrosus* were only found in January, February and March.
- (4) *A. tessellatus* was more frequent in the first half of the year.

APPENDIX B—(cont.)

TABLE II.

Adult anophelines caught at Quarters No. 562, Petaling Hill.

Month of year 1921.	Total number caught on which the percentage is calculated.	Percentage monthly catch for each species.											
		Large pool or open swamp breeders.					Shade breeders.			Small pool breeders.			
		<i>A. barbinotris.</i>	<i>A. hyrcanus.</i>	<i>A. acoutus.</i>	<i>A. fuliginosus.</i>	<i>A. subpictus</i> var. <i>malayensis.</i>	<i>A. leucosphyrus.</i>	<i>A. umbrinus.</i>	<i>A. tessellatus.</i>	<i>A. vagus.</i>	<i>A. kochi.</i>	<i>A. maculatus.</i>	<i>A. karicari.</i>
January ...	483	2.7	.8	84.9	.8	...	...	...	.4	7.0	2.9	.2	.2
February ...	285	5.3	1.5	56.1	4.2	.4	.4	17.2	.7	12.3	1.4	.7	...
March ...	380	6.8	6.8	39.5	3.4	...	.5	17.6	1.3	21.6	2.1	.3	...
April ...	213	6.6	4.2	33.3	10.8	...	...	8.9	1.4	32.9	1.4	...	.5
May ...	353	1.1	3.7	40.5	33.4	.3	...	6.5	.9	13.0	.6	...	...
June ...	150	1.3	3.4	19.3	52.6	.7	...	6.7	.7	14.0	...	.7	.7
July ...	108	1.9	4.7	30.6	42.6	...	...	2.8	...	15.7	1.9	...	...
August ...	256	1.6	.4	12.1	9.8	...	...	...	...	75.7	.4	...	...
September ...	151	1.3	1.3	10.6	25.2	...	...	.7	...	58.9	2.0	...	...
October ...	269	.7	1.5	13.4	49.8	...	...	.4	1.1	32.3	.7	...	...
November ...	223	2.7	.9	27.8	45.3	...	...	3.1	...	16.6	2.7	...	.9
December ...	414	3.1	.4	33.8	24.6	...	...	1.0	.2	34.3	1.7	...	.7
Total Specimens ...	3,285	103	77	1,281	695	3	3	184	20	854	52	5	8
Percentage for the year ...	...	3.1	2.3	39.0	21.2	.1	.1	5.6	.6	26.0	1.6	.2	.2

REMARKS.

- (1) The results as regards the large and small pool breeders are similar to those of Table I, but are not quite so marked.
- (2) The increase of *A. umbrinus* and the appearance of *A. leucosphyrus* in February and March coincides with what is seen in Table I.
- (3) *A. tessellatus* is more common in the first half of the year as in Table I.

APPENDIX B—(cont.)

TABLE III.

Adult anophelines caught in huts beside the Campbell Road Swamp, from which swamp the larvae shown on Table IV were collected.

Month of Year 1921.	Total number caught on which the percentage is calculated.	Percentage Monthly Catch for Each Species.											
		Large pool or open swamp breeders.					Shade breeders.			Small pool breeders.			
		<i>A. barbirostris</i> .	<i>A. hyrcanus</i> .	<i>A. aeneitus</i> .	<i>A. fuliginosus</i> .	<i>A. subpictus</i> var. <i>malayensis</i> .	<i>A. leucophrys</i> .	<i>A. umbrosus</i> .	<i>A. tessellatus</i> .	<i>A. vagus</i> .	<i>A. kochi</i> .	<i>A. maculatus</i> .	<i>A. karicari</i> .
January ...	776	.4	.6	95.5	...	.1	...	...	2.8	.1	.4		
February ...	851	...	.6	98.1	...	...	...	...	.7	.2	.3		
March ...	698	.3	.4	98.7	...	...	...	...	.6				
April ...	465	...	1.9	93.7	...	...	...	...	1.1	3.0	.2		
May ...	244	...	1.2	93.8	.8	...	...	...	1.2	2.9			
June ...	186	.5	.5	96.8	...	...	...	...	2.2				
July ...	253	...	1.2	84.2	...	...	...	...	13.0	.8	.8		
August ...	247	...	.4	74.5	...	...	...	...	16.6	8.5			
September ...	333	...	...	67.3	...	...	...	...	25.8	6.0	.9		
October ...	404	.5	...	74.3	...	...	...	...	23.0	1.7	.5		
November ...	265	...	...	82.6	...	...	...	...	12.1	5.3			
December ...	317	...	2.8	73.2	...	...	...	...	7.9	15.8	.3		
Total * Speci- mens ...	5,039	8	39	4,482	2	1	...	...	354	138	15		
Percentage for the year		.2	.8	88.9	.04	.02	...	...	7.0	2.7	.3		

REMARKS.

- (1) The same slight increase in proportion of large pool breeders in the first part of the year, and of the small pool breeders in the latter part of the year, as seen in Tables I and II is evident here.
- (2) In contrast to the previous tables, however, *A. tessellatus* increases in the second half of the year. This agrees with the larval findings from the neighbouring swamp which are shown in the following Table IV.
- (3) Adults of *A. maculatus* and *A. karicari* were not found in the neighbourhood of this swamp in contrast to their presence in Tables I and II.

APPENDIX B—(cont.)

TABLE IV.

Anopheline larvae caught in the Campbell Road Swamp.

(For adults caught in the neighbourhood of this swamp see Table III.)

Month of Year 1921.	Total number caught on which the percentage is calculated.	Percentage monthly catch for each species.											
		Large pool or open swamp breeders.					Shade breeders.			Small pool breeders.			
		<i>A. barbirostris</i> .	<i>A. hyrcanus</i> .	<i>A. aconitus</i> .	<i>A. fuliginosus</i> .	<i>A. subpictus</i> var. <i>malayensis</i> .	<i>A. leucophrys</i> .	<i>A. umbrosus</i> .	<i>A. tessellatus</i> .	<i>A. vagus</i> .	<i>A. kochi</i> .	<i>A. maculatus</i> .	<i>A. karwari</i> .
January ...	4,579	30.9	16.0	50.5	2.6	...	...	...	...	...	.04		
February ...	1,968	47.7	14.3	31.3	6.7	...	...	...	...	...			
March ...	2,525	48.4	13.9	31.6	6.1	...	...	...	...	.03			
April ...	1,906	21.7	29.1	46.3	2.9	...	.05	...	...				
May ...	2,443	24.4	12.2	58.9	4.5	...	...	...	...				
June ...	2,933	28.5	9.2	51.5	10.8	...	...	...	...				
July ...	3,049	24.0	5.8	66.0	4.1	...	...	...	.1	.03			
August ...	2,182	17.5	2.2	79.1	1.0	...	...	...	.3				
September ...	2,411	22.7	1.9	73.8	1.6	...	...	...	.04				
October ...	2,730	43.7	3.7	49.5	2.5	...	...	...	.2	.4	.03		
November ...	1,853	30.3	14.3	50.6	1.1	.1	...	...	2.1	.6	1.1		
December ...	1,860	34.3	17.2	40.6	7.5	...	...	...	.1	...	.3		
Total Speci- mens ...	30,439	9,472	3,443	16,118	1,295	1	1	...	57	23	29		
Percentage for the year		31.1	11.3	53.0	4.2	.003	.003	...	.2	.1	.1		

REMARKS.

- (1) The large pool breeders form practically the whole of the fauna, but even here *A. barbirostris* and *A. hyrcanus* are a little more prevalent in the earlier part of the year.
- (2) The small pool breeders, although few, are more often found in the latter part of the year.
- (3) The appearance of *A. tessellatus* larvae in the second half of the year is probably associated with the marked increase of adult *A. tessellatus* caught in the neighbourhood *vide* Table III.
- (4) The large proportion of *A. aconitus* throughout the year is in marked contrast to its rarity in the fish pond *vide* Table V. This feature was pointed out by Dr. Lamborn in February.
- (5) The absence of *A. maculatus* and *A. karwari* in this swamp is of interest.

APPENDIX B—(cont.)

TABLE V.

Anopheline larvae caught in a fish pond at Pudu.

Month of Year 1921.	Total number caught on which the percentage is calculated.	Percentage monthly catch for each species.											
		Large pool or open swamp breeders.					Shade breeders.			Small pool breeders.			
		<i>A. barbirostris.</i>	<i>A. hyrcanus.</i>	<i>A. acutus.</i>	<i>A. fuliginosus.</i>	<i>A. subpictus</i> var. <i>malayensis.</i>	<i>A. leucophrys.</i>	<i>A. umbrinus.</i>	<i>A. tessellatus.</i>	<i>A. vagus.</i>	<i>A. kochi.</i>	<i>A. maculatus.</i>	<i>A. karicuri.</i>
January ...	1,895	45.6	41.9	.1	.1	.4	...	...	...	11.8			
February ...	2,445	15.1	78.2	...	.5	...	...	...	...	6.2			
March ...	2,069	5.4	78.5	...	.7	.05	...	...	...	15.3			
April ...	2,642	9.9	62.6	.04	.7	.6	...	...	...	26.2			
May ...	2,775	9.8	84.5	.04	1.9	.3	...	...	...	3.5			
June ...	2,406	13.1	80.5	...	1.4	.08	...	...	...	5.0			
July ...	2,922	7.8	68.7	...	.3	.03	...	...	...	23.1			
August ...	2,489	.6	2.3	.04	.3	.04	...	...	...	96.5	.2		
September ...	2,691	9.3	6.3	...	.2	...	...	...	...	84.3			
October ...	2,412	.04	.2	...	...	...	...	...	...	99.7	.08		
November ...	2,378	3.6	4.4	...	2.6	.3	...	...	...	87.9	1.3		
December ...	1,232	8.6	18.5	...	.2	.2	...	...	...	71.9	.7		
Total Specimens ...	27,856	2,648	12,629	5	219	41	...	...	...	12,268	46		
Percentage for the year	...	9.5	45.3	.02	.8	.1	...	...	...	44.0	.2		

REMARKS.

- (1) Here again the large pool breeders are more prevalent in the first part of the year, and the small pool breeders increase markedly towards the end of the year.
- (2) The complete absence of shade breeders and of *A. maculatus* from this open pond is of interest.

APPENDIX C.

REPORTS AND PUBLICATIONS ISSUED FROM THE BUREAU.

BY DR. LAMBOEN.

Monthly Reports from January to March.

Annual Report for 1920.

Three Reports on specimens submitted for identification.

"The Nature and Function of the Caudal Tufts of Malayan Anophelines." Bulletin of Entomological Research, Vol. XII, part I.

"A Protozoon Pathogenic to Mosquito Larvae." Parasitology, Vol. XIII, No. 3.

In the same publication there appear the two following papers by D. Keilin, Sc.D., describing the material on which this paper was based:

"On a New Ciliate: *Lambornella stegomyiae* N.G., N.Sp., Parasitic in the Body-cavity of the Larvae of *Stegomyia scutellaris* Walker (Diptera, Nematocera, Culicidae)."

"On a New Type of Fungus: *Coelomomyces stegomyiae* N.G., N.Sp., Parasitic in the Body-cavity of *Stegomyia scutellaris* Walker (Diptera, Nematocera, Culicidae)."

BY DR. HACKER.

Monthly Reports from April to December.

Report on the first six months of 1921.

Twelve Reports on specimens submitted for identification.

Report on an Out-break of Flies at the District Hospital, 23rd May, 1921.

Preliminary Report on Traps for Mosquitos, 20th July, 1921.

ANNUAL REPORT OF THE INSTITUTE FOR MEDICAL RESEARCH FOR THE YEAR 1921.

1.—QUININE AND MALARIA.

During the year enquiries were made into the occurrence of quinine-resistant cases of malaria, and into the most suitable form of administering quinine and the total alkaloids of cinchona bark. These investigations are still in progress and a more detailed report will be furnished when they have been completed.

QUININE-RESISTANCE.

The majority of the Medical Officers in the British army who were called upon to treat malaria during the great war had never encountered the disease before, but all of them had been taught that it was one of the few diseases for which there exists a drug which is a specific cure, namely quinine. Consequently they entered upon the treatment of malaria with light hearts, fully expecting that they could cure it in a few days with two or three doses of quinine. They were grievously disappointed when they found that most of their patients were not cured and that many become worse instead of better.

They felt that they had been deceived and that quinine was useless. Numerous letters and papers were published showing that ten, twenty or even thirty per cent. of malarial infections were resistant to quinine. It was not realised that to cure malaria, quinine must be given regularly every day, for a long period, and that the British soldier avoided taking it whenever he could. Civilians are no better in this respect, and one nation is as bad as another. Terburgh writes of his experience in Java "If one permits the presence of but one small opening in the net through which the patient can wriggle it will become a matter of sport to squirm through it, to avoid quinine treatment".

In the treatment of trypanosomiasis with atoxyl, though the drug acts well at first and kills most of the parasites in the body, a few remain and from these springs a new generation of trypanosomes which are unaffected by the drug, so that the patient no longer benefits by its administration. These resistant trypanosomes, Erlich called "atoxyl-fast". Similarly many people who have had experience of malaria consider that when it is inadequately treated by quinine, a race of quinine-resistant parasites may develop which they term "quinine-fast", and they state that a patient who harbours such parasites is no longer benefitted by quinine.

The following paragraph from the Annual Report of the Nairobi Laboratory (1918) is given as an illustration of this hypothesis. "The blood of certain patients, slides from whom were sent to control treatment, would turn up positive with distressing frequency showing the ineffectiveness of treatment once parasites have been allowed to become quinine-fast".

Quinine resistance is held to be of two kinds; the drug is supposed to fail either because the patient is too weak and debilitated to overcome the disease, or because the parasites have become quinine-fast from prolonged administration of the drug.

It is clearly of great importance to us in this country, where malaria is common, to determine if the above views are correct and if there are cases which resist treatment with quinine.

Some years ago, as the result of experience in the treatment of a large number of cases in the General Hospital at Kuala Lumpur, we came to the conclusion that when a case of malaria appeared to be uninfluenced by quinine, it was either because the dresser did not give it to the patient or because the patient managed to avoid swallowing it. There may be other reasons for the apparent failure of quinine. Sometimes although the dose is given and swallowed, it fails to cure because it has been adulterated. When the Commission of the Rockefeller Foundation was working in Kuala Lumpur they discovered that a sample of quinine which they employed had been grossly adulterated. In 1918, Dr. Glennie, the Municipal Health Officer of Singapore, found that the quinine on sale in some of the dispensaries in that town had been adulterated to the extent of 50 per cent. Sometimes the fault lies with the dispenser, but his mistakes rarely come to light unless, as in a case which occurred some five years ago, he dispenses a poisonous drug such as strychnine in place of quinine.

But apart from these causes of failure in treatment, many authorities believe that malaria resists treatment by quinine in a large proportion of cases, in the sense that while the patients are taking as much as twenty grains every day, they continue to have attacks of fever with asexual parasites in the peripheral blood.

During the war we investigated a number of apparently quinine-resistant cases which occurred among soldiers who had been infected in Macedonia, Egypt and other parts of the world; but we found that in every instance the disease responded to treatment with

quinine. Only a few of these men were very ill at the time we saw them, and they were all being well nursed and well fed; consequently the objection was raised that quinine-resistance is unlikely to occur under such conditions, and that it should be looked for among debilitated people, saturated with malaria who have undergone great privation and hardships. Recently the opportunity occurred to study the question of quinine-resistance among such a group of people. By the courtesy of the Medical Officer in charge, we were permitted to examine a number of cases admitted to the District Hospital in Kuala Lumpur; most of them were vagrants, thrown out of work in consequence of the low price of rubber, who had been wandering about the country with no money and very little to eat. Some of them were little more than skeletons, and over 53 per cent. were suffering from dysentery.

We considered that the most satisfactory way of approaching the question was to treat and examine a few patients very thoroughly ourselves, rather than to attempt the investigation of a large number treated and examined by others.

The routine treatment of malaria in the District Hospital at Kuala Lumpur consists of ten grains of quinine sulphate in solution, three times a day, and for the purposes of our enquiry we considered as a quinine-resistant case any patient who still had malaria after he had been on this treatment for a week or more.

More than 27 per cent. of the malaria patients treated in the hospital appeared to be quinine-resistant in this sense. We investigated 44 such cases, but none of them proved to be truly quinine-resistant; in one instance a small number of parasites persisted in the peripheral blood without fever, in spite of quinine, but in all the others, both the fever and the parasites disappeared under regular treatment with quinine administered by ourselves. The quinine employed in the routine hospital treatment was of good quality and we were driven to the conclusion that the reason why the disease had resisted treatment in these cases, before they came under our care, was that the patients had not been swallowing the quinine which had been prescribed for them.

The routine procedure, which we adopted, was to give ten grains of quinine twice a day (sulphate, bi-hydrochloride or cinchona febrifuge) over a period of four weeks. The quinine was placed by Dr. Fletcher, in the patient's mouth, which was inspected after he had swallowed, to make sure that there was no evasion. The date and hour of administering the dose was then noted and initialled, on a slip of paper at the head of the patient's bed. Frequent examinations of blood-films were made by the Protozoologist, Miss Jepps, and by the Assistant Surgeon, Mr. A. Visuvalingam. An average of nineteen blood-films and four thick films was examined in each case during the four weeks of treatment.

Some of the forty-four supposed quinine-resistant patients had been undergoing the routine hospital treatment for a considerable time with little or no benefit. Twenty-one had received routine treatment for more than one week but less than two weeks, thirteen for more than two weeks but less than four, and ten for more than four weeks. When we gave these patients quinine ourselves, and saw that they swallowed it, their temperatures quickly became normal and, except in the one case mentioned above, the parasites rapidly disappeared from the peripheral blood.

As we have stated before, the conclusion was forced upon us that the patients whose fever resisted the routine hospital treatment, were resistant because they were not swallowing the quinine which they were supposed to be taking. The following case is given as an example of many similar instances. We examined blood-films from a patient named Tan Siong on the twenty-fourth day of his routine hospital treatment, (thirty grains of quinine daily) and we found an average of 2.2 subtertian ring parasites in each field of the microscope. We gave him ten grains of quinine twice a day and saw that he swallowed it, with the result that after three days he had no fever and no parasites, nor did they recur during the subsequent four weeks of his treatment; at the end of this time he had gained ten pounds in weight and his haemoglobin had increased by ten per cent. The improvement in general health was a marked feature in most of the pseudo-quinine-resistant patients while they were under our treatment. At the commencement of treatment the average percentage of haemoglobin was 61; at the end of four weeks it was 74. The average weight of adults was 88 lbs. (six stone four lbs.) at the beginning, and 91 lbs. at the end of the course. The increase in the average weight was small because many of the patients suffered from dropsy which disappeared during treatment.

Lack of faith in quinine is sometimes due to errors in diagnosis. A man who is suffering from malaria may have, at the same time, some other disease or complication which is uninfluenced by quinine, so that his temperature remains high in spite of its careful administration. These cases are frequently cited as examples of quinine-resistance. We have investigated five such cases during the past year; two were suffering from tuberculosis, two from bronchopneumonia and one from cellulitis. In each instance the malaria yielded readily to quinine which, of course, had no effect upon the complicating disease.

The following are details of the different kinds of treatment which we administered to the patients who had not been cured of malaria by the routine hospital treatment:

A.—Eleven cases treated with quinine bi-hydrochloride in solution.

Amount ten grains twice a day. Duration of treatment four weeks.

Types treated	{ Benign tertian	...	...	...	...	5
	{ Malignant tertian	...	...	...	...	3
	{ Quartan	...	...	...	...	1
	{ Mixed Benign and Malignant tertian	...	...	...	...	2

In no case were asexual parasites found in the blood after the fourth day of treatment except in the quartan case, where a parasite was seen on the fifth day. The average number of blood examinations in each case during treatment was ten. No relapses during treatment.

B.—Twenty cases treated with quinine bi-hydrochloride in cylindrical gelatine capsules No. 0.

Amount ten grains twice a day. Duration of treatment four weeks.

Types treated	{ Benign tertian	...	...	...	...	3
	{ Malignant tertian	...	...	...	...	11
	{ Quartan	...	...	...	...	1
	{ Mixed benign and malignant	...	...	...	...	3
	{ Mixed quartan and malignant	...	...	...	...	2

In no case did the fever fail to yield or the asexual parasites fail to disappear from the peripheral blood by the fourth day of treatment. The average number of blood examinations made in each case during the four weeks of treatment was 23. No relapses during treatment.

C.—Six cases treated with quinine sulphate in cylindrical gelatine capsules No. 0.

Amount ten grains twice a day. Duration of treatment four weeks.

Types treated	{ Malignant tertian	...	...	...	...	5
	{ Mixed malignant and benign	...	...	...	...	1

In every case the fever had gone and the asexual parasites had disappeared from the peripheral blood, by the fifth day of treatment. The average number of blood examinations made in each case during the four weeks of treatment was 22 ordinary films and 5.5 thick films. No relapses during treatment.

D.—Six cases treated with Cinchona Febrifuge in cylindrical gelatine capsules No. 0.

Amount ten grains twice a day. Duration of treatment four weeks.

Types treated	{ Malignant tertian	...	...	...	...	2
	{ Benign tertian	...	...	...	...	1
	{ Quartan	...	...	...	...	1
	{ Mixed benign and malignant tertian	...	...	...	...	2

In every case the temperature became normal by the third day and no asexual parasites were found in ordinary films after the fourth day except in one quartan case where they persisted until the sixth day. The average number of examinations made in each case during the four weeks of treatment was 23 ordinary films and 19 thick films. No relapses during treatment.

CONCLUSIONS: 1. We have found (as shown above) in common with MacGilechrist, Bass and others, that the sulphate of quinine is quite as efficacious as the more expensive bi-hydrochloride; consequently to prescribe the latter, except for injections, is to waste money.

2. The still cheaper cinchona febrifuge, concerning which we forward a separate report, is equally satisfactory.

3. In the investigation of 44, apparently, quinine-resistant cases we did not find a single infection uninfluenced by quinine, and only one "relatively resistant" case in which parasites persisted for a long time in spite of treatment. (We attach a special report of this case)

4. Malaria does not resist a daily dose of twenty grains of quinine swallowed and retained. As the Editor of the Indian Medical Gazette wrote recently "The mistake is all too common.....of imagining that the fact of having written a prescription amounts to evidence that the quinine has been properly compounded and that the prescribed amount of the drug has been swallowed by the patient. This is certainly a case in which there is many a slip between the cup and the lip".

PARTICULARS OF A CASE OF "RELATIVE QUININE RESISTANCE".

The following is an account of a case of "relative resistance" to quinine, in which asexual malaria parasites could be found in the peripheral blood although the patient was receiving quinine treatment which cured her fever.

The patient, a Tamil woman named Athi, was admitted to hospital with malignant tertian malaria on 30th July and ten grains of quinine sulphate, three times a day, was prescribed for her.

Seven days later she still had asexual parasites in her blood and we gave her quinine bi-hydrochloride in capsules, ten grains twice a day from 8th August; and we saw, personally, that she swallowed it.

Her blood was examined six times during the next six days, with the result that malignant tertian rings were found on every occasion; one parasite in 50 to 200 fields.

From 16th August, she was given quinine bi-hydrochloride in a mixture, ten grains twice a day. Her blood was examined every day for the next ten days, and every day parasites were found; though sometimes only after a long search through three or four slides.

From 27th August, until 13th September, she was given ten grains of cinchona febrifuge twice a day in capsules. During this period her blood was examined on fourteen days and parasites were found six times.

When she first came under observation in the laboratory she was very anæmic and was suffering from bacillary dysentery of the Flexner type. She improved greatly under treatment with quinine. She had no fever after she had been on our treatment for three days and the percentage of hæmoglobin improved from 50 per cent. on 17th August to 70 per cent. on 13th September, when she returned to work as a cooly on the Malaria Advisory Board's drainage works.

On 27th September, about two weeks after she had ceased taking quinine, her blood was re-examined, with the result that the number of parasites was found to have increased to about one in each field of the microscope. She had no fever and she both felt and looked in good health. On 4th October she came once more for examination, having walked two miles from her work to the laboratory. She had no fever; she looked well and said that she did her work without difficulty. On this occasion two or three subtertian parasites were found in each field. On 11th October, she was still in good health, with no fever, but crescents were found in her blood for the first time, and also benign tertian in addition to subtertian parasites, the former probably a fresh infection (she had been taking no quinine since 13th September). On 18th October, she was still working hard and felt well, but her temperature was 100°F. and the benign tertian infection had increased to an average of 1.2 parasites in each field.

Between 18th October, and the end of the year she came to the Institute nine times; but she had no more fever, though benign tertian and subtertian parasites were always found in her blood. On one occasion it was estimated that there were 5,280 benign tertian and 350 subtertian parasites in each cubic millimeter, yet she was able to do her work, she felt perfectly well and her hæmoglobin percentage remained the same as it was when she stopped taking quinine two and a half months before.

She was not seen again until 13th January, 1922. She was then pregnant but felt well, had no fever and did her work. There were a few malignant and benign tertian parasites in the peripheral blood. She was then given cinchona febrifuge, ten grains twice a day from 13th January to 25th January, with the result that no parasites were found in her blood in fourteen examinations made between 14th January and 14th February. A positive Tanret's reaction in the urine showed that the quinine was absorbed.

This patient was very ill when she began treatment; she received great benefit from quinine and it probably saved her life, but nevertheless the parasites persisted in the peripheral blood in spite of it, though they did not cause any fever or appear to affect her health. It may be because they produced no febrile reaction in the body that they persisted so long. We have been investigating so-called quinine resistant cases for several years but this is the first instance of what is termed "relative resistance" which we have encountered.

CINCHONA FEBRIFUGE.

Cinchona bark was brought to Europe in the year 1638 by the Countess of Chinchon, the wife of the Viceroy of Peru, and a decoction of this bark was employed in the treatment of ague for nearly two hundred years before the active principles of the drug were isolated. It is comparative recently that one of its alkaloids, quinine, has come to be used for the cure of malaria to the exclusion of its other constituents. Prain, Waters and Acton state that it is unnecessary to go to the expense of separating quinine from the other alkaloids of cinchona, because the unseparated mixture of the alkaloids is, at least, of equal value to quinine in the treatment of malaria. Major Acton has found that the mixed alkaloids are less toxic than quinine and that they are superior to it in the treatment of benign tertian ague. His experiments were carried out at the British Malaria Convalescent Depot at Dagshai, in the Himalayas, where there is no chance of re-infection with malaria. His patients were all soldiers, consequently he was able to keep them under observation for as long as eight weeks after they had finished a course of treatment.

A preparation containing the total alkaloids of cinchona bark is made at the Government quinine factories at Mungpoo in India, under the name of Cinchona Febrifuge and it was this preparation which Acton found so satisfactory. MacGilchrist states that the average composition of cinchona febrifuge is as follows:

Quinine	7.40	} 54.65 per cent. Crystallisable.
Quinidine	22.83	
Cinchonine	18.58	
Cinchonidine	5.84	
Uncrystallisable alkaloids, ash, etc.	45.35	
100.00		

A preparation containing the total alkaloids derived from cinchona bark grown in Java, is made by the Bandoengsche Kininefabriek Company and is sold by them also under the name of Cinchona Febrifuge. The average composition of this febrifuge is stated by the makers to be as follows:

Quinine	11.5	} 62.8 per cent. Crystallisable.
Quinidine	5.0	
Cinchonine	26.3	
Cinchonidine	20.0	
Uncrystallisable alkaloids, ash, etc.	37.2	
100.0		

It is estimated by the Collector of Statistics that nearly 20,000 lbs. quinine are imported annually, into the British Malaya.

The cost of this drug is at least \$28 a pound, while that of cinchona febrifuge is less than \$7. Consequently if cinchona febrifuge were employed instead of quinine there would be a saving of \$420,000 per annum. It is therefore of great importance to this country that Major Acton's conclusions should be verified.

He found that cinchona febrifuge was not only as potent as quinine in its immediate effects upon malaria, but in the benign tertian fever there were fewer relapses after a course of cinchona febrifuge than after a course of quinine. It is difficult to investigate the question of permanent cure in Kuala Lumpur, for here we are faced by several difficulties from which Acton was free. Firstly, patients may become re-infected with malaria while they are under observation after the conclusion of their treatment, and secondly it is impossible to persuade patients to remain in hospital for two months after they have completed a course of four weeks treatment.

Only a very small quantity of the Indian cinchona febrifuge was available; this we found as powerful as quinine in its immediate effects upon malaria, but we had no opportunity of investigating the permanency of the cure. We therefore obtained a quantity of the Java cinchona febrifuge which we determined to test upon a small number of patients suffering from quartan malaria. We decided upon a small number so that we could administer the drug to the patients ourselves and thus make sure that they actually swallowed it. By dealing with a small number we were able to make very frequent examinations of the blood in each case and to keep the patients in hospital after the conclusion of their treatment. We chose quartan cases because quartan malaria is rare; consequently, if the patients became re-infected while they were under observation after treatment, we considered it unlikely that they would be re-infected with quartan parasites. Moreover quartan malaria is said to be more prone to relapse than the tertian fevers; Acton estimates that no less than 80 per cent. relapse after a course of quinine.

By the courtesy of Dr. Woods, the Medical Officer in charge of the District Hospital, Kuala Lumpur, we were able to treat twenty-three patients with cinchona febrifuge. They were given ten grains of cinchona febrifuge twice a day for four weeks in cylindrical gelatine capsules (number 0.) by Dr. Fletcher; blood films were examined by the Protozoologist, Miss Jepps, and by the Assistant Surgeon, Mr. Visuvalingam. An average of 21 ordinary and 13 thick films were examined during the four weeks of treatment in each case.

Fifteen of the patients were suffering from quartan malaria, one from benign tertian, two from malignant tertian, two from mixed benign and malignant tertian and two from mixed quartan and malignant tertian. In every case the result of administering the cinchona febrifuge was to stop the fever and to cause the disappearance of the parasites. In no instance did the fever last longer than the fourth day of treatment, but in three quartan cases, parasites persisted longer and were found in ordinary films up to the fifth, the sixth, and the seventh day respectively. In thick films they were found as late as the eleventh day in one case, but not subsequently. The immediate effect of the febrifuge was therefore equal to quinine.

In order to investigate the permanency of cures in malaria, it is necessary to keep patients under observation for many weeks after treatment. We were unable, of course, to persuade all our patients to remain in hospital after the conclusion of treatment and it surprised us that we were able to induce sixteen of them to remain for as long as three weeks after they had undergone a four week's course of cinchona febrifuge. (They were, quartan 11; quartan and benign 2; benign 1; malignant 1; benign and malignant 1).

Major Acton states that, after the conclusion of a course of quinine, ten per cent. of malignant tertian, 75 per cent. of benign tertian and more than 80 per cent. of quartan cases relapse. Stephens has found that about 75 per cent. of relapses occur during the first three weeks after treatment; consequently one would have expected to see at least ten of our sixteen patients develop fever during the three weeks of observation; but in fact, there were only four relapses and these were as follows:

- (1) A case of quartan malaria; relapsed 19 days after finishing treatment. Quartan and benign tertian parasites in the blood.
- (2) A case of quartan malaria; relapsed 15 days after finishing treatment. Benign tertian parasites in the blood.
- (3) A case of mixed quartan and benign tertian; relapsed 16 days after finishing treatment. Benign tertian parasites in the blood.
- (4) A case of malignant tertian; relapsed 11 days after finishing treatment. Benign tertian parasites in the blood.

It is unlikely that all these four cases were relapses. Cases (2) and (4) were probably fresh infections; on the one hand, because numerous examinations had been made previously without finding benign tertian parasites, and on the other, because benign tertian infections had occurred in the neighbourhood. One may therefore conclude that the permanent, as well as the immediate therapeutic effects of Java cinchona febrifuge, in the treatment of malaria are, at least, as good as those of quinine.

Major Acton found that the cinchona febrifuge prepared in India, was less toxic than quinine. Using the Java preparation we found no evidence that it was more toxic than quinine. One patient for whom 30 grains of quinine daily, in mixture, had been prescribed 42 days before we examined her, and who was still suffering from malaria, complained that quinine always made her vomit and it increased the menorrhagia from which she suffered. She was able to take cinchona febrifuge in capsules without vomiting, she had no more fever and the menorrhagia stopped in three days.

A word of warning is necessary; cinchona febrifuge is not an official drug, and until its composition has been legally defined, dishonest traders are likely to sell powders deficient in alkaloids or containing harmful alkaloids, under the name of cinchona febrifuge.

2.—DYSENTERY.

INTRODUCTION.

The special inquiry into the pathology and specific treatment of dysentery, commenced in the previous year, was continued during 1921, with the assistance of Miss M. W. Jepps who was appointed, temporarily, as protozoologist for this purpose.

The work has been hampered by a shortage of staff due to illness; consequently many questions which we hoped to investigate have been left almost untouched. Among these may be mentioned the secondary infection of intestinal ulcers, which undoubtedly plays an important part in chronic dysentery. Another line of investigation which we were unable to follow was an enquiry into the pathogenicity of *Entamoeba histolytica* in some cases, and its apparent harmlessness in others. It is doubtful whether this organism is the sole cause of amoebic dysentery or if it is harmful only when it acts in conjunction with some other agent. A third point, which we hope to study later, is the bacteriology of the patchy pneumonia which occurs so frequently in cases of fatal bacillary dysentery. In many instances this pneumonia is due to an infection with coliform bacilli; in one case which we examined, the intestinal ulcers contained an almost pure culture of *B. mucosus capsulatus*, the organism which was also the cause of pneumonic patches in the lungs.

Pressure of work prevented us from carrying out our plan of personally enquiring into outbreaks of dysentery in rubber estates and Malay kampongs; and the chief part of our investigation was made, by the courtesy of the Medical Officer in charge, at the District Hospital, which adjoins the Institute for Medical Research. The work is still on progress and we propose to make a full report at a later date.

During the past year 4,190 specimens of faeces were examined, microscopically and bacteriologically, for the presence of protozoa and pathogenic bacteria. The number of cases investigated was, 1,348.

In addition to the specimens from the District Hospital, 144 were received from the General Hospital, Kuala Lumpur; 51 from patients treated in their own homes and in the European Hospital; 29 from other hospitals, etc.

Specimens of faeces from 37 European patients were received for examination. Twenty-one of these were not dysenteric stools. Dysentery bacilli of the Flexner type were isolated from eleven of the remaining sixteen cases, while *Entamoeba histolytica* was found in the other five. We heard of no deaths or cases of serious illness from acute dysentery among Europeans during the year. As was stated in the annual report for 1920, with reference to dysentery, under present conditions, in this country, "dysentery as it affects Europeans and well-nourished Asiatics is a trivial complaint compared with the same disease when it attacks debilitated coolies."

SPECIAL INVESTIGATION OF DYSENTERY IN THE DISTRICT HOSPITAL, KUALA LUMPUR.

One thousand and fifty-three cases from the dysentery wards of the District Hospital were examined during the year. Two hundred and forty of these patients died, a mortality of 22.79 per cent.

The examinations made this year confirmed the correctness of the opinion expressed in the annual report for the year 1920, that bacillary dysentery is much more common in this country than the amebic form. Dysentery bacilli were isolated in 473 cases (44.9 per cent.) while *E. histolytica* was found in only 167 (15.86 per cent.).

Bacillary Dysentery.—Infections with Shiga's bacillus were very rare; it was found in only 27 of the bacillary cases, the remaining 446 were due to Flexner's organism. One hundred and thirty-one of the 473 bacillary cases died, a mortality of 27.68 per cent.

Anti-dysentery serum was obtained from the Lister Institute and sent out in cold storage once every month. Tests made in this laboratory showed that the serum had a high agglutinin content, consequently it is probable that its anti-toxic property was little, if at all impaired. This serum was administered in doses of 40 to 160 cubic centimetres to 212 patients from whom dysentery bacilli had been isolated. Fifty-nine of these patients died; a mortality of 27.7 per cent.

The results were almost exactly the same in a control group of 261 bacillary cases treated without serum; 72 of these died; a mortality of 27.6 per cent.

The dysentery bacilli which were isolated from these cases are not strange races peculiar to this country; almost all of them belong to one or other of Andrewes, five races, which were found all over Europe during the war and which are used in the preparation of the serum which we employed. This serum, given early and in adequate doses, is a specific cure for cases of acute dysentery occurring in people who are otherwise strong and healthy, but so many of the patients who were admitted to the dysentery wards of the District Hospital during the year 1921, were in such a miserable condition that the administration of serum was quite useless. Many of the Tamil patients were coolies who had been out of work for some time owing to the collapse of the rubber industry. Some of these miserable people had walked long distances, begging food by the way, in the hope of finding the sea and getting back to their homes in India. Numbers of them were brought into hospital so weak from starvation, malaria and chronic dysentery, that no serum could be expected to cure them.

The low price of rubber and tin also brought to the hospital many old Chinese patients who would have been supported by their friends, or might have kept themselves by begging, when times were better. One day in November, out of 27 patients in the dysentery wards only three were under thirty years of age, eleven were over fifty, and six were more than sixty years old.

Malaria is an almost universal complication of dysentery among these vagrant coolies, and every dysentery patient was given twenty grains of quinine daily, from the day of his admission until he left the hospital. Though the present financial depression may have been partly responsible for the wretched condition of the coolies admitted to the dysentery wards of the District Hospital in 1921, the case mortality is sometimes as high in years of prosperity. In 1919 nearly 25 per cent. of the patients died who were diagnosed and treated as cases of dysentery in Government hospitals. This figure is very high when compared with the mortality from dysentery in the British Army during the great war. Manson-Bahr writes "The case mortality rate is difficult to compute; it was probably greater in the Dardanelles than elsewhere, but even at that period it is estimated as not exceeding 5 per cent."

Drugs, serums and vaccines can avail but little in the treatment of advanced cases of chronic bacillary dysentery occurring among malaria-stricken, half-starved coolies. Nursing and careful feeding would accomplish something, but examinations made after death show that, in many cases, the inflammation and ulceration of the intestine has been so extensive as to make it unlikely that the patients could ever become really healthy, or strong enough for hard manual labour. They may be apparently cured but they break down when they try to work and if they cannot work they cannot obtain proper food, consequently they are soon as ill as when they were first admitted to hospital.

The remedy is prevention by sanitary measures, and early treatment. Prophylactic vaccination on a large scale is of very doubtful value, and it is not likely to be of any use in preventing the Flexner type of bacillary dysentery which is seen in the hospitals of the Federated Malay States. Besredka states that he has been able to confer powerful immunity upon rabbits by feeding them with killed cultures of Shiga's bacillus, and during an epidemic of Shiga dysentery which occurred in Pahang, an emulsion of killed dysentery bacilli was supplied to the Medical Officer, Dr. Leicester, for administration by the mouth, in the way recommended by Besredka. Dr. Leicester considers that the vaccine was of use in checking the epidemic and writes as follows: "There were in all 69 cases with seventeen deaths. The vaccine was administered to thirty-one contacts. Four of them contracted dysentery; one on the following day, two after four days and one after eleven days. There were however no deaths. As no controls were made I cannot say, definitely, that the vaccine did any good; but in consequence of the insanitary condition of the houses it was the rule that nearly every contact developed the disease; so it would appear that the vaccine must have been of some use prophylactically. The vaccine was started on 19th September, and the last case was on 1st October."

This is encouraging as far as it goes and warrants a further trial of the vaccine under epidemic conditions, although recent investigations at the Lister Institute have failed to confirm Besredka's work.

As stated before, there were only 27 cultures of the Shiga type among the 473 strains of dysentery bacilli isolated from the patients in the District Hospital; we have, however, encountered two epidemics during the year, both of which were due to Shiga's organism. The one in Pahang, which we have just mentioned, and the other in some kampongs at Batu Limablas in Kuala Lumpur. The houses in both places were insanitary and the water-supply was obtained from shallow wells. Dr. Leicester thinks that in the Pahang outbreak the Malay *bomos* were responsible for carrying the infection from one kampung to another, and he recommends, as a first step in future epidemics, that all the doctors should be caught and shut up.

The sporadic cases of Flexner dysentery which are so common here are not due to infected water supplies, and we have seen no epidemics which could be traced to the consumption of infected drinking-water. The usual way in which infection occurs is, probably, through the ambulant mild case or through the numerous carriers, either directly, by personal contact, or indirectly by means of Osler's trinity—food, fingers and flies.

Food and fingers are of more importance than flies, in this country, where the latter are fortunately uncommon. Patients who develop dysentery, while they are under treatment at the District Hospital, are transferred to the dysentery wards. A record was kept of the wards from which these transfers were made, but it was found that no more were sent from those which were adjacent to the dysentery wards than from those which were distant from it; which is contrary to what one would expect if the infection had been carried by flies.

AMOEBC DYSENTERY.

One hundred and sixty-seven or 15.86 per cent. of the 1,053 patients examined at the District Hospital, were suffering from acute amoebic dysentery with active *Entamoebae* in their stools. Thirty of these patients (18 per cent.) died. In most of them, death was not due to dysentery but to some other disease.

In the annual report for 1920, it was stated that there was no evidence that emetine was of benefit to the debilitated coolies who were treated with it in the wards of the District Hospital. The experience of the first seven months of 1921, tended to confirm this opinion; active forms of *E. histolytica* persisted in the stools throughout treatment, the patients did not improve, and when they died, large amoebic ulcers were found in their intestines, even though they had been receiving emetine treatment up to the time of death. On 20th July, we commenced preparing solutions of emetine for injection, in the laboratory, and the injections were given and recorded by a member of the Institute staff. The result was that in only one, out of 90 cases, did we find the parasites resisting the drug and persisting in spite of it. At post-mortem examinations made on patients in this group, who had died from other diseases while they were undergoing a course of emetine injections, we found that the healing of amoebic ulcers takes place with almost magical rapidity during treatment with this drug.

CASES IN WHICH NEITHER DYSENTERY BACILLI NOR AMOEBAE WERE FOUND.

In 413 cases from which specimens were received, no dysentery bacilli or *Entamoebae* were discovered and, judging from the results of post-mortem examinations, it is probable that not more than 80 of these patients were really suffering from dysentery. Patients who complain of diarrhoea, on admission to the receiving-room at the District Hospital, are sent to the dysentery wards as quickly as possible, in order that there may be no delay in treatment. In consequence of this rule, some persons are admitted as dysentery patients who are not suffering from that disease.

The results of the post-mortem examinations in this group of cases, where neither dysentery bacilli nor amœbæ were found, is instructive because it shows what diseases may bear, at least a superficial resemblance to dysentery:

Cirrhosis of Liver ...	...	...	...	...	2
Tuberculosis ...	...	...	...	...	12
Pneumonia ...	...	...	...	...	13
Empyema ...	...	...	...	...	1
Pancreatitis ...	...	...	...	...	1
Malaria ...	...	...	...	...	5
Nephritis ...	...	...	...	...	3
Syphilis ...	...	...	...	...	3
Melioidosis ...	...	...	...	...	2
Gangrenous Appendicitis ...	...	...	...	...	2
Starvation ...	...	...	...	...	1
Intestinal obstruction ...	...	...	...	...	1
Paratyphoid fever A. ...	...	...	...	...	1
" " B. ...	...	...	...	...	1
Dysentery ...	...	...	...	...	14
No post-mortem ...	...	...	...	...	17
Total ...					79

PERSISTENCE OF DYSENTERY BACILLI IN THE FAECES.

A number of experiments have been made in this connexion and form the subject of a separate report. There is but little information to be gained by sending faeces to the laboratory from the dysentery wards of distant hospitals. Dysentery bacilli and *Entamoebæ* die very quickly outside the body; they may perish in an hour or two if the specimen contains any faecal matter. Fortunately, as pointed out in the annual report of this Institute for 1920, the diagnosis of bacillary or amœbic dysentery can be made quite easily and accurately in the hospital, by a simple examination of the stools with the microscope, and the patient can be given the appropriate treatment without delay. But this method of diagnosis is not always available. Sometimes dysentery occurs as an epidemic in an outlying village or district; it may be so severe as to resemble cholera and there is frequently some doubt about the diagnosis. After the epidemic has been in progress for a week or two, a clue is given by the presence of agglutinins in the blood of convalescents, but to wait for this is to lose valuable time. An earlier and more certain means of diagnosis is required.

In 1916, Teague and Churman devised a method of preserving typhoid bacilli in the faeces by mixing them with 0.6 per cent. salt-solution containing 30 per cent. of glycerine. We have found this method equally useful for the preservation of dysentery bacilli in the excreta of acute cases, where the specimens consist of bloody mucus and are fairly free from faecal matter. It is of little use in the ordinary cases of chronic dysentery such as are common in the hospitals of this country.

We have made experiments in acute dysentery with samples of excreta which we have divided into two portions, one of which has been mixed with Teague and Churman's solution, while the other has not. These samples have been kept at laboratory temperature (about 80°F) and plated out every day. We have isolated dysentery bacilli, of the Shiga type, as late as the sixteenth day, from a sample mixed with the glycerine solution, but not later than the fourth day from an unmixed sample. An outbreak of dysentery which occurred at Endau, illustrates the practical value of this method, in the field. The mukim of Endau is situated on the borders of Pahang and Johore; it is nearly 50 miles from the little town of Pekan and very difficult of access. Some of the villages in which the outbreak occurred are five or six hours journey apart by river, which is practically the only means of transport. An expedition to Endau from this laboratory would have occupied a great deal of time and cost a good deal of money. Fortunately Dr. Leicester, the Medical Officer at Pekan, had heard of the value of Teague and Churman's solution. He collected suitable specimens from three of the patients, mixed them with the solution and forwarded them to the laboratory. The specimens were respectively six, seven and eight days old when they were plated, yet Shiga's bacillus was isolated from each of them. This certainly could not have been done in a tropical country without the use of the preservative solution. The special knowledge possessed by the Medical Officer, in this case, and the trouble which he took in collecting suitable specimens thus enabled a diagnosis to be made, and saved the Government the expense of an expedition which would have cost, at least, a thousand dollars.

3.—MELIOIDOSIS.

Reference has been made to this disease in previous annual reports where it has been described under the names of pneumo-enteritis and pseudo-cholera.

It was first recognised by Major Whitmore in 1911, when he was making post-mortem examinations on subjects drawn from the vagrant classes of Rangoon, and it was described by him in 1913 under the title of "A Glanders-like disease, occurring in Rangoon."

A few years later Fletcher investigated an epizootic disease resembling glanders, which broke out among the laboratory animals in Kuala Lumpur during 1914; but he did not suspect any connexion with the human disease described by Whitmore.

In 1917, Stanton, in a study with P. H. Hennessy of a disease resembling Asiatic cholera, observed that patients who recovered from the initial attack might die later from a form of pyaemia with lesions of the lungs and other viscera, resembling to some extent those of miliary tuberculosis. He isolated the causative organism, and with it he reproduced the disease in a number of different animals. The lesions which he found in animals and in the more chronic human cases, led Stanton to suspect that he was dealing with the same disease which Whitmore encountered in Rangoon and that, both in Whitmore's cases and his own, the infecting agent was the same as that which caused the disease of laboratory animals investigated by Fletcher in 1914.

A comparison of the three organisms isolated by Whitmore, Fletcher and himself, established their identity and showed that this view was correct. On these grounds he suggested that the infection might be a natural disease of rodents and conveyed to man by contamination of food with the excreta of these animals.

The name Melioidosis was suggested by Stanton and Fletcher because glanders was described by Greek physicians as *malis* or *melis*.

They also proposed that the bacillus which is the cause of the disease should be called *Bacterium whitmori*.

During the year 1921, a few more cases were encountered; two of them are still alive and are the first cases of the disease which have been known to recover. Both these men were treated with autogenous vaccines, but it cannot justly be claimed that the vaccines saved the patients' lives, because they were not administered until they had been ill for three and for eight months respectively, whereas most cases have died within ten days of the onset. Experiments have been carried out during the year, in connexion with the bacteriology of this disease and a series of photographs has been made illustrating its aetiology and pathology. These studies form the subject of a special report which will be forwarded separately.

4.—VENEREAL DISEASES.

THE FORMOL-GEL REACTION.

Gaté and Papacostas's "formol-gel" reaction for syphilis, consists of the addition of two drops of commercial formalin to one cubic centimetre of the patient's serum. It is claimed that clotting occurs in the serum of syphilitics but not in that of other persons.

The test is so simple, compared with the elaborate Wassermann reaction, that it would be of the greatest use if it were reliable. Mr. J. E. Lesslar, Assistant Pathologist, has tested this reaction with 1193 specimens and has compared it with Wassermann reaction in each case. He found that it gave a positive reaction in 250 cases where the Wassermann reaction was negative; and that it gave a negative reaction in 92 cases where the Wassermann reaction was positive. This confirms the work of Ramakrishnar, in India, who compared the formol-gel and Wassermann reactions in 539 cases and found that the results agreed in only 66 per cent.

Enrique Ecker, who also investigated the reaction in a number of cases and compared the laboratory results with the clinical condition of the patients, concluded that "The reaction as it stands is of no diagnostic value because of its failure to react in clinically and serologically clear cut cases of syphilis, and the occurrence of positive reactions in the absence of disease".

WASSERMANN REACTIONS.

Three thousand, nine hundred and eighty-four specimens of blood were received during the year for examination by Wassermann's test. This is more than double the number dealt with in the previous year. A few organisms contaminating a blood sample, may multiply very rapidly in a tropical climate and soon render the specimen unfit for examination. Many of the specimens sent from a distance arrived in a condition quite unfit for testing and it was found necessary, in order to avoid delay, to employ a special messenger to bring specimens from the State of Perak by the night-mail.

The results of the test were as follow:

Positive	...	...	...	...	1,670
Negative	...	...	...	...	1,272
Anticomplementary	...	...	...	...	563
Contaminated, lysed, etc.	...	...	...	...	479
Total	...	...	...	...	<u>3,984</u>

5.—ENTERIC FEVER.

Bacillus typhosus.—Was cultivated from the blood in three cases. *B. paratyphosus A* and *B* once each. Five hundred and eighteen specimens of blood were received for agglutination tests, with the following results:

Positive agglutination with <i>B. typhosus</i>	...	...	102
<i>B. paratyphosus B.</i>	...	...	27
<i>B. paratyphosus A.</i>	...	...	7
<i>typhoid and paratyphoid</i>	...	...	22
Negative agglutination with <i>typhoid and paratyphoid</i>	...	...	360
Total	...	...	518

It is more than probable that many of the negative specimens were from cases of malaria. Films were made from some of the samples and malaria parasites were demonstrated in four.

The blood of a number of boys, cooks, etc., was examined in connexion with some sporadic cases of typhoid fever, but in only two cases out of 106, did the serum agglutinate *B. typhosus* in a dilution of more than 1 in 60.

Only two carriers of enteric organisms were detected during the routine examination of more than 1,000 cases of dysentery. In one of these, who died from dysentery, the gall-bladder was nearly a quarter of an inch thick and it contained a pure culture of *B. paratyphosus A*.

6.—OTHER INFECTIOUS DISEASES.

Plague } A few specimens were received and examined in connexion with these diseases
Cholera } but with negative results in every instance.

Cerebro-spinal fever.—Thirty-nine specimens of cerebro-spinal fluid were examined with the following results:

Meningococci isolated	...	...	...	...	19
Pneumococci	...	...	...	...	2
Negative	...	...	...	...	18
Total	...	...	...	...	39

There is no danger of cerebro-spinal fever spreading where there is adequate space and ventilation. When the disease occurs in barracks or schools it can be stopped by giving more room and more air.

Diphtheria.—Only seven specimens have been examined with positive results, compared with double that number in the previous year.

Rabies.—The brains of thirteen dogs were examined for Negri bodies with positive results in two cases.

General.—Large numbers of pathological specimens were examined and histological sections were cut, by Mr. Lesslar, the Assistant Pathologist. Miscellaneous examinations of blood-films, sputum, etc., numbered 3,283. Precipitin tests for human blood were carried out in sixteen cases with positive results in eleven.

Autogenous vaccines were prepared in 27 cases for furunculosis, asthma, colicystitis, etc.

COMPARATIVE TABLE OF STATISTICS, 1920 AND 1921.

Number of Examinations Carried Out in the Pathological Laboratory.

Period.	Wassermann.			Widal.			Diphtheria.			Rabies.			Cerebro-spinal Fluid.				Faces.	Agglutination for Dysentery.	Miscellaneous.
	Positive.	Negative.	Total.	Positive.	Negative.	Total.	Positive.	Negative.	Total.	Positive.	Negative.	Total.	Positive Meningococcus.	Positive Pneumococcus.	Negative.	Total.			
January to December, 1920	777	1,175	1,952	143	300	343	14	27	41	7	6	13	10	...	31	41	189	339	468
January to December, 1921	1,670	2,314	3,984	158	360	518	7	13	20	2	11	13	19	2	18	39	4,190	943	3,283

7.—CHEMICAL SECTION.

Mr. R. W. Blair, Chemist, reports as follows :

The work in the Chemical Laboratory has been confined to routine examinations.

The total number of exhibits received during the year was 5,330.

The number of exhibits under each heading is shown below :

Year.	Stains for blood.	Toxicological analysis.	Chandu.	Chandu dross.	Deleterious drugs.	Waters.	Milks.	Liquors.	Toddy.	Coins, etc.	Miscellaneous.	Total.
1920	64	106	143	58	19	114	315	690	365	110	49	2,033
1921	55	58	53	230	48	370	466	647	349	2,995	59	5,330

1. *Stains*.—The number of stained articles examined for the presence of blood was fifty-five. The articles consisted of knives, parangs and clothing.

The stains on twenty-six articles gave the reaction characteristic of blood, and of these, twelve gave the reaction characteristic of human blood, (precipitin test). In six cases, the stains were insufficient for the precipitin test.

2. *Toxicological*.—Fifty-eight exhibits were examined for poison. Thirty-six of these were human viscera. Arsenic was found in five, morphine in four, mercury in two, opium in one, alcohol in one, and arsenic and strychnine in one exhibit.

Portions of the viscera of six cattle were examined and in two of these arsenic was found to be present.

3. *Chandu*.—Fifty-three exhibits were examined. Six were found to contain illicit opium.

4. *Chandu Dross*.—Two hundred and thirty samples of chandu dross were received. One hundred and eighteen samples have been examined.

The morphine content varied from 7.6 per cent. to 1.8 per cent., the average being 5.58 per cent.

The samples were classified as follows :

Very good (Morphine more than 6 per cent.)	...	32.2 per cent.
Good (Morphine 5.1 per cent. to 6 per cent.)	...	44.1 "
Medium (Morphine 4.1 per cent. to 5 per cent.)	...	17.8 "
Poor (Morphine less than 4.1 per cent.)	...	5.9 "

All the samples were derived from chandu of Government manufacture.

5. *Water Samples*.—*Chemical Examination*.—Three hundred and forty-nine samples of water from existing and proposed supplies were examined.

The number of samples of water from the Kuala Lumpur supply was two hundred and thirty-three. Since 1st July, 1921, the raw and filtered waters from the Kuala Lumpur supply have been examined weekly.

Bacteriological Examination.—Bacteriological examinations were carried out on twenty-two samples

Milk Samples.—Four hundred and sixty samples of milk were examined.

The numbers from the chief districts were as follow :

Kuala Lumpur	...	...	...	...	...	227
Ipoh	...	...	...	...	...	105
Taiping	...	...	...	...	...	91

The samples, with a few exceptions, were collected under the provisions of the "Sale of Food and Drugs Enactment 1913," sixteen per cent. were deficient in milk solids compared with thirty-three per cent. deficient in 1921.

Seventy-eight certificates were issued for samples which failed to comply with the prescribed standards.

7. *Deleterious Drugs*.—Forty-eight samples were examined for deleterious drugs. Fifteen were found to contain morphine hydrochloride, and one to contain cocaine.

8. *Liquors*.—Under this heading, six hundred and forty-seven samples were examined. The alcoholic strength was determined in six hundred and thirty-five samples.

Eight samples were examined for denaturants, and four for inclusion in the approved list of spirits.

9. *Toddy*.—Three hundred and forty-five samples of toddy, and four samples of "nirah" were examined.

In eight samples the acidity (calculated as Acetic Acid) was found to be more than 0.8 per cent. the highest being 2.16 per cent.

The numbers from each State were as follow :

Selangor	...	...	...	...	...	227
Perak	...	...	...	...	...	84
Negri Sembilan	...	...	...	...	...	28
Pahang	...	...	...	...	...	6

The number of samples collected from toddy shops under the control of managers of Rubber Estates was one hundred and forty-six.

10. *Coins and Coining Materials*.—Exhibits numbering two thousand nine hundred and ninety-five were examined.

Counterfeit coins numbered two thousand nine hundred and forty-eight; genuine coins nine.

The remainder of the exhibits consisted of moulds, and pieces of metal used in the manufacture of counterfeit coins.

11. *Miscellaneous*.—The exhibits under this heading numbered fifty-nine. Of these, ten were bombs, received from the Police. The other exhibits included samples of urine, faeces, paint, alum and flour.

STAFF.

Dr. A. T. Stanton, Director, Government Laboratories, was absent on sick leave from 2nd July, until the end of the year.

Miss M. W. Jepps was appointed as Protozoologist on 26th February, for a period of eighteen months.

Mr. A. Visuvalingam, Assistant Surgeon was seconded for service at the Institute for Medical Research on 5th July.

We regret to record the death from phthisis of Mr. Lim Mook Sung, Librarian, after 16 year's service.

WILLIAM FLETCHER,

Acting Director, Government Laboratories, F.M.S.

ANNUAL REPORT OF THE CENTRAL ASYLUM, FOR THE YEAR 1921.

Nos (1) in 16/22.

Sir,—I have the honour to forward herewith the eleventh annual report of the Central Asylum,—for the year 1921.

	Males.	Females.	Total.
There remained on 31st December, 1920	652	186	838
Admitted during 1921	401	95	496
Discharged	128	49	177
(a) recovered	5	3	8
(b) relieved	4	1	5
(c) not improved	2	—	2
(d) not insane	28	1	29
Absconded	119	23	142
Died	767	201	968
Remaining on 31st December, 1921			
In addition there were Singapore patients—			
Remained on 31st December, 1920	129	64	193
Admitted during 1921	—	20	20
Discharged	1	2	3
Absconded	5	—	5
Died	12	3	15
Remaining on 31st December, 1921	111	79	190
Johore patients—			
Remained on 31st December, 1920	33	6	39
Admitted during 1921	11	3	14
Discharged	2	1	3
Absconded	—	—	—
Died	3	—	3
Remaining 31st December, 1921	39	8	47
Criminals—			
Remained on 31st December, 1920	52	2	54
Admitted during 1921	26	—	26
Discharged	10	—	10
Absconded	4	—	4
Died	8	—	8
Remaining 31st December, 1921	56	2	58
Kedah patients—			
Admitted during 1921	60	9	69
Discharged	8	—	8
Absconded	2	—	2
Died	8	1	9
Remaining on 31st December, 1921	42	8	50
Total remaining on 31st December, 1921	—	—	1,313
Percentage of Recoveries	35.68	per cent.	
Deaths	10.20	"	

An increase of 189 as against an increase of 104 in 1920.

A great part of this increase is due to the admission of Kedah patients, who began to come in for the first time in May. We have now 50 on our books. Federated Malay States patients increased by 133, which is greater by 29 than last year, but less than 1919.

The causes of the increase are a larger number of admissions and a proportionally smaller discharge rate. I say discharge rate advisedly as we have not discharged all the patients we could owing to bad times.

Admissions.—Admission of the Federated Malay States patients increased from 406 to 496. To a great extent I believe this was due to the bad times, as a great number of coolies were thrown out of work, with the result that starvation, or the fear of it upset a considerable number.

Again a few patients were admitted without papers as authorised some years ago.

We also admitted a number of patients at their own request. This is a most hopeful sign, as it means that people are at last beginning to appreciate the fact that this is a hospital, and that mental trouble is a disease and not a crime to be hidden away as long as possible, and only to be dragged into the light of day by the police.

As to the form of disorder on admission (F.M.S. patients table II.) Recent mania heads the list for the first time, having displaced Recent melancholia, which has held the field year after year. Recent mania occurred in 130 cases against 121 cases of Recent melancholia. Confusional insanity and Primary dementia kept the old places of third and fourth with 76 and 46 respectively. General Paralysis of the insane appeared on 22 occasions against 18 in 1920.

A feature of the admissions of 1921 was the increased number of patients of the clerical class that were admitted.

RECOVERIES (TABLE III).

The discharges (again dealing with Federated Malay States patients only) were 192 of whom 177 were discharged as recovered.

It is with the 177—I wish to deal.

The recovery rate works out at 35.68 as against 40.39 last year.

The largest number of recoveries took place in Recent mania with 62. Next came Recent melancholia with 49. Then Confusional insanity and Primary dementia with 26 and 12 respectively. The proportion of recovery to incidence leaves the four in the same order.

AETIOLOGY (TABLE IV).

As regards the aetiological table I must make all my comparisons with 1919 as no aetiological table was, as far as I can see, sent with the 1920 report. Again, though the table is included, it is hardly quite complete as, for the first three months of 1921 aetiological factors were not entered in the case books, and the clerk in charge of the books had let things get so far behind that, by the time I discovered the omission, things had got so far behind that we took a long time to get even more or less square, and in some cases failed to pick up. Still, I attach the table for what it is worth. Malaria takes first place as a cause with 77 appearances as against 52 in 1919, when it was only the fourth. "Gastro-intestinal system" comes next with 51 appearances against 58 but still in the second place. Syphilis comes third with 44 appearances against 64, and alcohol fourth with 36 appearances, against 54 and third place in 1919. Still, though the number of cases attributable to alcohol has fallen, it must be remembered that the return is not really for the whole of 1921. Again, if you put the 36 cases in which alcohol was the cause against the two in which opium was the cause one sees the havoc alcohol is doing. Especially is this so amongst the Chinese who, being more or less deprived of their opium, to which they have been accustomed for generations, take to alcohol—usually extremely bad spirit—and come in here.

With regard to the two cases returned as due to opium, though I accepted them as stated by the friends to be the cause, I have not seen a single case which showed deprivation symptoms. Another point in regard to alcohol as a factor in mental trouble is that, in common with Syphilis, it appears more frequently as a principal cause; whereas in the case of Malaria and Gastro-intestinal troubles both appear far more frequently as contributory causes only. A glance at table IV shows that, whereas Syphilis and alcohol appear as principal causes in 38 and 26 cases respectively, the others only appear as principal causes in six and ten respectively.

It is the same old story I have been pointing out year after year in my report that the Chinese are turning from opium, which is being placed beyond them, to alcohol (and bad alcohol at that) to which they are not accustomed, with disastrous results. As long as human nature is what it is, if one pleasure is placed out of reach another is substituted, and one, unfortunately, usually finds that the substitute is the more dangerous.

Practically a new cause has made its appearance this year in "Privation and Starvation", which only appeared three times in 1919, whereas it appears 26 times this year. Prolonged Mental stress has also gone up to 16 against 7 in 1919, so that we can attribute a considerable amount of the increased incidence of insanity to the bad times experienced in 1921.

Heredity does not appear in the aetiological table, which of course is absurd. This is to a great extent due to the fact that people look on mental disease as something to hide. Though many have advanced so far as to bring their relations to be treated they have not got so far as acknowledging that there has been a case of mental disease in the family before. With a little more education and a reasonable Mental Diseases Bill I hope we shall get over this difficulty too.

Deaths.—The death-rate on total treated is 10.20 per cent. This is slightly higher than last year when it was as low as 8.98 per cent. on total treated. The total number of deaths was 180. The chief causes being Dysentery 31, Malaria 29, Pulmonary tuberculosis 25, and General paralysis of the insane 20. I am glad to say that Dysentery is at last down to a more or less reasonable figure.

I am inclined to attribute this to the fact that all Dysentery cases are now isolated and kept so until they have ceased to be a danger.

The 29 deaths against 25 last year from Malaria may appear a great many. But when it is remembered that many of our patients came in soaked with Malaria, and that for purposes of observation it has been deemed advisable to do without mosquito nets in most of the wards, it will be seen that the number is not excessive.

The deaths from General paralysis of the insane appear to remain fairly constant year after year.

Pulmonary tuberculosis showed 25 deaths against 26 last year.

Suicide.—Unfortunately there is one suicide to chronicle; the first for four years. The suicide was a Tamil criminal who hanged himself. The attendant was apparently asleep at the time. I sent the attendant to court but he got off, and merely suffered summary dismissal from the Asylum service.

Fatalities.—We had three sudden deaths all from ruptured spleen. In one case a patient with a large spleen, had a quarrel with another patient who struck him, with the result that the large spleen ruptured, and the man died. The second was the case of a rather doddering old woman with a large spleen, who tripped and fell against the edge of a bed-board—again ruptured spleen, death. The third case was a most unpleasant one and I am not at all satisfied with the result. A patient in ward No. 26 was found dead one morning, and on post-mortem examination a ruptured spleen and kidney were found. Considerable violence to my mind must have been used to rupture the kidney. Another patient, who was awaiting discharge, accused the two night attendants of beating the patient. I enquired into the matter and was not satisfied with the attendants' explanation. In fact I was so satisfied that they had ill-treated the man, that I handed them over to the police. Unfortunately nothing definite could be found against the two men and they got off with immediate dismissal with loss of salary.

Absconding.—The number of patients absconding was 40 which is rather a large number. Though we had between 150 and 200 patients employed in farms, the cow-shed, etc., any of whom could abscond practically any time they liked, the majority of those who absconded were either from the wards or from working parties under attendants. The vast majority of the abscondings were due to sheer carelessness on the part of attendants, or the neglect to carry out instructions.

Criminals.—There were 26 admissions against 14 in 1920. Amongst those who were actually insane, the forms of insanity were much as in the ordinary patients. Four of the criminals—all murderers—were not insane, two of whom when brought to trial were condemned to death. One was returned to China, and the other was sent back to Kuala Lumpur, but as this latter case occurred before I returned from leave I do not know what happened to him.

Singapore.—The Singapore patients call for little comment seeing that they are all either demented or chronics. Three were discharged during the year which is as much as could be expected seeing the class of case they are. They were much more healthy than formerly and only 15 died during the year.

Johore.—The Johore patients came under the same category as the Singapore patients, being principally chronics. The Johore patients increased from 39 to 47 but I understand; we are to lose the Johore patients in 1922, as an asylum is being built in Johore Bharu.

Kedah.—Forty-one patients were admitted from Kedah on 31st March, 1921, when the Kedah Asylum was closed. Twenty-eight were admitted at different dates during the year, and we have 50 at present in the institution. As most of the original 41 were chronics I have not worked out a recovery rate; but, as cases are coming in now direct, I hope to do so in 1922. It was arranged to admit patients from Kelantan but they did not materialise; I do not know why.

New Buildings.—Ward I, on the female side was completed and handed over during the year and is now occupied. The Mosque and Hindu temple were also completed but have not yet been used, as railings have not yet been erected, and, as one has to take precaution against various patients of other religion entering, we cannot open them until the railings are erected. Wards Nos. 27 and 31 were completed, but as they have not yet got their locks we have not taken them over. No. 27 has the locks of 31 on it, as its own locks have not yet arrived, and 31 is padlocked.

Work.—I attach a list of the work done during the year and a valuation of it. The valuation of the building work was kindly made for me by the Public Works Department Overseer at the Central Asylum.

The work done in the various shops (valued at \$5,135) needs little comment. All the male attendants' clothing is now made in the tailor's shop and a certain amount of the male patients' clothing is made and repaired on the female side as can be seen from the list of work done in the sewing room. The value of the work done both in the work room and farm and field, cannot be estimated by the mere money value, as the work is undertaken primarily as a method of treatment, as suitable work suitably

carried out is one of the most valuable forms of treatment. This is I think not sufficiently realised, even by some of those who should know, who are inclined to look principally at the amount of revenue saved by our work, and farms; whereas from my point of view,—the medical point of view,—the revenue produced, or saved by patients' work is a secondary matter, and I would be completely satisfied even if the various works, farms etc., were run at a loss. Fortunately we are able, as it happens, to combine treatment with revenue saving, and year by year this saving should increase, and I shall do my best on these lines so long as the revenue saving does not interfere with treatment.

Anti-Malarial work.—The subsoil pipe making and draining comes properly under anti-malarial work and has resulted in drying up a considerable area of swamp. The swamp taken over from Mr. Heintze has been subsoiled and filled, and is now quite dry save for the central drain, which I have asked to have concreted. If this cannot be done I shall myself attempt to put it underground; but with the quantity of water which rushes down it in heavy rain I fear my attempt may not be a success.

The old paddy land out by the pig farm and what used to be the paddy farm has now been drained and is dry. The drains I hope to put underground later on. One great difficulty is the stream known as the Sungai Bulat. This stream flows right through the reserve from the railway boundary on the north-east side to the south-west boundary, where it enters estate land. Some years ago I cleared it right down to the railway culvert, at least half a mile beyond the south-west boundary, from the point when it enters the reserve at the north-east boundary. The last two hundred yards or so of its course in the reserve has now become swampy where the banks are low. The area between our boundary and the Ipoh-Tanjong Rambutan section of the railway line is all swampy, and the stream zigzags all over the place.

The Malaria Advisory Board has the question under consideration and I expect soon to have a report and a concrete scheme to lay before Government. If money is not forthcoming at present to do any work recommended by the Malaria Advisory Board, I would suggest the taking over by Government a strip of the swampy ground from our boundary to the railway culvert. I could then straighten out the stream again, and having done so keep it straight. This would of course need constant work, but could be done if the land in which the stream ran was ours.

Farms.—The farms had the most successful year they have had yet. Almost everything did well. The vegetable farms supplied 191,015.02 katies of vegetable valued at \$22,921.81. Again we had from the cultivated land outside the farms \$1,505 worth of various products, varying from rice and coconuts to tobacco.

Pork.—Supplied reached 4,704.8 katies valued at \$2,774 a record so far, but a record which I hope soon to see broken. During the year we bought two young boars so that we have reduced the danger of introducing disease by having to bring in an outside boar from time to time.

Cattle.—In August we bought Mr. La Brooi's half-bred Australian herd for \$3,965. This comprised 31 animals of all sexes and ages. In the first half of the year we supplied 2,199½ pints of milk whereas for the completed year we supplied 14,762 pints which means that 12,562½ pints were supplied in the second half, for only five months of which we had Mr. La Brooi's cattle. Some of these cows have given as much as 20 pints a day and 15 pints is quite an ordinary thing. It will be seen from the above that so far the purchase has been more than justified. We have practically ceased to purchase tinned milk.

In addition we supplied a young bullock to the hospital at Kuala Pillah valued at \$250, while 3 pairs which we also reared ourselves began to work during the year. These young ones were valued by the Veterinary Surgeon at \$500 per pair so that our young bullocks brought us in, or rather saved, \$1,750.

Sheep and Goats.—The sheep and goats were a disappointment during the year. Up to July they did quite well, but then they began to sicken and die. No cause could be made out. The Veterinary Department did post-mortems on a number and took specimens and made sections, but all the trouble and care could not find out the reason. We tried changing the grazing hours and grazing grounds but all to no purpose until about November, when we tried letting the goats and sheep out to graze first thing in the morning, instead of waiting till the usual 8 a.m. After this the sheep ceased to die; but I do not claim that the new grazing hours had anything to do with it, though it looks rather like it.

The fowl increased in number during the year as a result of setting plenty of eggs. We do not get a great number of eggs, but owing to the increase in the number of fowl, I hope to do fairly well next year. If we do it will be the first time we have done well. I am trying a new system of feeding and exercising.

Staff.—I was on leave during the early part of the year and returned to duty on 23rd March, taking over from the Acting Medical Superintendent, (Dr. Chambers) who had done very well during the time he acted for me. The permanent members of the staff were as usual satisfactory and backed me heartily as they always have done.

In December the club was opened and is proving a boon to the staff.

Dr. Stone arrived on 13th April to take the position of Assistant Medical Superintendent.

The attendants have given a considerable amount of trouble and on more than one occasion, as can be seen from previous paragraphs, acted in a way to bring the institution into bad odour.

Altogether the attendants have been most unsatisfactory save for the old steady ones we have had for years.

It takes years to make a good attendant, but if a man weathers the first 18 months one can hope to make something out of him. Lectures have only been given to attendants on the female side as we have only one permanent Assistant Physician, and it would be worse than useless to allow an inexperienced man who did not understand, or care for the work to lecture. We had three Assistant Physicians when I returned from leave but very soon lost one—Mr. Chelliah—who however returned again in August to replace Mr. Gupta who retired in September.

The matter of Assistant Surgeons is really a great handicap as it is impossible to do the work efficiently with only two. It may be said that the Assistant Medical Superintendent should make a difference—so he does; but I am the one principally relieved by the Assistant Medical Superintendent. His presence makes little or no difference in the amount of work which falls on the Assistant Surgeons.

Again as I pointed out above it is no use putting a man without experience and a love of the work to lecture to the attendants, so that until we get a permanent second Assistant Physician, the efficiency of the Institution will suffer.

We had three store-keepers since I returned from leave.

I myself have been lecturing to the candidates for the Medico-Psychological Association's Nursing Certificate. There are two candidates for the final and four for the Preliminary.

Maintenance.—The maintenance rate works out this year at \$223.41 per head per annum against \$291.73 in 1920. I hope to be able to reduce the cost still further in 1922.

General.—One of the most important happenings with regard to the Hospital is the progress that has at last been made to get the law into something which will not be a hindrance to the patients' prospects of recovery.

A Mental Diseases Enactment has been drafted and accepted in the Federated Malay States, and, I understand, is to be also recommended to the Colony. This Enactment does away with all the objectionable features in the old Enactment. The word "Lunatic" disappears and the "Lunatic Asylum" becomes the "Mental Hospital"; so that I am full of hope that the next year the report will be dated from the "Central Mental Hospital". I have every hope that the Federal Council will pass the Enactment. If I may do so I would thank the Chief Secretary and the Acting Principal Medical Officer for the support they have given me in my endeavour to get the law altered.

We have been developing our fruit farm, and, as can be seen from the list attached, we have produced a very fair variety of fruit. We have planted quite a number of trees, including Mulberries, Pomegranates, Avocado Pears, Cashew nuts, Belinbings, Buah Susu, Cape Gooseberry, Otaheiti chessnuts, Etc. It will be many years before all these are bearing but in time I hope we shall have the finest selection of fruit, out of the Agricultural Department's gardens, in the country.

We made considerable use of the hot bath treatment, though it could not be carried out to the best advantage owing to the faulty nature of the hot water supply. Although it is now some years since the acute wards (the Conolly Norman) were completed the water supply has not yet been put right. Anyhow, even with a makeshift supply, we managed to make considerable use of the baths. I found that the continuous hot bath had a marked effect on excited cases, more especially on the motor restlessness. More use was made of the bath on the female side, and the work was more thoroughly done. Of ten cases treated in this way on the female side from June, seven showed improvement. While out of 13 males treated, 11 showed improvement—two of them relapsed and again improved under treatment.

We also used Saline in suitable cases with very fair success; but the old treatment of feeding and suitable employment holds the field still in the majority of cases. We could make little or no use of Psycho analysis owing to the difficulties of language, etc.

For two or three months every patient admitted had a specimen of his blood sent for Wassermann test at the Institute, but shortage of staff there prevented every specimen being examined, so we had to content ourselves with sending only specimens from selected cases.

Now that the Central Asylum has run for ten complete years—as although I opened in 1911 it was only towards the end of the year that we were able to take in patients—a few figure may be of interest.

There were admitted during those ten years 4897 patients, 4001 males and 896 females. We discharged 1746 made up of 1431 males and 315 females giving a recovery rate of 38.06 per cent.

There died 1672 giving a death rate of 12.53 per cent.

The patients had the usual amusements during 1921.

Draft, chess, cards, etc., were indulged in. Football and cricket were also, played. The Football side did quite well but the cricket side was very weak. In fact so weak that we could not play matches. The sports were held on 2nd July and as usual were a great success, and provided a full day's sports for patients and staff.

The gramophone which Sir Edward Brockman kindly sent down from the Cottage when he was going home, and which was dug out of the store shortly after I returned from leave, has proved a real boon to the patients who have many a pleasant hour listening to it.

I cannot close my report without thanking Government for the continued support extended to me.

I have the honour to be,

Sir,

Your obedient servant,

TANJONG RAMBUTAN,

2nd February, 1922.

W. F. SAMUELS,

Medical Superintendent,

Central Asylum, Tanjong Rambutan, F.M.S.

I.

TABLE A.—General table showing the movement of the Asylum population during the year 1921.

	Certified patients.					
	M.	F.	Total.	M.	F.	Total.
On the Asylum Registers, 1st January, 1921 ...	866	258	1,124			
Total cases admitted during the year ...	498	127	625			
Total cases under treatment during the year ...	...	...	...	1,364	385	1,749
Cases discharged, transferred during the year—						
Recovered ...	143	51	194			
Relieved ...	7	4	11			
Not improved ...	4	1	5			
Not insane ...	6	0	6			
Died during the year ...	150	30	180			
Absconded ...	39	1	40			
Total cases discharged, transferred during the year ...	...	...	...	349	87	436
On the Asylum Register, 31st December, 1921...	...	...	...	1,015	298	1,313
Average number on the Registers during the year ...			1,233.64 per cent.			

Certified persons (i.e., separate persons in contradistinction to "Cases" which may include the same individual more than once).

		M.	F.	T.
Certified under care during the year ...	...	17	5	22
.. admitted ...	...	498	128	626
.. recovered ...	...	143	51	194

II.

Table showing the form of mental disorder on admission in the direct admissions and transfers during the year, 1921.

Forms of mental disorder.			Direct Admission.			Transfers.			Total.		
			M.	F.	Total.	M.	F.	Total.	M.	F.	Total.
1.	Intellectual	(a) With Epilepsy ...	1	...	1						
2.	Moral	(b) Without Epilepsy ...	7	...	7						
1.	Insanity with Epilepsy	...	7	4	11						
2.	General Peralysis of the insane	...	19	3	22						
3.	Insanity with grosser brain lesions	...	5	...	5						
4.	Acute Delirium	...	2	2	4						
5.	Confusional Insanity	...	61	15	76						
6.	Stuper	...	3	1	4						
7.	Primary Dementia	...	36	10	46						
8.	Mania	(a) Recent ...	110	20	130						
		(b) Chronic ...	1	...	1						
		(c) Recurrent ...	7	...	7						
9.	Melancholia	(a) Recent ...	95	26	121						
		(b) Chronic ...	...	2	2						
		(c) Recurrent ...	9	...	9						
10.	Alternating Insanity	...	10	3	13						
11.	Delusional	(a) Systematised ...	4	...	4						
	Insanity	(b) Non-Systematised ...	12	1	13						
12.	Volitional	(a) Impulse ...									
	Insanity	(b) Obsession ...									
		(c) Doubt ...									
13.	Moral Insanity	...									
14.	Dementia	(a) Senile ...	10	7	17						
		(b) Secondary ...	...	1	1						
15.	Not Insane	...	2	...	2						
Total			401	95	496						

III.

Table showing the form of mental disorder on admission in those discharged, recovered during the year 1921.

Forms of mental disorder (on admission).				M.	F.	Total.
1. Intellectual	...	{ (a) With Epilepsy ...	...	1	1	2
2. Moral	...	{ (b) Without Epilepsy ...	...			
3. Insanity with Epilepsy	...	...	...			
4. Acute Delirium	...	...	...			
5. Confusional Insanity	...	...	...	18	7	25
6. Stuper	...	...	...			
7. Primary Dementia	...	...	...	7	5	12
8. Mania	...	{ (a) Recent	...	43	16	59
	...	{ (b) Chronic	...			
	...	{ (c) Recurrent	...	5	1	6
9. Melancholia	...	{ (a) Recent	...	43	18	61
	...	{ (b) Chronic	...	1	...	1
	...	{ (c) Recurrent	...	1	...	1
10. Alternating Insanity	...	...	...	3	1	4
11. Delusional Insanity	...	{ (a) Systematised	...			
	...	{ (b) Non-Systematised	...	5	...	5
	...	{ (a) Impulse	...	1	0	1
12. Volitional Insanity	...	{ (b) Obsession	...			
	...	{ (c) Doubt	...			
13. Moral Insanity	...	...	...			
14. Dementia	...	{ (a) Senile	...			
	...	{ (b) Secondary	...			
Total				128	49	177

IV

Etiological.—Showing the etiological factors and associated conditions assigned in the direct admissions during the year 1921 distinguishing between cases—congenital, first attack, non-first attack, unknown, whether first attack or not

V.

An analyses of the discharges and transfers during the year 1921.

[illegible]

Two male patients discharged not insane and not included in the above.

VI.

Table showing the form of mental disorder on 31st December, 1921, of those on the Registers at that date

Form of mental disorder on 31st December, 1921.					M.	F.	Total.
1. Intellectual ...	{ (a) With Epilepsy ...	...	...	...	14	9	23
2. Moral ...	{ (b) Without Epilepsy ...	...	...	...			
1. Insanity with Epilepsy ...	...	...	...	...	15	5	20
2. General Paralysis of the insane ...	...	...	...	...	7	2	9
3. Insanity with grosser brain lesions ...	...	...	...	...	7	2	9
4. Acute Delirium ...	...	...	...	...	...	1	1
5. Confusional Insanity ...	...	...	...	...	69	17	86
6. Stuper ...	...	...	...	...	19	4	23
7. Primary Dementia ...	...	...	...	...	96	21	117
8. Mania ...	{ (a) Recent ...	...	...	...	65	14	79
	{ (b) Chronic ...	...	...	...	15	10	25
	{ (c) Recurrent ...	...	...	...	9	1	10
9. Melancholia ...	{ (a) Recent ...	...	...	...	61	17	78
	{ (b) Chronic ...	...	...	...	55	9	64
	{ (c) Recurrent ...	...	...	...	10	1	11
10. Alternating Insanity ...	...	...	...	...	25	8	33
11. Delusional Insanity ...	{ (a) Systematised ...	...	...	...	17	2	19
	{ (b) Non-Systematised ...	...	...	...	28	2	30
12. Volitional Insanity ...	{ (a) Impulse ...	...	...	...	4	...	4
	{ (b) Obsession ...	...	...	...			
	{ (c) Doubt ...	...	...	...			
13. Moral Insanity ...	...	...	...	...			
14. Dementia ...	{ (a) Senile ...	...	...	...	14	6	20
15. Not Insane ...	{ (b) Secondary ...	...	...	...	237	70	307
Total ...					767	201	968

Prospect of mental recovery	{ Favourable ...	...	...	207
	{ Doubtful ...	...	...	105
	{ Unfavourable ...	...	...	656

Specific diseases which caused death during 1921.

Deaths.				Deaths.			
Dysentery ...	...	...	31	Gangrene of lungs ...	...	...	2
Malaria ...	...	...	29	Acute Enteritis ...	...	...	2
Phthisis ...	...	...	25	„ Pancreatitis ...	...	...	2
G.P.I. ...	...	...	20	Gastric ulcer...	...	...	1
Ankylostomiasis ...	...	...	15	Acute Meningitis ...	...	...	1
Pneumonia ...	...	...	7	Cirrhosis of liver ...	...	...	1
Cerebral haemorrhage ...	...	...	6	Haemiplegia ...	...	...	1
Debility ...	...	...	4	Fractured rib causing injury to left lung ...	...	...	1
Exhaustion ...	...	...	4	Necrosis ...	...	...	1
Valvular heart disease ...	...	...	4	Asphyxia due to hanging ...	...	...	1
Ruptured spleen ...	...	...	3	Syphilis ...	...	...	1
Epilepsy ...	...	...	3	Beri-beri ...	...	...	1
Senile debility ...	...	...	2	Pyæmia ...	...	...	1
Bright's disease ...	...	...	2	Myelitis ...	...	...	1
Nephritis ...	...	...	2	Exhaustion from acute mania ...	...	...	1
Abscess of liver ...	...	...	2	Cancerum oris ...	...	...	1
Septicæmia...	...	...	2				
				Total ... 180			

SEWING DONE BY WORK MISTRESS.

Male patients' bajus	...	...	2,868 at 13 cents each	...	\$372.84
" " trousers	...	...	2,716 at 12 "	...	325.92
Female " bajus	...	...	1,063 at 20 "	...	212.60
" " sarongs	...	...	904 at 10 "	...	90.40
" attendants' kabayas	...	...	98 at 35 "	...	34.30
" " sarongs	...	...	89 at 15 "	...	13.35
Pillow cases	...	...	572 at 5 "	...	28.60
" covers	...	...	768 at 10 "	...	76.80

MENDINGS.

Male patients' bajus	...	...	1,090 at 5 cents each	...	\$ 54.50
Female patients' bajus	...	...	2,980 at 5 "	...	149.00
Male attendants' shirts	...	...	70 at 5 "	...	3.50
Female " kabayas	...	...	85 at 5 "	...	4.25
Male patients' trousers	...	...	924 at 5 "	...	46.20
" attendants' short pants	...	...	73 at 5 "	...	3.65
White blankets	...	...	343 at 8 "	...	27.44
Red " "	...	...	286 at 8 "	...	22.88
Sarongs	...	...	55 at 5 "	...	2.75
Canvas lock suits	...	...	14 at 40 "	...	5.60
Pillows	...	...	101 at 3 "	...	3.03
Turbans	...	...	12 at 5 "	...	.60
Cloak night head attendants	...	...	13 at 25 "	...	3.25
Curtains	...	...	28 at 10 "	...	2.80
Female patients' sarongs	...	...	3,865 at 5 "	...	193.25
" attendants' sarongs	...	...	22 at 5 "	...	1.10

Total ... \$1,678.61

Buildings.—

Erecting new cow shed at back of Woodside.
 Erecting one attap shed to keep three carts near the cow shed.
 Erecting one attap shed to keep hand carts near the workshop.
 Erecting a new brick oven next to the old incinerator to burn rubbish.
 Erecting one small shed for cooking cows' food.
 Erecting one attap shed to keep grass near the cow shed.
 Erecting one attap shed near Highfield to keep buffaloes.
 Converting old pig-sty into cow shed in Richmond Farm.
 Built iron fencing round two pig-sty in Protrane Farm to keep boars.

Repairing.—

Lalang rethatching to Woodside Farm.
 Lalang rethatching to Highfield and changing of timbers and structural works.
 Lalang rethatching to pig-sty in Richmond Farm.
 Repairing fences in yard of Leigh and Protrane Farms.

Bridges.—

Constructing one bridge across the Kinding near Farm III.
 Constructing one bridge near Woodside.
 Constructing one brick arch across the cement concrete drain near the incinerator.

Repairing Drains.—

Bridges along the road from Woodside to Highfield.
 Constructing new drain from Medical Superintendent's Stable to Mr. Heintze's pond concrete base (211 feet long).
 Opening new drains across the pond at Mr. Heintze's (10) ten subsoil drains in Mr. Heintze's pond leading to the main drain (1,324 feet long).
 Burying subsoiled pipe from the old pond at back of Contractor's workshop to the cement drain (230 feet long).
 Subsoiled drain along the road to the Farm II.
 Subsoiled drain in front of Farm II to the main cement drain.
 Five-hundred and eighty-six feet subsoiled drain in the dale joining the main drain to the cement drain.

Repairing.—

- Deepening and repairing side of drains from railway culvert.
Across the jungle at back of Woodside to the Kening River.
- Deepening and repairing the side of drain that runs from Heintze's land to the cement concrete drain in front of Farm II.
- Reopening old drain from a date at back of Woodside to the main drain in front of cow shed.

Carpentering.—

- Making new meal trays for patients (17).
- Clay pipes wooden model and bow (2).
- Sheep's feeding trays (4).
- Stools to fix coconut scrapers (2).
- Small wooden tubs for bathing (30).
- Buffalo sledge for use in the jungle (1).
- Sign board for farms and new wards (11).
- Sign board to hang asylum's plan (1).
- Board Inventory (28).
- Cross pole fixed to the new lawn mowers (1).
- Buffalo's yoke (1).
- Wooden box to keep sand in latrine (40).
- Making and adding new shelves to almeirah (1).
- Arm chairs (5).
- Pigs feeding trays (54).
- Pounder for pounding curry (1).
- Pan covers (wooden) (2).
- Coffins (112).
- Small sign boards for wards (in seclusion) (11).

Repairing.—

- 82 benches.
- 15 hand carts.
- 4 bullock carts.
- 26 wheel barrows (wooden).
- 28 meal trays.
- 2 chairs.
- 3 sledges.
- 14 wooden buckets.
- 32 bed boards.
- 12 dining tables.

Bamboo Works.—

- Bamboo brooms (3516).
- Coir bamboos (40).
- Baskets boiling fish (15).
- „ carrying vegetable from Farms (21).
- „ showels earth carrying (394).
- „ carrying grass (28).
- „ rations for attendants (92).
- „ flat for drying purposes (1).
- „ rice washing (12).
- Bamboo sieves (6).
- Hats bamboo (308).

Tailoring.—

- Made attendants' shirts (288).
- „ „ short pants (290).
- „ „ coats (6).
- „ „ pants (6).
- „ patients' bajus (760).
- „ „ trousers (721).
- „ sheep skin legging 3 pairs.
- „ canvas suits (10).

Tin Smiths.—

- Bathing tins (6).
- Repairing 175 hurricane lamps.
- „ 200 tin bowls.
- Made 585 tin bowls.
- „ 200 tin mugs.

Miscellaneous.—

- Made 33 pairs leather slippers.
- „ 150 tomb stones (cement concrete).
- „ 1000 clay pipes subsoiled.

Daily Works.—

- Laying out, weeding and clearing lands for planting foodstuffs.
- Assisting in farms to plant foodstuff.
- Drains cleaning and scavenging.
- Sweeping and clearing grass under the shade trees.
- Digging stumps and cut them in pieces for firewood.
- Carting wood and rubbish.
- Gardening
- Repairing and planting bamboo fence.
- Clearing along the boundary.
- Clearing roads and weeding in field.
- Scything.
- Clearing overgrown on side of drains.
- Filling up holes and swamps in the compound.
- Collecting fuels in the jungle for the kiln.

FARM PRODUCE FOR 1921.

Milk	14,762.00 pints	\$3,395.26
Pork	4,704.8	2,774.71
Mutton	314.14	256.65
Curry stuff	741.14	190.33
Hen eggs	688.	46.20
Cocoanuts	122.	8.26
Rice ground white	104.4	18.77
Chicken cleaned	48.10	38.34
Sago	31.2	4.67
Jam	3,655.00	548.25
Arrow-root	244.00	176.69
Millet	1,878.8	281.78
Peas	345.00	51.75
Indian corn	382.02	57.32
Cigars	2,912	29.12
Millet to cattle	216.00	32.40
Paddy	960.00	67.20
Limes	116	2.32
Indian corn to cattle	56.00	8.40
Kachang	55.00	8.25
Flour Tapioca	131.00	19.65
Bananas	1,045 bunches	2,090.00
Pine apple	3,097	371.64
Papayas	10,710.	642.60
Bulls' heart	6,774	406.43
Custard apple	290	17.40
Guava	5,484	54.84
Durian blanda	244	24.40
Jack fruits	108	54.00
Mangoes	26	5.20
Vegetables	191,015.02	22,921.81
Total		\$34,604.65

ABSTRACT.

Incinerator (building newly)	...	...	...	...	\$ 288.15
Arched culvert behind D. ward (building newly)	...	...	...	...	59.80
" by hen run	..	...	...	...	68.70
Iron fencing for boars at pig-stye	...	...	...	...	12.50
Grass shed (building newly)	...	...	...	...	86.94
Cart shed	..	...	...	...	88.22
Shed for cooking cowsfood (building newly)	...	...	...	...	49.86
Building a bridge for Woodside	..	...	...	...	45.20
Woodside farm rethatching	...	...	...	...	116.48
Cart shed near workshop (building newly)	...	...	...	...	48.11
Buffalo shed at High Field	..	...	...	...	49.30
High Field Farm repairing and rethatching	...	...	...	...	112.84
Richmond Farm rethatching	...	...	...	...	111.12
Cowshed at back of ward No. VI rethatching	...	...	...	...	48.00
Drain connecting stable outlet to main drain (permanent)	...	...	...	...	268.00
Total					<u>\$1,453.22</u>

Carpentering.—

Making new meal trolleys for patients	...	17 at \$9.00 each	...	\$153.00
Clay pipe wooden model and bow	...	2 " 2.00 "	...	4.00
Sheep feeding trays	...	4 " 0.25 "	...	1.00
Stools to fix coconut scrapers	...	2 " 0.20 "	...	.40
Small wooden tubs for bathing	...	30 " 0.10 "	...	3.00
Buffalo sledge for use in jungle	...	1 " 8.00 "	...	8.00
Sign boards for farms and new wards	...	11 " 2.00 "	...	22.00
" asylum plan	...	1 " 3.00 "	...	3.00
Board Inventory	...	28 " 0.25 "	...	7.00
Cross pole fixed to new lawn mower	...	1 " 1.00 "	...	1.00
Buffalo yoke	...	1 " 0.50 "	...	.50
Wooden box to keep sand in latrine	...	40 " 0.10 "	...	4.00
Making and adding new shelves to almeirah	...	1 " 1.00 "	...	1.00
Armed chairs	...	5 " 3.50 "	...	15.50
Pigs feeding trays	...	54 " 0.25 "	...	13.50
Pounder for pounding curry	...	1 " 2.00 "	...	2.00
Pan covers wooden	...	2 " 0.25 "	...	.50
Coffins	...	112 " 0.60 "	...	67.20
Small sign boards for wards	...	11 " 0.20 "	...	2.20

Repairing.—

Benches	...	82 at 1.00 each	...	82.00
Hand carts	...	15 " 8.00 "	...	120.00
Bullock carts	...	4 " 10.00 "	...	40.00
Wheel barrows wooden	...	26 " 2.00 "	...	52.00
Meal trays	...	28 " 1.00 "	...	28.00
Chairs	...	2 " 2.00 "	...	4.00
Sledges	...	3 " 5.00 "	...	15.00
Wooden buckets	...	14 " 0.25 "	...	3.50
Bed boards	...	32 " 1.00 "	...	32.00
Dining tables	...	12 " 3.00 "	...	36.00

Bamboo Works—

Bamboo brooms	...	...	3,516 at 0.22 each	...	8773.52
Coir brooms	...	...	40 " 0.22 "	...	8.80
Basket boiling fish	...	...	15 " 0.90 "	...	13.50
" carring vegetables	...	...	21 " 1.00 "	...	21.00
" shovels earth carrying	...	...	394 " 0.45 "	...	177.00
" carrying grass	...	...	28 " 0.50 "	...	14.00
" rations for attendants	...	...	92 " 0.15 "	...	13.80
" flat for drying purposes	...	...	1 " 0.60 "	...	.60
" for washing rice	...	...	12 " 1.25 "	...	15.00
Bamboo seive	...	...	6 " 0.35 "	...	2.10
Hats bamboo	...	...	308 " 0.60 "	...	184.80

Tailoring—

Attendants' shirts	...	...	288 at 0.70 each	...	201.60
" short pants	...	...	290 " 0.50 "	...	145.00
" coats	...	...	6 " 0.80 "	...	4.80
" pants	...	...	6 " 0.60 "	...	3.60
Patients' bajus	...	...	760 " 0.13 "	...	98.80
" trousers	...	...	721 " 0.12 "	...	86.52
Sheep skin legging	...	...	3 pairs " 2.00 "	...	6.00
Canvas shirts	...	...	10 " 0.60 "	...	6.00

Tin Smith.—

Bathing tins	...	...	6 at 0.25 each	...	1.50
Repairing hurricane lamps	...	...	175 " 0.10 "	...	17.50
" tin bowls	...	...	200 " 0.15 "	...	30.00
Made tin bowls	...	...	585 " 0.35 "	...	204.00
" mugs	...	...	200 " 0.08 "	...	16.00

Miscellaneous.—

Made leather slippers	...	...	33 pairs at 150.00 each	...	49.00
" tomb stones cement concrete	...	...	150 " 25.00 "	...	37.00
" clay pipes	...	...	6,000 " 10.00 "	...	600.00
					83,456.00

TANJONG RAMBUTAN,
2nd February, 1922.

W. F. SAMUELS,
Medical Superintendent,
Central Asylum, Tanjong Rambutan, F.M.S.



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FEDERATED MALAY STATES.

REPORT OF THE SENIOR HEALTH OFFICER, FEDERATED MALAY STATES, FOR THE YEAR 1921.

(Supplement to Medical Report, 1921.)

STAFF.

On paper the executive staff for the year included :

- 1 Senior Health Officer;
- 31 Health Officers;
- 8 Chief Sanitary Inspectors;
- 4 Assistant Surgeons;
- 36 Sanitary Inspectors.

The actual staff employed consisted of :

- 1 Senior Health Officer;
- 8 Health Officers, only three of which were permanent members of the Health Branch;
- 8 Chief Sanitary Inspectors;
- 1 Apothecary, 1 Sub-Assistant Surgeon and 1 Dresser, Grade I;
- 28 Sanitary Inspectors.

Requisitions were made to the Colonial Office for Health Officers and Chief Sanitary Inspectors and advertisements were inserted in the principal medical papers. All the Chief Sanitary Inspectors were engaged but up to date no Health Officers have been recruited for the permanent staff.

CHANGES IN EXECUTIVE STAFF.

Transfers from the Medical Branch.—

February 4th	...	Dr. R. G. Clements.
April 12th	...	.. R. B. Jackson.
October 10th	...	.. H. G. Holdbrook.
December 21st	...	.. W. Young.
" "	...	.. J. P. Fitzpatrick.

Engagement.—

April 13th ... Dr. W. O. Pou was engaged locally.

The following Chief Sanitary Inspectors reported for duty :

February 4th	...	Mr. W. H. Scott.
" 25th	...	.. O. M. Hale.
" "	...	.. H. J. Benjafield.
March 5th	...	Capt. J. W. Hoffin.
" 15th	...	Mr. L. J. Hort.
" "	...	.. J. Wishart.
" 23rd	...	.. E. G. Montford.
April 29th	...	.. H. Macdonald.

Reversion.—

September 26th ... Dr. A. K. Cosgrave reverted to the Medical Branch.

Leave.—

May 23rd ... Dr. R. G. Clements on medical grounds.
September 22nd H. M. C. Green

Resignation.—

September 23rd ... Dr. R. G. Clements.

Distribution of Staff.—

Senior Health Officer, January 1st to December 31st—Dr. A. R. Wellington.

Health Officer, Perak North, January 1st to December 31st—Dr. E. H. Black.

„ Kinta, January 1st to September 22nd—Dr. H. M. C. Green.

„ „ September 23rd to October 3rd—Dr. W. M. Chambers.

„ „ October 4th to December 31st—Dr. H. G. Holdbrook.

„ Lower Perak, January 1st to December 31st—Dr. J. E. Thomson

„ Selangor, January 1st to February 3rd—Dr. A. H. Savage.

„ Selangor East, February 4th to December 20th—Dr. A. H. Savage
(acting).

„ „ December 21st to 31st—Dr. W. Young.

„ Kuala Lumpur, February 4th to December 31st—Dr. A. H. Savage.

„ Coast, January 1st to December 31st—Dr. W. J. Moir.

„ Quarantine Camp, January 1st to December 31st—Dr. W. J. Moir
(acting).

„ Negri Sembilan, January 1st to September 25th—Dr. A. K.
Cosgrave.

„ „ September 26th to December 31st—Dr. R. B.
Jackson.

„ „ (additional), April 12th to September 25th—
Dr. R. B. Jackson.

„ „ December 21st to 31st—Dr. J. P. Fitzpatrick.

„ Pahang, April 13th to December 31st—Dr. W. O. Pou.

HOUSE AND OFFICE ACCOMMODATION.

Office accommodation in Taiping, in Kuala Lumpur, in Negri Sembilan and in Pahang was inadequate.

The duties of the Health Department include :

A. Work under—

- (1) Quarantine and Prevention of Disease Enactment;
- (2) Sanitary Boards Enactment;
- (3) Labour Code;
- (4) Sale of Food and Drugs Enactment;
- (5) Excise Enactment.

B. Malaria investigation, anti-malarial measures and anti-mosquito measures.

C. General, water and water-borne diseases, flies-prevalent diseases, schools examination.

Work under the Quarantine and Prevention of Diseases Enactment.—Responsibility under this Enactment was shared with the Medical Branch.

Port Health Work.—Until this year port health work was entirely in the hands of the Medical Branch. At the beginning of the year health work at Port Swettenham including that in connection with the quarantine camp was transferred to the Health Branch. When sufficiently staffed to undertake it all port health work will be taken over by the Health Department.

PORT SWETTENHAM.

Fifty-one ships with immigrant coolies arrived at Port Swettenham during the year. All were boarded by the Health Officer or in his absence by the Deputy Health Officer.

The Port Health Officer, Penang, reported s.s. "Thongwa" on 7th May, 1921, infected with cerebro-spinal meningitis, again on 5th August with cholera and s.s. "Tara" on 19th December infected with small-pox. No cases occurred in Port Swettenham. No vessels were disinfected.

The total number of immigrants who entered the quarantine station during the year was 11,238, the number remaining on 1st January, 1921, was 1,458, making a total of 12,696. These were accounted for as follows:

Discharged to depôt	...	...	...	...	...	12,455
Transferred to Klang Hospital	...	...	...	...	...	10
Absconded	...	...	...	...	...	26
Died in hospital	...	...	...	...	...	37
Remaining on 31st December, 1921	...	...	...	...	...	168
Total	...	...	...	...	...	12,696

The daily average number of immigrants in the camp was 225.77. The largest number on any one day was 1,497 on 1st January, 1921.

Four thousand one hundred and thirty-eight immigrants received anti-ankylostome treatment.

Six hundred and thirty-nine or five per cent. of the total number of immigrants were admitted to hospital. Of these 66 developed lung symptoms. Forty-eight of the lung cases were treated with influenza vaccine and of these 9 or 18.64 per cent. died.

Except for four cases of chicken-pox and one case of measles there were no cases of infectious disease.

There being plenty of space available in the camp a certain number of decrepits and unemployed collected by the Labour Department were admitted and given shelter, food and medical treatment.

Decrepits and unemployed:

Total admitted to camp	...	...	...	...	...	2,571
Discharged for work	...	...	...	...	...	1,482
Repatriated to India	...	...	...	...	...	868
Deaths	...	...	...	...	...	108
Transferred to Klang Hospital	...	...	...	...	...	24
Remaining on 31st December, 1921	...	...	...	...	...	92

Routine treatment was given for ankylostomiasis and malaria. One thousand one hundred and seventeen received hospital treatment.

The causes of death were:

Malaria	...	...	...	...	...	40
Dysentery	...	...	...	...	...	33
Ankylostomiasis	...	...	...	...	...	15
Lung diseases	...	...	...	...	...	9
Inanition	...	...	...	...	...	7
Septic condition	...	...	...	...	...	2
Bright's disease	...	...	...	...	...	1
Convulsions	...	...	...	...	...	1
Total	...	...	...	...	...	108

The following additions were made to the camp:

New camps	...	...	...	...	...	9
Small cholera hospital wards	...	...	...	...	...	12
Small small-pox hospital wards	...	...	...	...	...	6
European infectious disease ward	...	...	...	...	...	1
Male dysentery ward	...	...	...	...	...	1
Female dysentery ward	...	...	...	...	...	1
Dhoby house	...	...	...	...	...	1
Motor-car shed	...	...	...	...	...	1

INFECTIOUS DISEASES.

In this report infectious disease means cholera, plague, small-pox and cerebro-spinal meningitis.

Measures against infectious disease are partly the concern of the Health Branch partly the concern of the Medical Branch. Until this year there was some confusion as to which branch should be in charge of an outbreak. It has now been decided that though both branches must do all in their power to stamp out infectious disease the Health Branch shall wherever possible direct operations.

There were no cases of cholera or plague reported.

Seventy-six cases of small-pox were reported in Perak. There were no cases in the other three States. The principal infected centres were: (A) The Malay kampongs on the Perak River between Telok Anson and Kuala Kangsar. (B) In the kampongs about Sungkai. By the energetic action of the Medical and Health authorities the disease was stamped out. Dr. Thomson, Health Officer, Lower Perak, received the thanks of the Government for his share of the work.

The epidemics showed that many of the Malays in the districts concerned had managed to avoid vaccination.

Cerebro-spinal Meningitis.—Altogether there were 16 cases reported. Of these six were from Perak, eight from Selangor and two from Negri Sembilan.

All the six cases in Perak came from Dovenby Estate. In Selangor two of the cases came from the Police Depôt. All the rest were isolated cases.

As the diagnosis of this disease depends on the finding of the meningococcus in the cerebro-spinal fluid it is probable that the cases reported form only a small part of the actual number of infections.

Work under the Sanitary Boards Enactment.—The Health advisers to the Sanitary Boards are in some cases Health Officers in others Medical Officers.

Labour Code, Work under.—Under this Code the Principal Medical Officer is the "Medical Officer" with power to delegate his authority to others. The Principal Medical Officer has delegated his powers to the Health Officers.

The chief work of the Health Department lies in the inspection of estates with the object of ensuring a reasonable standard of sanitation on them.

The number of estates sending in returns was 1,268. It has not been possible to visit the whole of these owing to insufficiency of staff.

Owing to the slump all estates had to cut down expenditure. There was a tendency to begin on the sanitary and medical votes, a most unwise policy which had to be checked. There were 180 estate hospitals at the beginning of the year.

The number of visits paid by Health Officers to estate hospitals was 218.

It is essential that Health Officers visit estates more frequently.

Estates should be visited at least four times a year. To allow of this the Health staff must be increased by the recruitment of properly qualified Health Officers.

The Sanitary Inspectors inspected Government coolie lines as often as time allowed.

Mines.—The average mining population during the year was 86,329. Mines are not required to send in sickness and death returns and the sick-rates and death-rates are unknown. As the great majority of miners are Chinese whose habits are more hygienic than those of the Tamils forming the bulk of the estate population the sickness and death-rates on mines are probably lower than those on estates.

Work under the Sale of Food and Drugs Enactment.—Work under the Sale of Food and Drugs Act forms an important part of the duties of a Health Officer at home and the same should apply here. Unfortunately paucity of staff has rendered this Enactment more or less a dead letter. With the exception of the examination of milks and the seizure and condemnation of bad tinned food little was done under this heading.

Work under the Excise Enactment.—Work under this Enactment consists in keeping a watch on the toddy trade and on the spirit trade. All toddy-shops are visited periodically by the Health Inspectors and samples taken for analysis. Where samples are below the standards laid down by law the vendors are prosecuted.

Malaria, Malaria Investigation and Anti-Malarial Measures.—As usual malaria heads the list as the most important cause of sickness and death. The number of deaths recorded was 17,168 or nearly half the total number for all diseases. The death-rate was 13.16 per mille as compared with 15.24 in 1920. The figures do not represent all the deaths which were due to this disease they only show those for which it was directly responsible. Malaria was an essential factor in many deaths attributed to other diseases. For every person who died probably twenty-five recovered wholly or partially after a longer or shorter period of illness.

It is impossible to say what malaria cost this country last year but valued in dollars the figures must run into millions.

Malaria is preventible but at a cost. What that cost shall be depends on many factors and the factors differ in different cases. Only those who have studied the preventive side deeply, especially the mosquito aspect of it, can appreciate which are the essential factors and can say what is the cheapest practical preventive method in any particular case.

A properly staffed Health Department could deal with the problems and would save its cost over and over again.

The teaching of mosquitology continued throughout the year. All the Health Inspectors are now trained in both laboratory and field work. Anopheline surveys which were formerly considered beyond the powers of an ordinary inspector now form part of their routine duties.

Estate managers were invited to send their dressers to the various district health headquarters for instruction in mosquito work. A number availed themselves of the offer. Towards the end of the year a start was made in teaching the railway permanent way inspectors the elements of mosquitology.

Several estates asked for anopheline surveys to be made. The request was complied with and surveys provided free of cost.

Among other places, mosquito surveys were made in Taiping, Maxwell's Hill, Kuala Kangsar, Ipoh, Batu Gajah, Gopeng, Menglembu, Tasek, Chemor, Tapah, Bidor, Telok Anson, Bagan Datoh, Sungkai, Tanjong Malim, Kuala Lumpur, Kajang, Klang, Batu Tiga, Port Swettenham, Kuala Selangor, Morib, Seremban, Tampin, Gemas, Kuala Lipis, Raub, Bentong, Kuantan, and on a good many estates.

Quinine Distribution.—The small stock of quinine held by the Principal Medical Officer was handed over to the department for distribution. This soon ran out. A large stock was ordered from England but none of it arrived in time for distribution in 1921. It has been arranged that distribution shall take place from each District Health Office instead of from one central store as was the practice in former years.

Malaria Advisory Board.—The Board met monthly and the minutes of the meetings were published. Propaganda notices were published in the daily papers and propaganda posters were printed and distributed.

Among other things the Board recommended that hospital wards should be made mosquito proof, that valleys should be left under cover unless means were provided for through drainage, and that labourers admitted as hospital patients should receive half pay while in hospital.

Mosquito Destruction Boards.—The Mosquito Destruction Boards which were formed last year continued to functionate. Where there is a Health Officer resident he is Chairman of the Board.

Works in connection with Mosquito Destruction Boards take up much of the time of the Health Officers.

If malaria is to be got under in this country it must be through a proper system such as that organized by Gorgas for Panama.

Notification of Malaria.—Malaria has been made notifiable in a number of districts. Notification has not proved an unqualified success as far as the compilation of statistics is concerned for many cases are diagnosed and returned as malaria which are not malaria at all but influenza or some other febrile condition.

Water and Water-borne Diseases.—Dysentery and diarrhoea rank next to malaria as a cause of death. The number of deaths was 2,999 and the death-rate was 2.30 per mille. Most of the water supplies in this country are subject to considerable risk of contamination. The waterworks of all towns which possess such are under the control of the Public Works Department. As a rule the rate through the filters is regulated to suit the supply.

Public wells in villages exist but are as a rule not used.

Flies (Carriers of Diseases).—Flies are prevalent in most of our towns and villages which means that there is faulty scavenging and disposal of refuse. All refuse should be properly burned or buried.

Fly screening of foods in markets which is insisted on by Perak Sanitary Board law has proved a failure. Except when a member of the sanitary authority is present the screens are not used. This is a repetition of what happened in Rawang and Serendah years ago. It is no use screening foods in the markets if the houses are full of flies. The logical way of dealing with flies is to clear away their breeding places and by good scavenging and night-soil disposal ensure that waste organic matter is not allowed to remain long enough for fly metamorphosis to become complete.

Inspection of Schools.—This year the department was ordered to include the inspection of schools in its routine duties. Instructions were accordingly issued to the various District Health Officers to comply with the orders as far as it was physically possible.

The department with its small staff made a serious attempt to comply with the instructions but was unable to do more than scratch the surface of the new work. Altogether 350 schools were inspected and reported on. Copies of reports were sent to the Inspectors of Schools.

PULMONARY TUBERCULOSIS.

Pulmonary tuberculosis ranks third as a cause of death. The number of deaths was 2,255, giving a death-rate of 1.73 per thousand. The rate for 1920 was 1.95.

Pulmonary tuberculosis is a disease which thrives in dark and ill-ventilated houses, especially if there be overcrowding. There are still a great many houses in towns which are far below the standard required by the Sanitary Board law both as regard lighting and ventilation. These doubtless play an important part in the dissemination of the disease. In towns like Kuala Lumpur where most of the houses are up to the required standard overcrowding is mainly responsible for the high incidence and death-rates.

The slump in rubber and tin, the two chief industries of the country, has produced conditions which will tend to increase the spread of the disease.

Good and cheap housing accommodation will go far to reduce both incidence and death-rates.

ANKYLOSTOMIASIS.

The number of deaths attributed to this disease was 685, giving a rate of 0.52 per mille. Ankylostomiasis is of course a real disease but its importance in this country both as a cause of invaliding and of death has been much exaggerated.

PNEUMONIA.

Pneumonia caused 1,900 deaths as compared with 2,016 deaths in 1920. The rate per mille was 1.46.

INFLUENZA.

Influenza during the year caused little sickness and few deaths.

INFANTILE MORTALITY.

There were 6,646 deaths of children under one year of age, giving an infantile mortality rate of 183 per 1,000 births as compared with a rate of 188 for 1920. The high mortality is chiefly due to the ignorance and carelessness of the native women. Lady doctors and district nurses and midwives would be effective in lowering the rate but male doctors and Sanitary Inspectors can do little in a country like this where male teaching or treatment is not accepted.

VITAL STATISTICS (FEDERAL).

POPULATION.

The census was taken in April. It shows that the rate of increase between 1901 and 1911 has not been maintained. The actual population of the Federated Malay States as estimated from the census figures was at the end of June, 1921, 1,304,825. Had the 1901-1911 rate been maintained it would have been 1,387,582 or 82,757 more than it actually was.

The race distribution was as follows:

Europeans and Americans	...	...	...	...	...	5,738
Eurasians	...	...	...	...	...	3,202
Malays and other races of the Archipelago	...	...	...	...	...	487,066
Chinese	...	...	...	...	...	495,475
Indians	...	...	...	...	...	307,992
Others	...	...	...	...	...	5,352
Total	...	...	...	...	...	1,304,825

BIRTHS.

Thirty-six thousand two hundred and ninety-four births were registered during the year, giving a birth-rate of 27.81 per mille population. In 1920 the number was 36,556 and the rate 27.05.

Race.	No. of births.	Birth-rate.
Europeans and Americans	186	32.41
Eurasians	109	34.04
Malays and other races of the Archipelago	19,772	40.59
Chinese	8,483	17.12
Indians	7,583	24.63
Others	159	29.71

DEATHS.

Thirty-eight thousand and seventy-seven deaths were registered, giving a death-rate of 29.18 per mille. The rate for 1920 was 32.34.

The distribution of deaths among the several races was as follows:

Race.	No. of deaths.	Death-rate.
Europeans and Americans	34	5.92
Eurasians	64	2.00
Malays and other races of the Archipelago	13,019	26.73
Chinese	13,306	26.85
Indians	11,505	37.35
Others	149	27.89

The death and death-rates for the total population for the last ten years were as follows:

Year.	Population.	Deaths.	Rate per mille.
1912	1,081,799	40,901	37.80
1913	1,117,625	38,000	34.00
1914	1,136,500	39,000	34.31
1915	1,172,336	33,899	28.92
1916	1,208,177	36,985	30.60
1917	1,244,018	42,514	34.17
* 1918	1,279,859	67,639	52.85
1919	1,315,700	38,645	29.37
1920	1,351,541	43,705	32.34
1921	1,304,825	38,077	29.18

Table showing causes of deaths in 1921.

Diseases.	No. of deaths.	Rate per mille.
Malaria	17,168	13.16
Dysentery and diarrhoea	2,999	2.30
Pneumonia	1,900	1.46
Pulmonary tuberculosis	2,255	1.73
Ankylostomiasis	685	0.52
Beri-beri	422	0.32
Syphilis	99	0.08
Enteric	28	0.02
Tetanus	11	0.01
Diphtheria	5	0.00
Convulsions	3,392	2.60
Other diseases	9,113	6.98

* High figure due to influenza epidemic.

The diseases which caused the greatest number of deaths were malaria, dysentery and diarrhoea, pneumonia and pulmonary tuberculosis.

The following table shows the deaths and the death-rates from the principal diseases for the last ten years :

Year.	Malaria.		Dysentery and diarrhoea.		Pulmonary tuberculosis.		Beri-beri.	
	Deaths.	Rate.	Deaths.	Rate.	Deaths.	Rate.	Deaths.	Rate.
1912 ...	17,870	16.52	5,885	5.44	1,353	1.25	1,212	1.12
1913 ...	16,414	14.69	5,317	4.75	1,623	1.45	1,190	1.06
1914 ...	13,634	11.99	5,235	4.60	1,655	1.45	1,223	1.07
1915 ...	15,208	12.97	3,148	2.63	1,995	1.70	871	.74
1916 ...	17,627	14.58	3,197	2.64	2,193	1.81	757	.62
1917 ...	18,750	15.07	4,942	3.97	2,446	1.96	1,207	.97
*1918 ...	31,515	24.62	4,280	3.34	3,184	2.48	1,277	.98
1919 ...	16,975	12.90	3,712	2.82	2,445	1.86	939	.71
1920 ...	20,595	15.24	3,804	2.81	2,634	1.95	431	.32
1921 ...	17,168	13.16	2,999	2.30	2,255	1.73	422	.32

VITAL STATISTICS (State figures for comparison).

Estimated population of all races on June 30th, 1921.

State.	Europeans and Americans.	Eurasians.	Malays and other natives of the Archipelago.	Chinese.	Indians.	Others.	Total.
Perak ...	2,048	988	228,886	224,283	131,642	1,982	589,829
Selangor ...	2,503	1,569	90,294	171,220	133,565	1,892	401,043
Negri Sembilan ...	904	528	76,777	65,751	34,038	871	178,869
Pahang ...	283	117	91,109	34,221	8,747	607	135,084
Total, F.M.S. ...	5,738	3,202	487,066	495,475	307,992	5,352	1,304,825

VITAL STATISTICS (State figures for comparison).

Birth Table.

State.	No. of births.	Birth-rate per 1,000 living.	1920 birth-rates.
Perak ...	16,521	28.01	26.61
Selangor ...	10,364	25.84	26.91
Negri Sembilan ...	5,042	28.19	30.03
Pahang ...	4,367	32.33	26.06

Birth Statistics of different nationalities.

State.	Europeans and Americans.		Eurasians.		Malays and other races of the Archipelago.		Chinese.		Indians.		Other races.	
	No. of births.	Birth-rate.	No. of births.	Birth-rate.	No. of births.	Birth-rate.	No. of births.	Birth-rate.	No. of births.	Birth-rate.	No. of births.	Birth-rate.
Perak ...	82	40.04	31	31.38	9,021	39.46	4,091	18.24	3,225	24.50	71	35.82
Selangor ...	84	33.56	56	35.09	3,771	41.76	2,731	15.94	3,700	27.78	22	11.63
Negri Sembilan ...	15	16.58	20	37.88	3,317	43.22	1,093	16.62	545	16.01	52	59.70
Pahang ...	5	17.67	2	17.09	3,063	40.20	568	16.60	115	13.59	14	23.06

* Influenza epidemic year.

State figures for comparison.

Year.	Perak.			Selangor.			Negri Sembilan.			Pahang.		
	Malaria.	Dysentery and diarrhoea.	Pulmonary tuberculosis.	Malaria.	Dysentery and diarrhoea.	Pulmonary tuberculosis.	Malaria.	Dysentery and diarrhoea.	Pulmonary tuberculosis.	Malaria.	Dysentery and diarrhoea.	Pulmonary tuberculosis.
1916	15.26	1.91	2.40	13.57	4.03	1.44	16.53	3.58	1.00	12.26	1.12	1.03
1917	15.81	2.58	2.25	12.75	4.38	1.47	18.81	4.26	2.80	14.00	1.30	1.14
* 1918	Unreliable.			20.29	3.78	1.62	36.31	5.84	4.93	26.62	1.63	1.41
1916	13.45	2.21	1.83	10.23	3.59	2.39	17.15	4.77	1.39	13.22	1.27	1.01
1920	15.82	2.21	2.11	13.13	3.77	1.89	18.18	4.31	2.37	15.24	1.19	0.94
1921	13.32	1.54	1.78	11.80	3.29	1.85	13.07	3.42	1.68	16.61	1.19	1.18

VITAL STATISTICS OF THE FOUR LARGE TOWNS, KUALA LUMPUR,
IPOH, SEREMBAN AND TAIPING.

The population in each case is that within the Sanitary Board limits.

The crude death-rates are calculated on the total number of deaths within the Sanitary Board limits.

The corrected death-rates are calculated on the total number of deaths occurring within the Sanitary Board limits and including infants less than 30 days old but excluding the deaths of other persons who had been, at the date of death, resident for less than 30 days within Sanitary Board limits.

Town.	Estimated population.	Births.		Deaths of persons who previous decease had resided in town one month.	
		No.	Rate per mille.	No.	Rate per mille.
Kuala Lumpur ...	81,197	1,652	20.35	2,194	27.02
Ipoh ...	37,194	887	23.85	758	20.38
Seremban ...	17,479	490	28.03	632	36.16
Taiping ...	21,178	677	31.97	1,060	50.05

Table showing corrected deaths and death-rates during last six years.

Year.	Kuala Lumpur.		Ipoh.		Seremban.		Taiping.	
	Population.	Death-rate.	Population.	Death-rate.	Population.	Death-rate.	Population.	Death-rate.
1916 ...	61,443	27.73	29,915	30.15	11,397	52.55	22,237	36.00
1917 ...	63,064	28.45	31,032	32.67	13,620	55.35	22,859	31.00
1918 ...	64,686	38.34	32,150	35.92	14,082	81.66	23,481	41.61
1919 ...	66,308	26.36	33,238	23.56	14,544	45.38	24,721	37.45
1920 ...	67,930	30.00	34,357	22.64	15,006	34.05	25,434	39.90
1921 ...	81,197	27.02	37,194	20.38	17,479	36.16	21,178	50.05

* Influenza year, figures probably very inaccurate.

Table showing corrected deaths and death-rates for principal diseases.

Town.	Malaria.		Dysentery and diarrhoea.		Pulmonary tuberculosis.		Beri-beri.	
	Deaths.	Rate.	Deaths.	Rate.	Deaths.	Rate.	Deaths.	Rate.
Kuala Lumpur	425	5.23	294	3.62	261	3.21	27	0.33
Ipoh ...	418	11.24	89	2.39	169	4.54	10	0.27
Seremban ...	249	11.76	226	16.71	132	6.23	61	2.88
Taiping ...	438	25.06	106	6.06	69	3.95	12	0.69

Infantile Mortality Table.

Town.	Births.	Deaths under one year.	Rate per 1,000 births.
Kuala Lumpur...	1,652	398	240.92
Ipoh ...	887	155	174.75
Seremban ...	490	153	312.24
Taiping ...	679	143	210.60

Table showing corrected death-rates in the four towns for the past five years.

Year.	Kuala Lumpur.			Ipoh.			Seremban.			Taiping.		
	Malaria.	Dysentery and diarrhoea.	Pulmonary tuberculosis.	Malaria.	Dysentery and diarrhoea.	Pulmonary tuberculosis.	Malaria.	Dysentery and diarrhoea.	Pulmonary tuberculosis.	Malaria.	Dysentery and diarrhoea.	Pulmonary tuberculosis.
1917 ...	4.65	3.47	3.23	11.98	2.70	3.67	22.33	8.00	1.47	11.16	3.79	3.62
1918 ...	6.08	4.05	3.43	7.52	3.85	4.72	40.83	10.01	3.48	22.32	2.63	2.03
1919 ...	4.69	3.35	3.24	6.32	3.55	3.09	19.18	7.70	3.71	16.78	3.52	2.42
1920 ...	5.08	2.49	3.48	5.64	2.64	3.75	8.99	5.00	3.40	19.14	2.99	1.57
1921 ...	5.25	3.63	3.22	11.24	2.39	4.54	11.76	16.71	6.23	25.06	6.06	3.95

ESTATE STATISTICS.

Returns were received from 1,268 estates. Besides these there are many small estates of less than 100 acres each which do not send returns. The 1,268 estates are distributed as follows :

Perak ...	Perak North	...	...	265	= 574
	Kinta	...	...	120	
	Lower Perak	...	...	94	
	Batang Padang	...	...	95	
Selangor ...	Bernam	...	...	8	= 347
	Coast Districts	...	...	150	
	Kuala Lumpur, Selangor East,	...	...	189	
	Ulu Selangor and Ulu Langat	...	...	189	
Negri Sembilan ...	All districts	...	...	233	= 233
Pahang ...	"	...	...	114	= 114

Total average number of labourers was 175,649.

" " Indian " 135,017.

The distribution of labour was as follows :

		Indians.	Others.	Total.
Perak ...	Perak North ...	24,184	4,921	29,105
	Kinta ...	6,914	1,897	8,811
	Lower Perak and Batang			
	Padang ...	21,860	4,165	26,025
Selangor...	Bernam ...	2,132	78	2,210
	Kuala Lumpur, Ulu			
	Selangor and Ulu Langat	18,673	7,540	26,213
	Coast ...	41,207	1,525	42,732
Negri Sembilan ...	All districts ...	17,922	16,113	34,035
Pahang ...	" ...	2,125	4,393	6,518
Total, F.M.S. ...		135,017	40,632	175,649

The table below sets out the mortality rates among estate labourers during the past 11 years, that is, since the Health Branch took over the supervision of health condition on estates :

Year	Total number of estate labourers.	Deaths.	Death-rate per mille.
1911 ...	143,614	9,040	62.9
1912 ...	171,968	7,054	41.02
1913 ...	182,937	5,592	29.6
1914 ...	176,226	4,635	26.3
1915 ...	169,100	2,839	16.78
1916 ...	187,030	3,299	17.61
1917 ...	214,972	3,906	18.71
* 1918 ...	213,425	9,081	42.55
1919 ...	216,573	3,384	15.16
1920 ...	235,156	4,367	18.57
1921 ...	175,649	3,195	18.19

There were 2,447 deaths among the 135,017 Indian estate labourers during the year giving a mortality rate of 18.12 per mille :

Divisions.	Malaria admissions to estate hospital.	Malaria deaths in estate hospitals.	Total admissions to estate hospitals.	Total labourers employed all nationalities.	Total deaths.	Death-rate per mille.	Indians employed.	Deaths Indian labour force.	Death-rate Indian labour force.	Number of estates.	Number of hospital.
Selangor East ...	7,845	164	13,758	26,213	512	19.53	18,673	482	25.81	189	24
Coast, Selangor ...	7,301	222	17,307	42,732	659	11.99	41,207	655	15.90	150	35
Pahang ...	2,317	15	5,475	6,518	129	19.79	2,125	68	32.00	114	9
Negri Sembilan ...	8,445	142	18,040	34,035	621	18.24	17,922	521	29.01	233	45
Perak North ...	2,853	51	6,031	29,105	444	15.25	24,184	402	16.62	265	27
Kinta ...	1,196	18	2,213	8,811	102	11.57	6,914	102	14.75	120	7
Lower Perak ...	4,184	74	12,005	26,025	719	27.63	21,860	208	9.52	189	26
Bernam ...	125	...	947	2,210	9	4.07	2,132	9	4.33	8	2
Total ...	34,206	686	75,776	175,649	3,195	18.19	135,017	2,447	18.12	1,268	175

* Influenza year.

KUALA LUMPUR,
3rd April, 1922.

A. R. WELLINGTON,
Senior Health Officer, F.M.S.

